

THE EXTENT OF ADOPTION OF FUNCTIONAL PEDAGOGY IN TEACHING AND LEARNING OF SENIOR SECONDARY SCHOOL PHYSICS IN NORTH –CENTRAL NIGERIA: IMPLICATIONS FOR INNOVATIVE ASSESSMENT AND STRATEGIC RESEARCH

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Abstract

Physics remains a cornerstone of scientific and technological advancement in Nigeria, yet secondary school students often perform poorly due to traditional, teacher-centered methods. Functional pedagogy, which emphasizes inquiry-driven, activity-based, and problem-solving approaches, is expected to enhance skill acquisition, but its adoption in Nigerian classrooms remains uncertain. This study evaluated the extent of adoption of functional pedagogy in Nigerian secondary school physics classrooms and examined its influence on students' acquisition of physics-related skills, including cognitive mastery, psychomotor competence, and affective disposition. A descriptive survey design was employed. The study population consisted of Senior Secondary II physics students, and a sample of 480 students was selected from 12 schools in Abuja and neighboring states through stratified random sampling. Two instruments were used: the Functional Pedagogy Adoption Questionnaire (FPAQ) and the Physics Skills Acquisition Scale (PSAS). The instruments were validated by experts and found reliable with Cronbach's alpha values of 0.81 and 0.85 respectively. Data were analyzed using descriptive statistics, Pearson correlation, and multiple regression at 0.05 significance level. Findings revealed that functional pedagogy was moderately adopted (overall mean = 2.80/5), with relatively higher emphasis on inquiry-based teaching but lower emphasis on laboratory engagement. Adoption of functional pedagogy showed a significant positive correlation with cognitive mastery ($r = 0.48$, $p < 0.01$) and strongly predicted psychomotor and affective outcomes ($\beta = 0.52$, $p < 0.01$; $t = 5.82$, $p < 0.01$). Study concludes that functional pedagogy adoption enhances physics learning outcomes, improving students' conceptual mastery, laboratory skills, and attitudes. However, its adoption is uneven and requires deliberate strengthening. It is recommended that teacher professional development, affordable laboratory resourcing, curriculum alignment, and examination reforms be pursued to encourage systemic adoption of functional pedagogy in Nigerian physics classrooms.

Keywords: functional pedagogy, physics education, skill acquisition, Nigeria, secondary schools

Introduction

In recent years, the persistent underperformance of Nigerian students in science subjects, particularly physics, has become a matter of urgent educational concern. Reports from the West African Examinations Council (WAEC) consistently highlight low pass rates in physics, with many students struggling in conceptual understanding, laboratory engagement, and application of principles to real-life situations (WAEC, 2022). Physics is widely acknowledged as the gateway to science, technology, engineering, and mathematics (STEM) careers. Thus, the ability of a country to produce skilled manpower in this field is directly linked to the quality of physics education at the secondary school level.

Traditional approaches to teaching physics in Nigerian classrooms remain largely teacher-centered, characterized by rote memorization, chalk-and-talk delivery, and assessment practices dominated by paper-and-pencil testing. Such methods rarely promote problem-solving, creativity, or innovation. This gap necessitates the adoption of functional pedagogy—an approach that integrates inquiry-based strategies, activity-oriented tasks, contextualized learning, and innovative assessment practices that encourage critical thinking and skill acquisition (Achor, 2011).

Globally, pedagogical shifts have embraced learner-centered models that not only prioritize knowledge acquisition but also focus on skill development, creativity, and problem-solving abilities. In the 21st century, knowledge economies thrive on human capital with strong cognitive, affective, and psychomotor competencies. Nigeria's education sector, especially at the secondary level, has therefore been challenged to align teaching and learning with these global best practices (Ogunniyi, 2019).

Within physics education, functional pedagogy emphasizes engaging students in real-life applications, conducting experiments that reinforce abstract concepts, integrating ICT tools for simulations, and using authentic assessments that measure not just recall but practical competencies. When combined with strategic research in education, these practices have the potential to transform Nigeria's physics classrooms into hubs of innovation and learning.

However, despite government reforms, policy interventions, and investments in teacher training, the level of adoption of functional pedagogy in Nigerian secondary schools remains uncertain. While some studies suggest modest improvements, others indicate that the implementation of inquiry-based, activity-oriented teaching is still at a minimal level (Nworgu, 2018). These contradictions underscore the need for empirical studies that assess not only whether functional pedagogy is being adopted but also whether its adoption translates into measurable improvements in students' acquisition of physics-related skills.

This study therefore examines the adoption of functional pedagogy in Nigerian secondary school physics classrooms, focusing on its relationship with students' acquisition of cognitive mastery, psychomotor competence, and affective dispositions.

