AFRICAN JOURNAL OF THEORY AND PRACTICE OF EDUCATIONAL RESEARCH (AJTPER)
Print ISSN: 2630-6565
e-Copy ISSN: 2992-3638
VOL. 14 JUNE, 2026

A SURVEY OF PHYSICS TEACHERS' ADOPTION OF EDUCATIONAL SCIENCE RESEARCH AND ASSESSMENT-BASED FINDINGS FOR INNOVATIVE TEACHING IN NORTH- CENTRAL NIGERIA SECONDARY SCHOOLS

https://doi.org/10.83151/nabp-rm45

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Abstract
This study examined Physics teachers' adoption of educational science research and assessment-based evidence for innovative teaching in senior secondary schools in North–Central Nigeria. A descriptive survey of 187 teachers employed the Physics Teachers' Research and Assessment Utilisation Questionnaire (PTRAUQ; α = 0.87) and analysed data using medians, Mann–Whitney U tests, and Spearman correlation. Results show high engagement with research and assessment (Median = 3.00), moderate use of inquiry-based learning, learner-centred instruction, ICT integration, and continuous assessment, but lower uptake of diagnostic assessment and simulations. Significant urban–rural differences were found in research integration (U = 2.85, p = 0.005, r = 0.21), assessment use (U = 2.41, p = 0.017, r = 0.18), and challenges (U = 3.02, p = 0.003, r = 0.22). A moderate relationship emerged between evidence use and innovation (ρ = 0.42, p = 0.001). The study shows that evidence use is structurally mediated, contributing a context-sensitive explanatory model of instructional practice.

Keywords: Educational Research Adoption, Assessment Literacy, Innovative Teaching, Physics Education.

Introduction
The quality of science education remains central to the development of innovation-driven economies, particularly in disciplines such as Physics, which underpin technological advancement and scientific literacy. Contemporary perspectives grounded in

constructivist learning theory and the assessment-for-learning (AfL) framework position teaching as a responsive process in which instructional decisions are continuously shaped by evidence derived from learners' understanding and performance (Schunk, 2021; Black & Wiliam, 2023). From this standpoint, effective pedagogy depends not only on subject knowledge but also on teachers' capacity to interpret educational research and assessment data and translate such evidence into instructional action (Hattie, 2023).

Despite this expectation, Physics education in Nigeria continues to record persistent underperformance. Reports from the West African Examinations Council (WAEC, 2019–2023) consistently document students' weak conceptual understanding, limited application of principles, and poor problem-solving skills. Although earlier studies attribute these outcomes to teacher-centred instruction and limited pedagogical innovation (Aina, 2013; Mekonnen, 2014; Adeyemo & Oloyede, 2021), recent evidence suggests that instructional improvement is strongly linked to teachers' access to and use of formative assessment and feedback systems (OECD, 2023; Brame, 2011). However, these strands of literature remain fragmented, as pedagogical studies emphasise instructional style, assessment literature focuses on feedback mechanisms, and professional development studies highlight teacher capacity, with limited convergence on how teachers actually engage with and utilise evidence in classroom practice.

A key issue emerging across these bodies of literature is therefore not the absence of educational research or assessment systems, but the inconsistent conversion of such resources into instructional improvement. Although research evidence provides tested pedagogical strategies and assessment systems that generate continuous feedback on learning, their influence on classroom decision-making remains uneven. This is reflected in studies showing awareness of research evidence but limited classroom application (Okon & Salisu, 2022), as well as limited assessment literacy that constrains effective instructional adaptation (Uche & Edeh, 2024; Uwadileke & Ogundare, 2024). Taken together, these findings suggest that the challenge is not isolated to knowledge or skills alone, but lies in the weak alignment between evidence generation and its pedagogical utilisation.

This pattern points to a more fundamental explanatory limitation in existing studies: they describe barriers to evidence use but do not sufficiently explain why teachers in similar policy and curriculum environments differ in their adoption of research and assessment findings. While teacher capacity and school context have been identified as influencing factors in science education outcomes (Okeke & Madu, 2023), less attention has been given to the mechanisms through which evidence is interpreted, prioritised, and translated into instructional decisions. Consequently, current explanations do not fully account for variation in adoption patterns across school contexts, particularly between teachers exposed to similar curricular reforms but demonstrating different instructional behaviours.

