

## A Comparative Study of Innovative Pedagogical Approaches on Academic Achievement in Basic Technology among Alimosho Junior Secondary School Students

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### Abstract

*This study examined the effects of innovative pedagogical approaches (problem-based learning and context-based learning) compared with conventional teaching methods on the academic achievement of Junior Secondary School students in Basic Technology in Alimosho Area of Lagos State, Nigeria. Two research questions and hypotheses guided the study. A quasi-experimental pretest–posttest non-equivalent control group design was adopted. Using multistage sampling techniques, 468 JSS2 students from three public junior secondary schools participated. Nine intact classes were assigned to experimental and control groups. Students in the experimental groups were taught using innovative pedagogical approaches, while those in the control groups received instruction through conventional methods. Data were collected using the Basic Technology Achievement Test (BTAT). The instrument was validated by experts, and reliability testing using the Kuder–Richardson formula (KR-20) yielded a coefficient of 0.78. Mean scores and standard deviations answered the research questions, while analysis of variance (ANOVA) tested the hypotheses at 0.05 significance level. Findings showed that students taught using innovative pedagogical approaches achieved significantly higher academic performance than those taught using conventional methods. The study concludes that problem-based and context-based teaching strategies improve students' achievement in Basic Technology and recommends their adoption in junior secondary schools.*

**Keywords:** Keywords: Junior Secondary School, Basic Technology, Innovative Pedagogy, Conventional Teaching Methods, Academic Achievement

## Introduction

Education is a vital instrument for societal transformation and development. According to Singh (2012), quality education promotes cultural understanding and international solidarity. It also prepares individuals for the world of work. Achieving this purpose depends on instructional approaches. Technological advancement and changing workforce demands have compelled education systems to reconsider teaching and learning. Traditional teacher-centered methods are increasingly viewed as insufficient for 21st-century competencies. Consequently, there has been a global shift toward innovative, learner-centered pedagogies that emphasize active engagement and problem-solving (Schleicher, 2012).

This shift has placed heightened expectations on teachers. Educators must design learning experiences that actively involve students. Hoffmann & Koifman (2013) argue that effective teachers must possess innovative instructional skills. The African Union (2007) stress that teaching quality is linked to teachers' competence, including pedagogical knowledge and ICT integration. Educational effectiveness is now judged by how well teaching fosters transferable skills.

The 21st-century world is characterized by rapid change, influencing educational delivery. Charalambidis (2014) noted that schools are affected by these transformations. Educational reforms emphasize pedagogies that are flexible and responsive to learners' experiences. Bernad-Cavero and Llevot-Calvet (2018) observed that modern pedagogies depart from rigid models toward creative approaches that improve learning outcomes.

Educational stakeholders have intensified efforts to reform curricula to promote learner-centered approaches. These reforms advocate innovative pedagogy to enhance students' critical thinking and collaborative abilities (Li & Zhang, 2021; Sakata et al., 2021). In Nigeria, similar reforms ensure education responds to national development needs. Innovative pedagogy involves improving teaching practices through creative methods for better learning outcomes. Research indicates innovative approaches support problem-solving abilities important in technology subjects (Aduba & Mayowa-Adebara, 2020; Okolie et al., 2021).

The Junior Secondary School (JSS) system in Nigeria emerged from the 6-3-3-4 system of education (NPE, 2004). JSS is a three-year stage for learners aged 12 to 14 years (NPE, 2013). The curriculum includes prevocational courses to equip learners with foundational skills. Basic Technology (BT) is a compulsory prevocational subject. It integrates content from metalwork, woodwork, technical drawing, electronics, auto-mechanics, and building construction. The subject exposes students to technological concepts and practical skills. Emphasis is placed on hands-on activities and problem-solving. The objectives of Basic Technology align with the National Policy on Education, which seeks literacy, numeracy, and life skills (FRN, 2013). The subject lays a foundation for lifelong learning and STEM education (Okorie & Uche, 2021).

