



RESEARCH ENGAGEMENT OF SCIENCE TEACHERS IN FEDERAL AND STATE COLLEGES OF EDUCATION IN ENUGU STATE: A COMPARATIVE SURVEY ON DUAL MANDATE IMPLEMENTATION

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Abstract

Teaching and research is central to colleges of education, yet research engagement among science teachers in advent of Dual-Mandate remains uneven due to institutional and professional constraints. This study examined research engagement of science teachers in federal and state colleges of education in Enugu State, Nigeria, and its implications for Dual-Mandate implementation. A comparative survey design was adopted. A sample of 103 science lecturers from federal and state colleges of education was selected via stratified sampling in Enugu State. Data were collected using REDMIQ four-point Likert scale. Mean, standard deviation, and t-test analyses were conducted using SPSS at 0.05 significance level. Findings showed generally high level of research engagement (cluster mean = 3.18), especially in supervision, collaboration, and publication. Research engagement significantly enhanced teaching effectiveness and Dual-Mandate implementation (cluster mean = 3.51). Institutional factors moderately constrained engagement (cluster mean = 2.76), while professional factors strongly influenced engagement (cluster mean = 3.25). t-test results indicated significant differences between federal and state colleges in research engagement and institutional conditions, with no difference in professional factors; state colleges reported higher Dual-Mandate contribution perceptions. The study concludes that research engagement is structurally driven, requiring stronger institutional support.

Keyword: *Research Engagement, Dual Mandate, Science Teachers, Colleges of Education, Institutional and Professional Factors*

Introduction

The Dual-Mandate Programme in Nigerian colleges of education emerged as a major policy reform aimed at repositioning these institutions as centres for both teacher preparation and academic scholarship. Traditionally, colleges of education in Nigeria were established primarily to award the National Certificate in Education (NCE), a three-year professional qualification recognized as the minimum teaching credential for basic education in the country. However, concerns about limited opportunities for academic progression, the need to enhance teacher quality, and the desire to align teacher education with global higher education standards prompted reforms that expanded the mandate of colleges of education beyond NCE training. Consequently, at a point, some colleges were authorized to offer bachelor's degree programmes through affiliations with universities. Recently, the federal government has approved Dual-Mandate programmes for colleges of education authorising a direct degree-awarding powers under the regulatory oversight of the relevant educational authorities (Egede, 2020). At the central of this innovative model is the planned integration of the 3-Year National Certificate in Education (NCE) programme, which serves as the foundational cornerstone for fostering educational excellence and the synergistic 2-Year Degree programme, which functions in tandem with the NCE programme. This Dual-Mandate structure is designed to lift educational accomplishment by providing a comprehensive and dynamic learning experience that spreads beyond the conventional boundaries of academic programmes. This reform reflects national efforts to enhance the professionalization of teaching and to ensure that colleges of education contribute more substantially to knowledge production, innovation, and national development. The policy framework underpinning the Dual-Mandate is derived from directives of the Federal Government of Nigeria, the regulatory guidelines of the National Commission for Colleges of Education (NCCE), National University Commission and subsequent legislative and administrative reforms that expanded the academic responsibilities of colleges of education. Under this framework, institutions are expected to balance instructional excellence with research productivity, community engagement, and scholarly dissemination. Consequently, academic staff are no longer viewed solely as classroom instructors but also as researchers expected to generate new knowledge, publish in reputable outlets, supervise student research projects, attract research funding, participate in professional development activities, and contribute to institutional and national educational advancement (Egede, 2020).

Research engagement has been widely recognized as a vital driver of academic effectiveness and institutional performance. Empirical evidence designates that active participation in research advances teaching quality, strengthens curriculum relevance, and fosters students' critical and analytical capabilities (Miao et al., 2025). Within Science Education, where knowledge changes rapidly, sustained research engagement is indispensable for maintaining instructional currency and aligning teaching with current scientific developments (Olowu, 2025). Therefore, academic productivity pointers such as scholarly publications, conference

participation, research supervision, and grant acquisition are increasingly used as proxies for institutional quality and effectiveness.