Viewed from an integrated constructivist and assessment-for-learning perspective, teacher decision-making is shaped by how instructional evidence is perceived, interpreted, and judged for classroom relevance (Bandura, 1997; Schunk, 2021). Constructivism implies that teachers continuously reconstruct instructional strategies in response to

perceived learner needs, while AfL emphasises that feedback from assessment should directly inform subsequent teaching actions (Black & Wiliam, 2023). However, the extent to which these theoretical expectations translate into practice depends on teachers' interpretive capacity, institutional support, and access to usable evidence. Where these conditions are weak, evidence remains peripheral to instruction; where they are strong, it becomes central to pedagogical adjustment and innovation (Hattie, 2023).

Against this backdrop, this study investigates the extent to which Physics teachers in senior secondary schools in the Federal Capital Territory, Abuja, integrate educational science research findings and assessment-based evidence into instructional practice. It further examines how such integration relates to innovative teaching practices and how contextual conditions shape teachers' capacity to utilise evidence in instruction. By focusing on the conditions that influence how evidence is interpreted and enacted within classroom realities, the study moves beyond descriptive accounts of barriers to provide a clearer explanatory account of why the presence of research and assessment data does not automatically lead to instructional transformation. It thus contributes to the literature by clarifying the contextual and cognitive factors that enable or constrain evidence-informed teaching in Physics classrooms, with implications for strengthening teacher education, professional development, and education policy.

Statement of Problem

Educational science research and assessment systems are designed to inform instructional improvement, yet their use in Physics classrooms remains inconsistent and unevenly understood. Existing studies typically treat research use and assessment use separately, offering fragmented accounts that fail to explain how teachers actually integrate multiple forms of evidence in classroom decision-making. Consequently, there is limited empirical clarity on the cognitive and contextual processes through which Physics teachers interpret, prioritise, and translate educational research and assessment feedback into instructional action. This leaves a critical gap in understanding why evidence-based resources do not consistently result in instructional change, despite strong policy advocacy for their use. This study, therefore, examines the extent and determinants of Physics teachers' use of educational science research and assessment evidence in instructional practice within Nigerian secondary schools

Research Questions

1. To what extent do Physics teachers integrate educational science research findings into their classroom instruction?
2. How frequently do Physics teachers use assessment-based findings to guide lesson planning and improve teaching strategies?
3. To what extent does the adoption of research and assessment evidence enhance innovative teaching practices (such as inquiry-based learning, ICT integration, learner-centred methods, and formative assessment) in Physics classrooms?
4. What are the major challenges faced by Physics teachers in utilizing research and assessment findings for instructional improvement?

Hypotheses

H_{01}: There is no significant difference between urban and rural Physics teachers in their level of integration of educational science research findings into the classroom instruction.

H_{02}: There is no significant difference between urban and rural Physics teachers in the frequency of using assessment-based findings to guide lesson planning and improve instructional strategies.

H_{03}: The adoption of educational science research and assessment-based evidence does not significantly influence innovative teaching practices in Physics classrooms, measured in terms of inquiry-based learning, ICT integration, learner-centred instruction, formative assessment use, and instructional creativity.

H_{04}: There is no significant difference between urban and rural Physics teachers in the challenges encountered while utilizing educational science research and assessment findings for instructional improvement.

Research Method

This study adopted a descriptive survey research design to examine Physics teachers' adoption of educational science research and assessment-based findings for innovative teaching in senior secondary schools in the Federal Capital Territory (FCT)-Abuja, North-Central Nigeria. The population comprised all Physics teachers in public secondary schools across the six Area Councils of the FCT.

A multistage sampling procedure was employed to ensure representativeness and adequate coverage. At the first stage, three Area Councils (Gwagwalada, Kwali, and Abuja Municipal Area Council—AMAC) were selected using simple random sampling to reflect both urban and rural contexts. At the second stage, secondary schools within the selected Area Councils were also selected through simple random sampling. At the final stage, all Physics teachers in the selected schools were included through total enumeration due to the relatively small and uneven distribution of Physics teachers across schools. This approach ensured a balance between probabilistic sampling at the institutional level and comprehensive inclusion of respondents.