Despite its relevance, students' performance in Basic Technology remains poor in many parts of Nigeria. Lagos State demands technological competence, but recent Basic Education Certificate Examination (BECE) results indicate only about 48% attained credit-level passes (BECE, 2024). Reliance on conventional, teacher-centered methods limits students' active participation and higher-order thinking (Nwaodo et al., 2018). Innovation is critical for educational improvement. Okpalaoka (2022) describe innovation as applying new ideas for transformation. In education, innovative approaches integrate modern strategies to enhance engagement (Gampala, 2023). Approaches such as project-based learning and gamification improve motivation and achievement (Gampala, 2023; Taneja et al., 2018).

Innovative pedagogy refers to learner-centered strategies. Context-Based Learning (CBL) and Problem-Based Learning (PBL) are acknowledged approaches. CBL uses real-life contexts to make learning meaningful. Sutaphan & Yuenyong (2019) described CBL as integrating theoretical knowledge with real-world examples. Yarmatov & Ahmedova (2020) noted that CBL is driven by learners' environment. Empirical studies demonstrate CBL's effectiveness in technology education (Olelewe et al., 2021).

Problem-Based Learning (PBL) presents students with real-world problems requiring inquiry and collaboration. Lanubile et al. (2023) noted that PBL promotes critical thinking. Agbo et al. (2024) highlighted the positive impact of ICT tools on engagement. PBL improves motivation and higher-order thinking skills (Mann et al., 2021).

Given the nature of Basic Technology, CBL and PBL hold potential for improving achievement. These approaches promote hands-on learning and real-life application. Olelewe et al. (2020) found students taught with modern methods performed better. Yi-Lin et al. (2023) showed digital tools boost creative confidence. George and Chukwuka (2023) recommended adaptive learning platforms. Academic achievement is closely linked to students' future prospects. It is the attainment of educational goals (Steinmayr et al. 2014), and its Achievement in Basic Technology is influenced by instructional methods and learner characteristics (Nwaodo et al., 2018).

Gender is frequently examined. Research findings are mixed. Some studies report male dominance (Alordiah et al., 2015), while others indicate no significant differences with innovative approaches (Ajai & Imoko, 2015). Teaching methods may play a more decisive role. Due to persistent poor performance, there is a need to explore effective instructional strategies. This study investigates the effectiveness of innovative pedagogical approaches on academic achievement in Basic Technology.

### **Research Questions**

Based on the research purpose, the following research questions were posed:

- i. What difference exists in the academic achievement of students' taught Basic Technology using innovative pedagogy (PBL & CBL) and those taught using conventional teaching methods (CTM) in Junior Secondary School students' (JSSII) in Lagos State, Nigeria?
- ii. What effect does students gender (male and female) has on junior secondary school (JSSII) students' academic achievement in Basic Technology in Lagos Sate, Nigeria?

### **Research Hypotheses**

The following null hypotheses were tested at 0.05 level of significance:

H<sub>01</sub>: There is no significant difference in the academic achievement of students' taught Basic Technology using innovative pedagogy and those taught using conventional teaching methods in Junior Secondary School students' (JSSII) in Lagos State, Nigeria.

H<sub>02</sub>: There is no significant difference on the basis of gender (male and female) on junior secondary school (JSSII) students' academic achievement in Basic Technology in Lagos State, Nigeria.

### **Methodology**

This study adopted a quasi-experimental pretest–posttest non-equivalent control group design. Intact classes were used. The study involved an experimental group taught using Problem-Based Learning (PBL) and Context-Based Learning (CBL) and a control group taught using the Conventional Teaching Method (CTM).

The population comprised all Junior Secondary School II (JSS II) students in Lagos State, estimated at 375,717 (Lagos State Annual School Census, 2024/2025). Using stratified and purposive sampling, three public co-educational junior secondary schools were selected from Alimosho Local Government Area. A sample of 468 JSS II students (213 males and 255 females) participated, with 156 students from each school. Participants were drawn from intact classes (JSS 2A, 2B, and 2C). Two classes served as the experimental group, while one class served as the control group.