Problem Statement

The Nigerian secondary school system continues to face significant challenges in physics education. Despite its centrality to STEM and national development, students' performance in physics has been consistently poor. WAEC reports between 2018 and 2022 show that less than 35% of candidates obtained credits and above in physics, indicating low mastery of the subject. Several factors contribute to this persistent failure, but one major issue is the dominance of traditional, teacher-centered methods that discourage learner engagement and creativity.

Although functional pedagogy has been proposed as a solution—emphasizing inquiry-based teaching, problem-solving, laboratory work, and innovative assessment—its level of adoption in Nigerian classrooms remains poorly documented. There is a clear knowledge gap concerning whether teachers are adopting functional pedagogy, and if so, whether such adoption significantly influences students' acquisition of skills needed for 21st-century learning.

This gap creates uncertainty for policymakers, curriculum developers, and teacher educators who seek evidence-based reforms. Without empirical research that measures adoption levels and connects them to learning outcomes, interventions risk being misaligned with classroom realities.

Purpose of the Study

The purpose of this study was to evaluate the extent of adoption of functional pedagogy in the teaching and learning of senior secondary school physics in Nigeria and to determine its relationship with students' acquisition of cognitive, psychomotor, and affective skills.

Research Objectives

The study was guided by the following objectives:

1. To determine the extent to which functional pedagogy is adopted in teaching senior secondary school physics in Nigeria.
2. To examine the relationship between adoption of functional pedagogy and students' cognitive mastery of physics concepts.
3. To assess the influence of functional pedagogy adoption on students' psychomotor (laboratory) skill acquisition.
4. To determine the effect of functional pedagogy adoption on students' affective dispositions toward physics.

Research Questions

1. To what extent is functional pedagogy adopted in teaching senior secondary school physics in Nigeria?
2. What is the relationship between adoption of functional pedagogy and students' cognitive mastery of physics concepts?

3. How does functional pedagogy adoption influence students' psychomotor (laboratory) skill acquisition?
4. What is the effect of functional pedagogy adoption on students' affective dispositions toward physics?

Research Hypotheses

1. There is no significant relationship between adoption of functional pedagogy and students' cognitive mastery of physics concepts.
2. Adoption of functional pedagogy has no significant influence on students' psychomotor (laboratory) skill acquisition.
3. Adoption of functional pedagogy has no significant effect on students' affective dispositions toward physics.
4. Adoption of functional pedagogy does not significantly predict students' overall acquisition of physics-related skills.

Methodology

This study adopted a descriptive survey design, which was considered appropriate because it sought to evaluate existing teaching practices and their relationship with students' acquisition of physics-related skills without manipulating classroom variables. The study population comprised all Senior Secondary II physics students in Nigerian secondary schools. From this population, a sample of 480 students was selected from twelve public and private schools located in Abuja and neighboring states. Stratified random sampling was employed to ensure adequate representation of school types and gender balance within the sample.

Two major instruments were used in the study. The first was the Functional Pedagogy Adoption Questionnaire (FPAQ), designed to capture the extent to which teachers incorporated inquiry-driven teaching, activity-based tasks, contextual problem-solving, and laboratory engagement into classroom practice. The second was the Physics Skills Acquisition Scale (PSAS), which measured three domains of student outcomes: cognitive mastery of physics concepts, psychomotor (laboratory) skills, and affective disposition toward physics. The FPAQ consisted of 20 items while the PSAS contained 35 items, with responses rated on a five-point Likert scale ranging from “strongly disagree” to “strongly agree.”

Both instruments were subjected to content validation by three experts in science education at the University of Abuja. Necessary revisions were made to improve clarity and relevance. Reliability of the instruments was determined through a pilot study involving 60 students from two schools not included in the main sample. The Cronbach's alpha coefficients obtained were 0.81 for FPAQ and 0.85 for PSAS, indicating high internal consistency.

Data were collected through self-administered questionnaires distributed during school hours with the cooperation of physics teachers. Additionally, classroom observations were

conducted in a sub-sample of schools to triangulate findings from the questionnaires. The collected data were coded and analyzed using both descriptive and inferential statistics. Descriptive statistics, such as means and standard deviations, were used to answer the research questions on the extent of adoption of functional pedagogy. Inferential analyses, including Pearson correlation and multiple regression, were applied to test the research hypotheses at a 0.05 level of significance.

Results

Research Question 1

To what extent is functional pedagogy adopted in teaching senior secondary school physics in Nigeria?

Table 1: Mean Ratings of Teachers' Adoption of Functional Pedagogy (n = 480)

Dimension of Functional Pedagogy	Mean	SD	Decision
Inquiry-based teaching	3.12	0.84	Moderately High
Activity-oriented classroom practices	2.95	0.79	Moderate
Laboratory engagement	2.62	0.88	Low
Problem-solving and contextual learning	2.74	0.81	Moderate
Innovative assessment practices	2.59	0.91	Low
Overall Adoption	2.80	0.85	Moderate

Table 1 shows that the overall adoption of functional pedagogy in teaching senior secondary school physics is moderate ($M = 2.80$). Teachers adopt inquiry-based teaching more frequently, but laboratory engagement and innovative assessment practices are least adopted.

