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Research Article

Teacher-Centered Systemic Reform Model: An Exploration of the Contributing Factors to Science Teachers' Adoption of Inquiry-Based Pedagogy

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Abstract
Inquiry-based pedagogy is a constructivist-based student-centered instructional approach that facilitates learners' active construction of knowledge through exploration and questioning. Recognized in national curricula, such as the Framework for K-12 Science Education, this approach has been identified as a powerful strategy to achieve the goal of science education: preparing scientifically literate citizens capable of addressing societal challenges. Despite its benefits, prior research highlights the slow adoption of inquiry-based pedagogy among science teachers, limiting meaningful teaching and learning opportunities for learners. This study investigates the factors influencing teachers' adoption of inquiry-based pedagogy through the lens of the Teacher-Centered Systemic Reform (TCSR) model in the Nigerian context. Employing a survey research design, data were collected using a structured questionnaire distributed via Google Forms to science teachers across Lagos State, Nigeria, with 206 respondents filling out and returning the survey. Descriptive and regression analyses of the data revealed that among the variables considered, only years of teaching experience significantly predicted teachers' adoption of inquiry-based pedagogy (β =0.91, p< 0.005). Other variables, including teacher responsibility, support, classroom management, and teacher thinking, were found to be statistically insignificant. These findings prompted a deeper exploration of potential reasons for their lack of significance, shedding light on systemic challenges within the educational landscape that science teachers have surmounted over the years. The study suggests the need for the Nigerian education system to prioritize creating an enabling environment that empowers teachers at all experience levels to embrace innovative, student-centered pedagogical practices that meet the demands of 21st-century education.

Keywords: Science Teacher, Adoption of Inquiry Pedagogy, Teacher-Centered Systemic Reform Model

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1. INTRODUCTION

In the 21st century, nations increasingly rely on advances in science and technology to drive growth, ensure national security, and remain competitive in a globalized world. This reliance on science and technology is reflected in varying levels of investment in science education across countries (Okoye et al., 2022). Science education is recognized as a way to equip learners with essential 21st-century skills, such as critical thinking and problem-solving, necessary to navigate global systems' complexities. Successful navigation through the complex world system is possible when students learn to problematize scientific ideas in their environment. Such a contextual learning environment calls for a learner-centered pedagogy, project-based, case-based, or problem-based, that allows students to see how concept knowledge is applied to address societal issues right from the school (Markula et al., 2022). The National Research Council (NRC,

2000a) strongly advocates for an inquiry-based pedagogy in science education, as it empowers students to cultivate the habit of investigating scientific concepts, ask critical questions, and discover knowledge independently. Such active involvement and construction of meaning are essential in making sense of the world and becoming a responsible problem solver (Fitzgerald et al., 2019; Ogegbo, 2021). In recognition of the potency of inquiry-based pedagogy, the Nigerian Government advocated through its National Policy on Education to foster meaningful teaching and learning at all educational levels (Federal Republic of Nigeria [FRN], 2013). This National policy made it compulsory for all teachers to understand how inquiry strategies are incorporated into their teaching. By extension, it mandated all teacher education programs to equip teachers with these skills. In response, through its Ministry of Education, the Lagos State Government organized a series of workshops to equip in-service teachers with the skills to adopt inquiry-based pedagogy into their classroom teaching. Despite these efforts, research indicated that science teachers still struggle with effectively implementing inquiry-based teaching in their teaching practice (Ogegbo, 2021). This study further revealed that while some science teachers integrate strategies that encourage students to investigate scientific issues and discover knowledge on their own, those teachers cannot isolate these strategies from the traditional dominant instruction. As students are ultimately at the receiving end, these challenges hinder teachers from designing and implementing learning experiences that benefit the students.

Researchers have partly ascribed this misunderstanding of the inquiry-based approach to insufficient professional development and a lack of resources to support its practical application (Ogegbo, 2021). Other authors also attributed the slow pace of adoption of inquiry-based learning to teachers' characteristics such as attitude and belief (e.g., perceived students' ability, collaborative environment, and responsibilities) (Gess-Newsome et al., 2003; Voet & De Wever, 2019). Furthermore, Ogegbo (2021) reported a disconnect between science teachers' self-reported practices and their understanding of inquiry-based teaching, revealing inconsistencies in the practical application of the pedagogy in teaching.

In a context where the emphasis is placed mainly on students' scores in external and national examinations, such as those conducted by the West African Examination Council (WAEC) and the National Examination Council (NECO), for assessment, this lack of teachers' understanding of inquiry-based pedagogy and the slow pace in its adoption pose a significant challenge. For example, when students are not engaged in inquiry-based learning, they are deprived of opportunities for meaningful learning, which limits their ability to make meaning and recognize the relevance of scientific content in their environment (Brand & Moore, 2011). Additionally, rather than students engaging in the application of knowledge to solve problems, they resort to rote learning content only to excel in their examinations.