Data were collected using a structured questionnaire titled Physics Teachers' Research and Assessment Utilisation Questionnaire (PTRAUQ), developed by the researchers based on an extensive review of literature on educational research utilisation, assessment literacy, and innovative teaching practices. The instrument comprised four subscales: adoption of educational research (10 items), use of assessment-based findings (9 items), innovative teaching practices (9 items), and challenges to evidence use (8 items). Sample items included: "I adjust my teaching methods based on research findings," "I use students' assessment results to guide instructional decisions," and "I incorporate inquiry-based and learner-centred strategies in my teaching."

Responses were measured on a four-point Likert scale (Strongly Agree = 4 to Strongly Disagree = 1). Descriptive statistics, including frequency distributions, percentages, median, and mode, were used to summarise response patterns. A median

score of 3.00 or above was interpreted as agreement, while values below 3.00 indicated disagreement. The mode was used to identify the most frequently selected response.

Given the ordinal nature of the data, assumptions of normality and homogeneity of variance required for parametric tests were considered inappropriate; therefore, non-parametric techniques were employed. Accordingly, t-tests and ANOVA were not used. The Mann–Whitney U test was applied to test hypotheses H_{01}, H_{02}, and H_{04} to determine differences between urban and rural teachers, while Spearman Rank Correlation (ρ) was used to test H_{03} to examine the relationship between adoption of evidence and innovative teaching practices. All hypotheses were tested at the 0.05 level of significance ($p < 0.05$).

Content and face validity of the PTRAUQ were established through expert review by two specialists in Physics Education and one expert in Measurement and Evaluation from the University of Abuja. Construct validity was further examined using Exploratory Factor Analysis (EFA). Results indicated that items loaded appropriately on their respective constructs, with acceptable factor loadings and minimal cross-loadings, thereby supporting the structural validity of the instrument.

Reliability of the instrument was determined through a pilot study involving 20 Physics teachers outside the main study area. Internal consistency was assessed using Cronbach's Alpha, yielding coefficients of 0.83 (research adoption), 0.85 (assessment use), 0.88 (innovative teaching practices), and 0.81 (challenges), with an overall reliability index of 0.87. These values indicate satisfactory internal consistency across all subscales.

Results

Data were analysed in alignment with the research questions and corresponding hypotheses. Descriptive statistics (frequencies, percentages, median, and mode) were used to summarise responses, while Mann–Whitney U and Spearman Rank Correlation (ρ) were used for hypothesis testing at the 0.05 level of significance. Results are presented according to the research questions and associated hypotheses.

Research Question One: To what extent do physics teachers integrate educational science research findings into their classroom instruction

Table 1: Median, Mode, and Percentage Distribution of Physics Teachers' integration of educational science research findings into their classroom instruction (N=187)

S/N	Item Statement	SA (%)	A (%)	D (%)	SD (%)	Median	Interpretation
1	Apply research findings	36.4	39.6	17.6	6.4	3 (A)	Agree
2	Read journals	31.6	38.0	20.9	9.6	3 (A)	Agree
3	Use research for strategies	39.0	42.8	12.8	5.3	3 (A)	Agree
4	Experiment with approaches	34.2	42.2	16.6	7.0	3 (A)	Agree
5	Use assessment data	37.4	41.2	15.5	5.9	3 (A)	Agree

6	School encourages research	29.9	40.1	22.5	7.5	3 (A)	Agree
7	Translate research easily	27.8	35.3	25.7	11.2	3 (A)	Agree
8	Improve conceptual understanding	38.0	42.2	13.4	4.8	3 (A)	Agree
9	Collaborate with colleagues	32.1	41.7	19.8	6.4	3 (A)	Agree

Median and modal values were consistently 3 across all items, while the proportions of "Agree" and "Strongly Agree" responses exceeded those of "Disagree" and "Strongly Disagree." Response patterns were relatively uniform, with minor variations across items.

Research Question Two: How frequently do physics teachers use assessment-based findings to guide lesson planning and improve teaching strategies?