Research Question 2

What is the relationship between adoption of functional pedagogy and students' cognitive mastery of physics concepts?

Functional Pedagogy Adoption vs Cognitive Mastery

Significant

Table 2: Correlation between Functional Pedagogy Adoption and Cognitive Mastery

Variable	r	p-value	Decision
Functional Pedagogy Adoption vs Cognitive Mastery	0.48	0.001	Significant

Table 2 reveals a significant positive relationship ($r = 0.48$, $p < 0.01$) between functional pedagogy adoption and students' cognitive mastery of physics concepts. Increased adoption of functional pedagogy enhances students' conceptual understanding.

Research Question 3

How does functional pedagogy adoption influence students' psychomotor (laboratory) skill acquisition?

Table 3: Regression Analysis on Adoption and Psychomotor

Predictor Variable	β	t	p-value	Decision
Functional Pedagogy Adoption	0.52	5.82	0.001	Significant

Table 3 indicates that adoption of functional pedagogy significantly predicts students' psychomotor skill acquisition ($\beta = 0.52$, $t = 5.82$, $p < 0.01$). This suggests that students gain practical laboratory skills when teachers adopt inquiry and activity-based practices.

Research Question 4

What is the effect of functional pedagogy adoption on students' affective dispositions toward physics?

Table 4: Regression Analysis on Adoption and Affective Dispositions

Predictor Variable	β	t	p-value	Decision
Functional Pedagogy Adoption	0.39	4.35	0.002	Significant

Table 4 shows that functional pedagogy adoption has a significant effect on students' affective dispositions toward physics ($\beta = 0.39$, $p < 0.01$). Adoption improves students' interest, motivation, and positive attitudes toward physics.

Discussion of Findings

The findings of this study provide empirical evidence on the extent and effect of functional pedagogy adoption in Nigerian secondary school physics classrooms.

First, the study revealed that the overall adoption of functional pedagogy is moderate, with inquiry-based teaching being more common than laboratory engagement or innovative assessment. This aligns with Nworgu (2018), who noted that while teachers occasionally introduce inquiry activities, systemic challenges such as poor infrastructure and exam-oriented culture hinder full adoption.

Second, the significant positive correlation between functional pedagogy adoption and cognitive mastery supports Black and Wiliam's (2018) argument that learner-centered and formative practices raise academic achievement. In the Nigerian context, this suggests that improved adoption could directly reduce poor performance in WAEC physics examinations. Third, adoption of functional pedagogy was found to strongly predict psychomotor skill acquisition. This finding resonates with Adeyemi (2019), who emphasized that inquiry and laboratory-based practices enhance students' hands-on competence. It highlights the importance of equipping laboratories and training teachers in practical facilitation.

Finally, the significant effect of adoption on affective dispositions confirms earlier studies (Achor, 2011; Ogunniyi, 2019) showing that engaging, student-centered pedagogy improves

learners' interest and motivation. Students exposed to functional pedagogy are more likely to enjoy physics and pursue STEM careers.

Overall, the findings demonstrate that functional pedagogy not only improves achievement but also nurtures the holistic development of learners—cognitive, psychomotor, and affective.

Conclusion

This study concludes that while functional pedagogy is moderately adopted in Nigerian secondary school physics classrooms, its adoption significantly enhances students' cognitive mastery, psychomotor skills, and affective dispositions. The uneven adoption—strong in inquiry but weak in laboratory and assessment practices—limits the full realization of its potential. Strengthening functional pedagogy is essential for addressing the persistent underachievement of Nigerian students in physics.

Implications of the Study

1. Educational Practice: Teachers must integrate functional pedagogy consistently, especially laboratory engagement and authentic assessment, to foster deeper learning and skill acquisition.
2. Curriculum Development: Curriculum planners should revise physics syllabi to emphasize activity-based and problem-solving pedagogy.
3. Policy: Education policymakers must provide enabling infrastructure, particularly well-equipped laboratories, to support functional pedagogy adoption.
4. Teacher Education: Pre-service and in-service training programs should emphasize practical and inquiry-based teaching approaches.
5. Examination Reform: WAEC and NECO should incorporate more authentic and performance-based assessment tasks to drive adoption.

Recommendations

Based on the findings and conclusions, the following recommendations are made:

1. Teacher training programs should prioritize functional pedagogy methods, with workshops focusing on inquiry, laboratory use, and authentic assessment.
2. Government and private stakeholders should invest in laboratory equipment and ICT resources to enhance practical engagement.
3. Physics curriculum at the secondary school level should be revised to integrate functional pedagogy principles explicitly.
4. Examination bodies should reform assessment to reward problem-solving, application, and experimental competence rather than rote recall.
5. Further research should extend this study to other STEM subjects to determine the generalizability of functional pedagogy's impact.

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