The instrument was the Basic Technology Achievement Test (BTAT), adapted from past BECE questions (2021-2024). The BTAT consisted of 35 multiple-choice items. Experts validated the instrument. Reliability testing using Kuder–Richardson formula (KR-20) yielded 0.78. A pilot test produced a test–retest coefficient of 0.81.

Lesson plans based on PBL and CBL were developed for the experimental group. Teachers were trained. A pretest assessed initial knowledge. Teaching occurred over four weeks, covering Basic Technology topics. In the fifth week, a reshuffled BTAT was administered as a posttest.

Data were analyzed using mean and standard deviation for research questions, and Analysis of Variance (ANOVA) for hypotheses at 0.05 significance.

### **Presentation of Results**

**RQ1:** What difference exists in the academic achievement of students taught Basic Technology using innovative pedagogy (PBL & CBL) and those taught using conventional teaching methods (CTM)?

**Table 1:** Mean and Standard Deviation of Scores

Sources of Variation	Methods	N	Pretest Mean	SD	Posttest Mean	SD	Mean Gain
Treatment Groups	PBL	156	19.20	4.78	27.85	5.68	8.65
	CBL	156	16.05	3.41	24.67	4.39	8.62
Control Group	CTM	156	15.21	3.30	19.19	3.78	3.98
<b>Total</b>		<b>468</b>					

Table 1 shows a mean gain of 8.65 for PBL, 8.62 for CBL, and 3.98 for CTM. Both PBL and CBL had positive effects on achievement.

**RQ2:** What effect has students gender (male and female) on junior secondary school (JSSII) students' academic achievement in Basic Technology in Lagos State, Nigeria?

**Table 2:** Pretest and Posttest Mean and Standard Deviation by Gender

Sources of Variation	N	Pretest Mean	SD	Posttest Mean	SD	Mean Gain
Male	213	19.34	4.40	24.02	4.90	4.68
Female	255	21.43	4.63	23.77	4.87	2.34
<b>Total</b>	<b>468</b>					

Table 2 shows a mean gain of 4.68 for males and 2.34 for females. Male students performed better under the same conditions.

**H<sub>01</sub>:** No significant difference in achievement between innovative pedagogy and conventional methods.

**Table 3:** ANOVA Results

Description	Df	Sum of Squares	Mean Square	F-cal	F-tab	Sig.	Decision
Between	2	5974.57	2987.29	107.44	3.02	0.05	Rejected
Residual	466	12957.3					
<b>Total</b>	<b>468</b>	<b>18931.87</b>					

F-cal (107.44) > F-tab (3.02). The hypothesis is rejected. There is a significant effect.

**H<sub>02</sub>:** There is no significant difference on the basis of gender (male and female) on junior secondary school (JSSII) students' academic achievement in Basic Technology in Lagos State, Nigeria.

**Table 4:** ANOVA Results for Gender

Model	Df	Sum of Squares	Mean Square	F	Sig.	Decision
Regression	3	7.823	2.608	0.122	0.947	Accepted
Residual	152	3245.170	21.350			
<b>Total</b>	<b>155</b>	<b>3252.994</b>				

F=0.122, p=0.947. The null hypothesis is not rejected. There is no significant gender difference.

### Discussion of Findings

The findings show that innovative teaching approaches Problem-Based Learning (PBL) and Context-based Learning (CBL) are more effective than conventional methods in improving academic achievement in Basic Technology. Results from Table 1 reveal that students taught using PBL and CBL achieved higher learning gains. Students in the PBL group recorded the highest improvement. This indicates learner-centered approaches are more effective.