However, research engagement in developing contexts, including Nigeria, remains constrained by persistent structural and professional challenges. Institutional limitations such as inadequate funding, poor research infrastructure, excessive teaching workloads, and limited administrative support have been consistently identified as barriers to research productivity (Onayinka et al., 2023). In addition, professional variables including academic qualifications, research competence, mentorship, and promotion requirements play a critical role in shaping individual research behaviour (Miao et al., 2025). These constraints are particularly evident in Colleges of Education, which have historically prioritized teaching functions over research, thereby weakening the operationalisation of the Dual-Mandate.

In the Nigerian higher education system, disparities between federal and state colleges of education introduce further complexity. Federal institutions are generally better resourced and supported by national frameworks, whereas State institutions habitually function under tighter financial and administrative constraints (Ofuani & Okoh, 2025). These structural differences are likely to produce differences in research engagement among academic staff. Notwithstanding this, existing studies have few empirical attentions to colleges of education and even least focus on comparative analyses between federal and state institutions, particularly within science teacher education.

More critically, although the research–teaching nexus is well documented, there is a paucity of context-specific empirical evidence linking science teachers’ research engagement to the effective implementation of the Dual-Mandate in colleges of education in Nigeria. In particular, little is known about how institutional and professional factors interact to shape research engagement across different governance structures, and how such engagement translates into pedagogical and institutional outcomes. This establishes a strong knowledge gap that limits evidence-based policy and institutional interventions meant at strengthening research culture in teacher education (Gros et al., 2020).

Against this background, this study examines the research engagement of science teachers in federal and state colleges of education in Enugu State, Nigeria, with specific emphasis on its implications for Dual-Mandate implementation. The study comparatively analyses the extent of research involvement, evaluates the contribution of research engagement to teaching and institutional objectives, and identifies the institutional and professional factors influencing research engagement. By adopting a comparative survey design, the study provides context-sensitive empirical insights into how structural and individual determinants shape research practices in colleges of education.

The study contributes to the literature by addressing the paucity of comparative evidence on research engagement in non-university teacher education institutions in Nigeria. It

additionally advances understanding of the mechanisms through which research engagement supports dual mandate implementation, thereby offering practical implications for policy formulation, institutional strengthening, and professional capacity development in colleges of education.

Statement of the Problem

According to the Dual-Mandate programme, integrating teaching and research is central to the effectiveness of higher education institutions, particularly in teacher education where science teachers are expected to apply research to enhance instructional practice. Although research engagement is connected to improved teaching quality and institutional performance. Its realization in Nigerian colleges of education remains uncertain.

In Nigeria, research engagement is constrained by institutional factors such as inadequate funding, poor infrastructure, and heavy teaching workloads, as well as professional factors including limited research competence and weak mentorship. These challenges are further complicated by disparities between federal and state colleges of education, which differ in resource availability and administrative support. Notwithstanding this, empirical studies have largely overlooked colleges of education and rarely deliver comparative evidence across institution types. More importantly, there is limited context-specific evidence on how science teachers' research engagement contributes to the effective implementation of the dual mandate, particularly within varying institutional contexts. This gap constrains evidence-based policy and institutional reforms.

Therefore, this study addresses this gap by comparatively examining research engagement among science teachers in federal and state colleges of education in Enugu State and its implications for dual mandate implementation.

Purpose of the Study

This study examined the level of research engagement among science teachers in federal and state colleges of education in Enugu State, Nigeria, within the framework of dual mandate implementation. Specifically, this study:

- i. compared the extent of research involvement between science teachers in both institution types;
- ii. examined how their research engagement contributes to the realization of the dual mandate of teaching and research; and
- iii. identified the institutional and professional factors that account for observed differences in research engagement between science teachers in federal and state colleges of education.