Table 2: Median, Mode, and Percentage Distribution of Physics Teachers' Assessment of the use of educational science research findings in their classroom instruction (N=187)

S/N	Item Statement	SA (%)	A (%)	D (%)	SD (%)	Median	Interpretation
10	Adjust teaching	39.6	42.2	13.4	4.8	3 (A)	Agree
11	Assessment guides planning	36.4	41.2	16.6	5.9	3 (A)	Agree
12	Analyse performance	42.8	40.1	12.8	4.3	3 (A)	Agree
13	Provide feedback	45.5	37.4	12.3	4.8	3 (A)	Agree
14	Use formative tests	38.0	42.2	13.9	5.9	3 (A)	Agree
15	School support	32.1	39.6	20.3	8.0	3 (A)	Agree
16	Use diagnostic tests	28.3	36.9	24.1	10.7	3 (A)	Agree
17	Share findings	32.6	40.6	19.8	7.0	3 (A)	Agree

All items recorded median values of 3, with modal responses of either 3 or 4. Across items, the combined proportions of "Agree" and "Strongly Agree" were higher than those of disagreement, with observable variation in response intensity.

Research Question Three: To what extent does the adoption of research and assessment evidence enhance innovative teaching practices (such as inquiry-based learning, ICT integration, learner-centred methods, and formative assessment) in Physics classrooms?

Table 3: Median, Mode, and Percentage Distribution of Physics Teachers' **Innovative Practices in** their classroom instruction (N=187).

S/N	Item Statement	SA (%)	A (%)	D (%)	SD (%)	Median	Interpretation
18	Inquiry learning	36.9	41.7	15.0	6.4	3 (A)	Agree

19	Encourage questioning	38.5	42.8	13.4	5.3	3 (A)	Agree
20	Use ICT	31.0	43.3	17.1	8.6	3 (A)	Agree
21	Use simulations	29.4	38.5	20.3	11.8	3 (A)	Agree
22	Student participation	40.1	42.2	12.3	5.3	3 (A)	Agree
23	Collaborative learning	37.4	41.2	15.0	6.4	3 (A)	Agree
24	Continuous assessment	39.0	41.7	13.9	5.3	3 (A)	Agree
25	Adjust teaching	35.8	43.9	14.4	5.9	3 (A)	Agree
26	Real-life application	40.6	40.1	13.9	5.3	3 (A)	Agree

Median values remained at 3 for all items, with modal responses predominantly at 3 and occasionally 4. The distribution shows higher proportions of agreement across items, with some variation evident, particularly in technology-related practices.

Research Question Four: What are the major challenges faced by Physics teachers in utilizing research and assessment findings for instructional improvement?

Table 4: Descriptive Statistics on Challenges Faced by Physics Teachers in Using Research and Assessment Evidence

S/N	Item Statement	SA (%)	A (%)	D (%)	SD (%)	Median	Interpretation
27	Access materials	37.4	40.6	15.0	7.0	3 (A)	Challenge
28	Lack of time	40.1	42.2	12.3	5.3	3 (A)	Challenge
29	Interpret research	36.9	39.6	16.6	7.5	3 (A)	Challenge
30	Training issues	38.5	41.2	14.4	5.9	3 (A)	Challenge
31	Skill gap	35.3	39.0	18.2	7.5	3 (A)	Challenge
32	ICT access	41.7	40.1	12.8	5.3	3 (A)	Challenge
33	Large class	42.8	38.5	13.4	5.3	3 (A)	Challenge
34	Institutional support	38.0	39.6	15.5	7.0	3 (A)	Challenge
35	Collaboration	34.2	41.7	16.6	7.5	3 (A)	Challenge
36	Professional development.	41.2	39.0	14.4	5.3	3 (A)	Challenge

Median and modal values were generally 3 or 4 across items, with “Agree” and “Strongly Agree” responses constituting the majority. Variations in response distribution were observed across specific challenge areas.

Table 5A: Mann–Whitney U Test Results Comparing Urban and Rural Physics Teachers (N = 187)

Hypothesis	Variable	Group	N	Mean Rank	U	z	p-value	Effect Size (r)	Decision
H_{01}	Integration of educational science research findings	Urban	102	104.62	3325.00	-2.85	0.005	0.21	Reject H_{01}
		Rural	85	79.48					
H_{02}	Use of assessment-based findings in instruction	Urban	102	101.37	3498.50	-2.41	0.017	0.18	Reject H_{02}
		Rural	85	83.21					
H_{04}	Challenges in using research and assessment evidence	Urban	102	82.15	3187.00	-3.02	0.003	0.22	Reject H_{04}
		Rural	85	108.64					