These findings support that innovation improves teaching and learning. Innovative pedagogies encourage active participation and real-life application. In Basic Technology, methods such as PBL

and CBL allow meaningful engagement. This result is consistent with previous studies (Taneja et al., 2018; Olelewe et al., 2020; Yi-Lin et al., 2023; George & Chukwuka, 2023).

The inferential analysis confirms these findings. The calculated F-value led to the rejection of the null hypothesis. PBL and CBL had a meaningful positive effect.

Context-Based Learning effectiveness is explained by linking learning to real-life situations. Students understand and remember better when lessons connect to everyday experiences (Sutaphan & Yuenyong, 2019; Yarmatov & Ahmedova, 2020). Problem-Based Learning improves problem-solving skills and achievement (Lanubile et al., 2023; Agbo et al., 2024; Mann et al., 2021).

With regard to gender, the results in Tables 2 and 4 show no statistically significant difference between male and female students' academic achievement, although both groups benefited from the instructional approaches. This may be influenced by social and cultural factors that shape students' interest and participation in technology-related subjects (Alordiah et al., 2015; Westbrook & Saperstein, 2015). Also, earlier studies suggest that when innovative teaching methods are used, gender differences tend to reduce (Ajai & Imoko, 2015). Overall, the findings suggest that teaching method plays a more important role than gender in improving students' academic achievement in Basic Technology.

## **Conclusion**

This study provides robust empirical evidence that pedagogical approach is a decisive factor in student achievement in Basic Technology. The significantly higher performance of students exposed to Problem-Based Learning (PBL) and Context-Based Learning (CBL), compared to those taught with conventional methods, leads to a definitive conclusion: the active, collaborative, and context-driven nature of innovative pedagogies is fundamentally more effective for teaching this applied, skill-based subject.

While the analysis indicated a difference in achievement levels between male and female students, the central finding remains that both genders demonstrated markedly greater improvement under innovative teaching conditions. This underscores that the choice of instructional strategy is a more powerful lever for enhancing learning outcomes than inherent gender-based predispositions.

Therefore, the persistent issue of poor academic performance in Basic Technology can be directly addressed through pedagogical reform. Transitioning from teacher-centered instruction to learner-centered approaches like PBL and CBL is not merely a recommendation but a necessary step for achieving the subject's objectives of developing practical technological literacy and problem-solving skills in junior secondary school students.

### **Recommendations**

Based on the conclusive evidence that innovative pedagogies significantly boost achievement in Basic Technology, the following targeted recommendations are made:

- i. **Mandate Pedagogical Shifts in Teacher Practice:** Education agencies and school administrators should officially promote and integrate Problem-Based Learning (PBL) and Context-Based Learning (CBL) into the instructional framework for Basic Technology. Teachers should be directed to move beyond lecture-based methods and systematically incorporate these student-centered strategies into their lesson plans.
- ii. **Implement Sustained, Practical Teacher Training:** Rather than general workshops, government and educational partners should organize hands-on, subject-specific training programs. These programs must equip Basic Technology teachers with the practical skills to design PBL scenarios and CBL modules using locally available materials and real-world contexts relevant to the Nigerian student experience.
- iii. **Embed Innovative Strategies in Curriculum and Assessment:** The Basic Technology curriculum guidelines should be revised to explicitly prescribe PBL and CBL as core teaching methodologies. Furthermore, examination bodies should align question formats to assess problem-solving and applied knowledge, thereby incentivizing the use of these methods.
- iv. **Provide Minimum Standards for Instructional Resources:** School management committees should be tasked with providing basic kits of tools, recycled materials, and visual aids that facilitate hands-on, problem-based activities. This addresses a fundamental barrier to implementing the recommended pedagogies effectively.

- v. Guide Future Research: Researchers should build on this study to investigate the retention of knowledge and skills over a longer period following PBL/CBL instruction. Additional studies should also explore the specific aspects of these methods (e.g., group dynamics in PBL, context relevance in CBL) that most significantly contribute to improved achievement and engagement.

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