Research questions

This study was guided by the following research questions:

**Research Engagement of Science Teachers in Federal And State Colleges of Education In Enugu State:
A Comparative Survey on Dual Mandate Implementation**

- a. What is the extent of research involvement between science teachers in federal and state colleges of education in Enugu State?
- b. How does research engagement science teachers contribute to the realization of the dual mandate objectives of teaching and research in colleges of education?
- c. What institutional factors influence differences in research engagement amongst science teachers in federal and state colleges of education in Enugu State?
- d. What professional factors influence differences in research engagement between science teachers in federal and state colleges of education in Enugu State?

Hypotheses

The following null hypotheses were formulated to guide the study:

- H₀₁: There is no significant difference in the extent of research engagement between science teachers in federal and state colleges of education in Enugu State, Nigeria.
- H₀₂: There is no significant difference between federal and state colleges regarding perceived contribution of research engagement to dual.
- H₀₃: There is no significant difference between federal and state colleges regarding institutional factors influencing research engagement.
- H₀₄: There is no significant difference between federal and state colleges regarding professional factors influencing research engagement.

Methodology

This study adopted a comparative survey research design to examine and compare the level of research engagement among science teachers in federal and state colleges of education in Enugu State and its relationship with the implementation of the dual mandate. The population comprised 158 science lecturers drawn from the Federal College of Education, Eha-Amufu (92) and Enugu State College of Education (Technical), Enugu (66), covering the departments of Biology, Chemistry, Computer Science, Integrated Science, Mathematics, Physics, and Physical and Health Education.

A sample of 103 science lecturers was selected using a stratified proportionate sampling technique. Lecturers were first stratified according to departments, after which proportionate sampling was employed to ensure satisfactory departmental representation and improve comparability between the two institutions.

Data were collected using a researcher-developed instrument titled *Research Engagement and Dual Mandate Implementation Questionnaire (REDMIQ)*. The questionnaire consisted of items structured on a four-point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1). The instrument was subjected to face and content validation by experts in Educational Research and Measurement and Evaluation, whose observations and recommendations guided the revision of the instrument. To establish the reliability of the instrument, a pilot study was conducted among science lecturers in a college of education

outside the study area but with characteristics similar to those of the study population. Data obtained from the pilot study were analyzed using Cronbach's Alpha reliability coefficient to determine the internal consistency of the instrument. The reliability coefficient of 0.90 was obtained.

Data analysis was carried out using IBM SPSS Version 20. Research questions were answered using arithmetic mean, while null hypotheses were tested using t-test at the 0.05 level of significance. Mean responses were interpreted as follows: 3.50–4.00 = Strongly Agree, 2.50–3.49 = Agree, 1.50–2.49 = Disagree, and 1.00–1.49 = Strongly Disagree.

RESULTS

Research Question One

What is the extent of research involvement of science teachers in federal and state colleges of education in Enugu State?

Table 1: Mean Responses of science teachers on extent of research involvement

S/N	Item Statement	$\bar{x}$	SD	Remark
1.	I regularly conduct research related to my area of specialization.	3.35	.479	A
2.	I publish research articles in peer-reviewed journals.	3.25	.437	A
3.	I present research papers at academic conferences.	3.40	.867	A
4.	I supervise students' research projects regularly.	3.98	.139	SA
5.	I collaborate with colleagues on research projects.	3.58	.496	SA
6.	I apply for research grants or funding.	2.72	.833	A
7.	I participate in research workshops and seminars.	2.86	.780	A
8.	I am involved in interdisciplinary research activities.	3.25	.437	A
9.	I contribute to textbook or academic book writing.	3.10	1.098	A
10.	I review manuscripts for academic journals or conferences.	2.35	.750	D
	Cluster mean	3.1769	.25539	A

Key: $\bar{x}$ = mean, SD = standard deviation, SA = strongly agree, A = agree, D = disagree, SD =strongly disagree

Table 1 answered the questions on the responses of science lecturers on the extent of research involvement. Findings addressing Research Question One show that science teachers in federal and state colleges of education in Enugu State revealed a generally high level of research involvement, with an overall cluster mean of 3.18 (SD = 0.26), suggesting agreement across most indicators.