Effect size (r) was computed using $r=\frac{z}{\sqrt{N}}$, where N=187

Table 5A shows that there are statistically significant differences between urban and rural Physics teachers across all three variables examined. Urban teachers recorded higher mean ranks in research integration and assessment-based instructional use, whereas rural teachers recorded higher mean ranks in perceived challenges. Although these differences are statistically significant ($p < 0.05$), the corresponding effect sizes ($r = 0.18–0.22$) are small, indicating that the magnitude of the differences is limited. This suggests that while measurable differences exist between the two groups, they are not substantial

Table 5B: Relationship Between Adoption of Research and Assessment Evidence and Innovative Teaching Practices

Hypothesis	Predictor Variable	Outcome Variable	Statistical Test	r-value	p-value	Decision
H_{03}	Adoption of research and assessment evidence	Innovative teaching practices	Pearson Correlation	0.42	0.001	Reject H_{03}

Table 5B indicates a moderate, positive, and statistically significant relationship between teachers' adoption of research and assessment evidence and their engagement in innovative teaching practices ($r = 0.42$, $p = 0.001$). This indicates that higher levels of evidence adoption are associated with increased use of innovative teaching practices.

Discussion of Findings

This study examined Physics teachers' engagement with educational research and assessment-based evidence, focusing on urban–rural differences and its relationship with innovative teaching practices. Overall, the findings indicate a generally positive orientation toward evidence-informed teaching, though the depth of implementation varies across contexts.

The results show that teachers are aware of research-informed strategies, consistent with earlier findings on pedagogical awareness in Nigerian schools (Aina, 2013; Adeyemo & Oloyede, 2021). However, awareness does not consistently translate into classroom application, suggesting that access to research alone is insufficient for instructional transformation (Hattie, 2023).

Significant urban–rural differences were observed, with urban teachers reporting higher use of research and assessment evidence, while rural teachers reported greater instructional challenges. This suggests unequal access to professional support and learning resources. Although previous studies note general constraints in science teaching (Mekonnen, 2014), the present findings highlight the contextual nature of evidence use.

From a theoretical perspective, these findings align with constructivist and social cognitive views that emphasise the role of both cognition and environment in shaping instructional behaviour (Schunk, 2021; Bandura, 1997). Teachers reconstruct instructional practices based on experience, but this process is constrained when institutional support is limited.

In relation to assessment practices, teachers reported use of assessment information; however, implementation appears more feedback-oriented than diagnostic. This suggests partial enactment of the assessment-for-learning cycle (Black & Wiliam, 2023) and supports concerns about limited assessment literacy in classroom practice (Uche & Edeh, 2024; Uwadileke & Ogundare, 2024).

The moderate positive relationship between evidence use and innovative teaching practices indicates that teachers who engage more with research and assessment evidence are more likely to adopt learner-centred approaches. However, the moderate strength of this relationship suggests that evidence use alone does not guarantee instructional transformation, consistent with Hattie (2023).

Conclusion and Recommendations

This study concludes that Physics teachers' use of educational research and assessment-based evidence is generally positive but uneven across contexts. Although teachers demonstrate awareness of evidence-informed strategies, their classroom application is shaped by contextual factors such as access to professional support, instructional resources, and institutional capacity, particularly across urban and rural school settings. The findings further indicate a positive but moderate relationship between evidence use

and innovative teaching practices, suggesting that awareness alone is insufficient for sustained instructional transformation.

The study contributes to the literature by shifting attention from whether teachers use research and assessment evidence to how and under what conditions such evidence is translated into classroom practice. It demonstrates that evidence-informed teaching is not solely a function of teacher knowledge or access, but is structurally mediated by contextual and institutional factors, offering a more nuanced explanation of variability in Physics instructional practice.

1. Professional development programmes should focus on strengthening teachers' capacity to interpret, adapt, and apply educational research and assessment evidence through structured, practice-based training and subject-specific instructional design, reflecting the observed gap between awareness and classroom implementation.
2. Education authorities should integrate diagnostic assessment into routine classroom practice by providing tools, guidelines, and training that support systematic identification of learning gaps and instructional adjustment, in response to the weak implementation of the full assessment-for-learning cycle.
3. Targeted interventions should prioritise resource provision, mentoring, and professional learning networks for teachers in under-resourced (particularly rural) contexts to address the observed urban–rural disparities in evidence use.
4. Focused investment in infrastructure and teacher training is required to enhance the effective integration of ICT tools and simulation-based strategies, addressing the limited adoption of these approaches in Physics instruction.

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