Precisely, respondents reported active engagement in core research activities, including conducting research within their areas of specialization (M = 3.35, SD = 0.48), publishing in peer-reviewed journals (M = 3.25, SD = 0.44), and presenting papers at academic conferences (M = 3.40, SD = 0.87). High involvement was also observed in student-focused

and collaborative dimensions, particularly in supervising students' research projects ($M = 3.98$, $SD = 0.14$) and collaborating with colleagues on research initiatives ($M = 3.58$, $SD = 0.50$).

Moderate engagement was noted in applying for research grants ($M = 2.72$, $SD = 0.83$) and participation in workshops and seminars ($M = 2.86$, $SD = 0.78$), suggesting relatively lower involvement in capacity-building and funded research activities. Similarly, involvement in interdisciplinary research ($M = 3.25$, $SD = 0.44$) and contribution to textbook or academic book writing ($M = 3.10$, $SD = 1.10$) were within the agreement range but less pronounced.

Research Question Two

How does research engagement of science teachers contribute to the realization of the dual mandate objectives of teaching and research in colleges of education?

Table 2: Mean Responses of science teachers on how research engagement contribute to the realization of the dual mandate objectives

S/N	Item Statement	$\bar{x}$	SD	Remark
11.	My research activities improve the quality of my teaching.	3.38	.487	
12.	Research engagement enhances my ability to update course content.	3.50	.502	SA
13.	Conducting research helps me integrate current knowledge into classroom instruction.	3.50	.502	SA
14.	Research experience improves my effectiveness in supervising students' projects.	3.55	.500	SA
15.	Research engagement contributes to the academic reputation of my institution.	3.56	.498	SA
16.	My involvement in research supports the realization of the dual mandate of teaching and research.	3.67	.632	SA
17.	Research findings from my work are used to solve educational or societal problems.	3.21	.412	A
18.	I use research outcomes to develop instructional materials.	3.56	.498	SA
19.	Research engagement enhances innovation and critical thinking in my teaching.	3.56	.498	SA
20.	My institution encourages the integration of research into teaching practice.	3.55	.500	SA
	Cluster mean	3.5058	.40676	SA

Key: $\bar{x}$ = mean, SD = standard deviation, SA = strongly agree, A = agree, D = disagree, SD =strongly disagree

Findings for Research Question Two revealed that science teachers in federal and state colleges of education in Enugu State perceive research engagement as having a strong positive impact on teaching effectiveness, with an overall cluster mean of 3.51 ($SD = 0.41$), indicating strong agreement (Table 2).

Respondents strongly agreed that research involvement improves many dimensions of pedagogical practice, including updating course content ($M = 3.50$, $SD = 0.50$), integrating current knowledge into classroom instruction ($M = 3.50$, $SD = 0.50$), and improving effectiveness in supervising students' projects ($M = 3.55$, $SD = 0.50$). Similarly, research engagement was perceived to contribute significantly to institutional academic reputation ($M = 3.56$, $SD = 0.50$), support the realization of the dual mandate of teaching and research ($M = 3.67$, $SD = 0.63$), and foster innovation and critical thinking in teaching ($M = 3.56$, $SD = 0.50$). Teachers also reported strong agreement that research outcomes are utilized in developing instructional materials ($M = 3.56$, $SD = 0.50$) and that their institutions encourage the integration of research into teaching practice ($M = 3.55$, $SD = 0.50$).

Although still within the agreement range, comparatively lower ratings were observed for the direct application of research findings to solving educational or societal problems ($M = 3.21$, $SD = 0.41$) and the general improvement of teaching quality ($M = 3.38$, $SD = 0.49$).

Research Question Three

What institutional factors influence differences in research engagement amongst science teachers in federal and state colleges of education in Enugu State?

Table 3: Mean Responses of science teachers on institutional factors influencing differences in research engagement

S/N	Item Statement	$\bar{x}$	SD	Remark
21.	My institution provides adequate funding for research activities.	2.60	1.003	A
22.	Heavy teaching workload limits my ability to conduct research.	2.95	.879	A
23.	Availability of research facilities influences my level of research engagement.	3.22	.816	A
24.	My institution provides access to relevant academic journals and databases.	2.73	.972	A
25.	Administrative support encourages staff to engage in research.	2.75	.813	A
26.	Institutional policies promote staff participation in research activities.	2.93	.690	A
27.	Opportunities for research collaboration are supported by my institution.	2.75	.997	A
28.	My institution provides incentives or rewards for research productivity.	2.11	1.212	D
29.	Availability of research training programmes influences	2.45	.987	D

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S/N	Item Statement	$\bar{x}$	SD	Remark
	my research engagement.			
30.	Institutional bureaucracy discourages research activities.	3.08	1.218	A
	Cluster mean	2.7563	.76089	A

Key: $\bar{x}$ = mean, SD = standard deviation, SA = strongly agree, A = agree, D = disagree, SD =strongly disagree

Results for Research Question Three indicate that institutional factors moderately influence differences in research engagement among science teachers in federal and state colleges of education in Enugu State, as reflected in a cluster mean of 2.76 (SD = 0.76), denoting general agreement (Table 3).

Respondents agreed that structural and resource-related variables shape their research participation. Particularly, the accessibility of research facilities (M = 3.22, SD = 0.82) and institutional bureaucracy (M = 3.08, SD = 1.22) were recognized as important determinants, with the latter perceived as a restraint on research activities. Heavy teaching workload was also recognized as a limiting factor (M = 2.95, SD = 0.88), alongside institutional policies that encourage staff participation in research (M = 2.93, SD = 0.69).

Moderate agreement was noted for access to academic journals and databases (M = 2.73, SD = 0.97), administrative support (M = 2.75, SD = 0.81), and opportunities for research collaboration (M = 2.75, SD = 1.00), suggesting that these enabling conditions are present but not adequately robust. Similarly, funding for research activities (M = 2.60, SD = 1.00) was perceived as insufficient, reflecting a critical resource gap.

Conversely, respondents disagreed that their institutions provide adequate incentives or rewards for research productivity (M = 2.11, SD = 1.21) and sufficient research training programmes (M = 2.45, SD = 0.99), highlighting key deficiencies in motivational and capacity-building mechanisms.

Research Question Four

What professional factors influence differences in research engagement between science teachers in federal and state colleges of education in Enugu State?

Table 4: Mean Responses of science teachers on research engagement

S/N	Item Statement	$\bar{x}$	SD	Remark
31.	My academic qualification influences my research productivity.	3.33	.821	A
32.	My academic rank affects my level of research	3.16	.789	A

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	involvement.			
33.	Research competence and skills influence my engagement in research activities.	3.13	.696	A
34.	My years of teaching experience affect my research engagement.	3.50	.558	SA
35.	Participation in professional associations enhances my research involvement.	3.52	.502	SA
36.	My personal interest in research motivates me to conduct research.	3.01	1.176	A
37.	Lack of research mentorship limits my research productivity.	3.30	1.018	A
38.	Access to professional development opportunities influences my research engagement.	3.19	.961	A
39.	My ability to use statistical and research tools affects my research participation.	2.96	1.075	A
40.	Promotion requirements motivate me to engage in research activities.	3.43	1.006	A
	Cluster mean	3.2524	.36024	A

Key: $\bar{x}$ = mean, SD = standard deviation, SA = strongly agree, A = agree, D = disagree, SD = strongly disagree

Findings for Research Question Four show that professional factors exert a substantial influence on research engagement among science teachers in federal and state colleges of education in Enugu State, with a cluster mean of 3.25 (SD = 0.36), indicating overall agreement (Table 4).

Respondents strongly agreed that years of teaching experience (M = 3.50, SD = 0.56) and participation in professional associations (M = 3.52, SD = 0.50) significantly improve research involvement. Other key determinants include academic qualification (M = 3.33, SD = 0.82) and academic rank (M = 3.16, SD = 0.79), both of which were perceived to shape research productivity and engagement levels. Research competence and skills (M = 3.13, SD = 0.70), as well as access to professional development opportunities (M = 3.19, SD = 0.96), were also recognized as vital enabling factors.

Motivational dimensions were obvious, with promotion requirements (M = 3.43, SD = 1.01) and personal interest in research (M = 3.01, SD = 1.18) contributing to research participation. However, respondents recognized that lack of research mentorship (M = 3.30, SD = 1.02) establishes a significant constraint. Similarly, competence in the use of statistical and research tools (M = 2.96, SD = 1.08), although agreed upon, appears moderately less robust.

t-test Results Comparing Mean responses based on Type of Institution

Table 5: t-test Results Comparing Mean responses based on Type of Institution

Variables	Categories	n*	$\bar{x}$	SD	T	df	p	Decision
Extent of Research Engagement	Federal	66	3.22	.230	2.561	101	.012	Reject H ₀₁
	State	37	3.09	.279				
Contribution of Research to Dual Mandate Implementation	Federal	66	3.40	.416	-3.684	101	.000	Reject H ₀₂
	State	37	3.69	.318				
Influencing of Institutional Factors on Research Engagement	Federal	66	2.98	.694	4.322	101	.000	Reject H ₀₃
	State	37	2.36	.718				
Professional Factors Influencing Research Engagement	Federal	66	3.24	.348	-.546	101	.587	Accept H ₀₄
	State	37	3.28	.385				

n = number of respondents; * Total number of respondents in each case (*N*) = 103; $\bar{x}$ = mean, *SD* = standard deviation;

t = t-statistic; *df* = degrees of freedom; *p* = p-value; significance level = 0.05

The independent samples t-test results in Table 5 disclose statistically significant differences between science teachers in federal and state colleges of education on numerous key variables. For extent of research engagement, a significant difference was observed ($t(101) = 2.561$, $p = .012$), with teachers in federal institutions ($M = 3.22$, $SD = 0.23$) reporting higher engagement than their counterparts in state institutions ($M = 3.09$, $SD = 0.28$). Consequently, the null hypothesis (H_{01}) was rejected.

A significant difference was also established in the perceived contribution of research to the implementation of the Dual-Mandate ($t(101) = -3.684$, $p < .001$). In this case, respondents from state colleges ($M = 3.69$, $SD = 0.32$) reported significantly higher perceptions compared to those in federal colleges ($M = 3.40$, $SD = 0.42$), leading to the rejection of H_{02} .

Similarly, institutional factors influencing research engagement varied significantly across institution types ($t(101) = 4.322$, $p < .001$), with federal college respondents ($M = 2.98$, $SD = 0.69$) signifying stronger institutional influence than those in state colleges ($M = 2.36$, $SD = 0.72$). Thus, H_{03} was rejected.

However, no statistically significant difference was found in professional factors influencing research engagement ($t(101) = -0.546$, $p = .587$), as respondents from both federal ($M = 3.24$,

SD = 0.35) and state institutions (M = 3.28, SD = 0.39) reported comparable views. Therefore, H_{04} was accepted.

Discussion

There is a demonstration of a generally high level of research engagement in this study and this suggests that research is increasingly becoming an integral aspect of academic practice among science educators, particularly in core activities such as project supervision, collaboration, publication, and conference participation in both federal and state colleges of education in Enugu State. This finding is consistent with the view of Thu et al. (2025) who reported that research-active academics incline to contribute more effectively to knowledge production and pedagogical improvement. However, the relatively lower engagement in grant applications, research training, and journal reviewing indicates structural weaknesses in advanced research participation. This pattern mirrors persistent resource and capacity restraints often reported in developing higher education systems, where academic staff are more involved in teaching-related responsibilities than in competitive research outputs (Kadikilo et al., 2024). The limited participation in grant acquisition and peer review further suggests underdeveloped research ecosystems within colleges of education, which may hinder the sustainability of research productivity.

The revelation of a strong perceived contribution of research engagement to teaching effectiveness and Dual-Mandate realization was remarkable. Science teachers reported that research improves curriculum updating, instructional innovation, and supervision effectiveness. This finding supports earlier studies which established a positive research–teaching nexus, where research-active academics establish improved pedagogical quality and curriculum relevance (Benayoune et al., 2022). The strong agreement that research supports innovation and critical thinking further reflects the epistemic role of research in enhancing reflective teaching practice. However, the comparatively lower mean for solving societal problems suggests that the translation of research outputs beyond classroom contexts remains limited. This aligns with Nurhayati et al. (2025) who noted that while research improves instructional practice, its broader societal application in many developing contexts remains weak due to institutional and systemic barriers.

It was observed that institutional factors moderately influence research engagement and key determinants include availability of research facilities, workload, bureaucracy, and institutional policies. This is consistent with previous evidence that inadequate infrastructure and excessive teaching loads significantly constrain academic research productivity in developing countries (Uwizeye et al., 2022). The low ratings for funding, incentives, and research training indicate critical institutional deficiencies that undermine sustained research engagement. According to Igiri et al (2021), such disparities are particularly pronounced in African higher education systems where resource allocation between institutions is uneven.

The absence of strong motivational structures further weakens institutional research culture, limiting competitiveness and scholarly output.

It was demonstrated that professional factors significantly influence research engagement and variables such as teaching experience, professional association membership, academic qualification, and promotion requirements were identified as major drivers of research involvement. This finding is consistent with Sackdanouvong (2025), who argued that academic career progression and professional identity strongly shape research productivity. The importance of mentorship and research competence highlights the role of capacity development in sustaining academic research engagement. However, the moderate rating of statistical and methodological competence suggests skill gaps that may limit research quality and output. Sumbilon et al. (2025) similarly observed that research productivity is strongly dependent on both individual competence and institutional support structures, particularly mentorship and professional development opportunities.

The t-test revealed significant institutional differences in research engagement and related factors. Science teachers in federal colleges reported higher research engagement than those in state colleges likely reflects better resource availability and institutional support systems. This finding supports Ladipo et al. (2022), who noted that federal institutions in Nigeria generally benefit from stronger funding and more stable academic environments. Interestingly, state colleges recorded higher perceived contribution of research to Dual-Mandate implementation, suggesting that although engagement levels may be lower, the perceived relevance of research to teaching is stronger among state institution staff. This may reflect compensatory pedagogical adaptation in resource-constrained environments. Institutional factors also differed significantly, with federal colleges reporting stronger enabling conditions. This confirms structural inequalities in research infrastructure and administrative support across institution types (Aljehani & Mohebi, 2025, Thu et al., 2025). In contrast, no significant difference was found in professional factors ($p = .587$), indicating that individual-level determinants such as qualification, experience, and motivation are relatively uniform across both institutional settings. This suggests that disparities in research engagement are driven more by institutional than personal factors.

Jointly, the findings demonstrate that while science teachers exhibit moderate to high research engagement and recognize its importance for teaching effectiveness, systemic institutional constraints continue to limit optimal research productivity. The evidence further indicates that differences between federal and state colleges are largely structural rather than professional, reinforcing the centrality of institutional investment in strengthening research culture and sustaining Dual-Mandate implementation in colleges of education in Nigeria.

Conclusion

This study concludes that science teachers in federal and state colleges of education in Enugu State exhibit generally high but uneven research engagement, with strong involvement in teaching-related research activities such as student supervision, collaboration, publication, and conference participation, but weaker engagement in grant acquisition, journal reviewing, and formal research capacity development. Research engagement is strongly perceived to enhance teaching effectiveness, curriculum relevance, and pedagogical innovation, thereby supporting Dual-Mandate implementation. However, its full realization is constrained by persistent institutional challenges, including inadequate funding, weak research infrastructure, heavy workload, limited incentives, and insufficient training opportunities, alongside professional skill and mentorship gaps. Comparative analysis shows that federal colleges demonstrate higher research engagement and stronger institutional support, while state colleges report a higher perceived contribution of research to teaching, indicating context-driven adaptation to resource disparities. Since no significant differences were found in professional factors, the study concludes that variations in research engagement are largely structurally driven. Overall, strengthening the Dual-Mandate in colleges of education requires targeted institutional investment and sustained capacity-building for science teachers.

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