Further research into the literature further shows that guided inquiry instructional methods had a higher mean value than the lecture teaching method in facilitating achievement and retention in basic science (Emmanuel et al., 2024). Additionally, Okedeyi (2018) revealed further that the Inquiry-Based Strategy was more effective in leading to significant student performance. These studies imply that Inquiry-Based Pedagogy is an effective approach to delivering highly engaging learning experiences.

Given the need for scientifically literate citizens who use scientific knowledge to advance technological and economic domains, it is crucial to understand the factors hindering science teachers from adopting inquiry-based pedagogy in their classrooms. To address this need, the present study draws on the Teacher-Centered Systemic Reform (TCSR) model, which has been used across contexts to examine factors influencing instructional change within school systems (Gess-Newsome et al., 2003). Applied within the Nigerian educational context, the model provides a framework for examining how contextual factors, personal factors, and teachers' thinking predict science teachers' adoption of inquiry-based pedagogy was used within the Nigerian educational context, to examine how various factors: contextual factors, personal factors, and teacher's thinking, predict science teachers' adoption of inquiry-based pedagogy.

Understanding how these factors interact offers critical insights for educational stakeholders by unraveling the systemic and individual constraints shaping classroom practices. Such insights can inform evidence-based policy decisions, targeted professional development, and the design of sustainable teacher-centered reforms grounded in science teachers' lived experiences. Accordingly, this study addresses the following research questions: How do contextual factors, personal factors, and teachers' thinking identified in the TCSR model predict teachers' adoption of inquiry-based pedagogy?

1.1. Literature Review

1.1.1. Inquiry-Based Teaching in Science Education

The National Science Education Standards (NSES) have viewed the inquiry-based pedagogy as one of the strategies for teaching and learning science. The reason for this acceptance of inquiry-based learning is mainly to prepare scientifically literate individuals who should be critically sound and able to use scientific knowledge to solve societal problems (Duran & Duran, 2004). The inquiry-based approach is rooted in the constructivist idea that knowledge is not handed down but actively constructed (von Glasersfeld, 2001). Inquiry-based pedagogy is an active learning method that involves students in the scientific process of asking questions, forming hypotheses, and conducting experiments (van Uum et al., 2016). It encourages students to explore scientific issues by observing a situation, asking questions, running experiments, and sharing ideas. Instead of memorizing facts and rules, students discover scientific knowledge through engaging in scientific methods, with the teacher facilitating the process. As an active learning approach, inquiry learning requires teachers to design learning experiences, facilitate student participation, and focus on students' thinking as they interact with the material. In an inquiry setting, the goal is for students to construct meaning through these experiences by connecting their prior knowledge with new information that the teacher provided in the classroom (Brand & Moore, 2011). Therefore, to promote systemic reform that fosters meaningful learning, educators must adopt inquiry-based pedagogy to prepare future citizens capable of making informed decisions and addressing complex societal challenges.

1.1.2. Teacher-Centered Systemic Reform (TCSR) Model

Educational reform is inherently dynamic, continuously evolving in response to societal needs. It demands a flexible and adaptive framework capable of addressing the complexities of teaching and learning environments. The Teacher-Centered Systemic Reform (TCSR) model, developed by Woodbury and Gess-Newsome (2003), serves this purpose by recognizing teachers at the center of educational reform efforts. This framework identifies key factors that influence the implementation of innovative pedagogical practices, especially inquiry-based teaching, and organizes these factors into three interconnected categories: contextual factors, personal factors, and teachers' thinking.

Recognizing teachers as pivotal agents of change, the TCSR model underscores the challenges educators face within educational systems that often hinder their ability to promote progressive pedagogical practices. These include structural conditions such as class size, workload, institutional support, and the availability of professional learning communities. In various contexts, studies have found that these external pressures significantly influence whether teachers adopt inquiry-based teaching or not (Fitzgerald & Palincsar, 2019). For example, Voet et al. (2018) reported that teachers' self-efficacy and their working environment together accounted for up to 38% of the difficulties in implementing inquiry-based instruction. Similarly, Jamal et al. (2023) showed that teachers with access to adequate resources and professional support systems are more likely to commit to instructional reform that embraces inquiry-based teaching than those without. Additionally, Gigante and Firestone (2008) asserted that guaranteed support from institutions fosters greater teacher dedication to educational reform efforts, particularly those from the classroom.

The importance of teacher collaboration and community has also been mentioned as a central theme. Teachers embedded in professional communities where reform is a shared goal are more likely to adopt inquiry practices (Young et al., 2022). In such communities, they exchange strategies to manage classroom pressures and refine their instructional approaches (Author, 2024). These social networks not only bolster confidence but also create a sense of belonging and mutual accountability that enhances reform implementation. Grieger et al. (2022), using the TCSR model, noted that departmental support and the pedagogical mindset of teachers are critical predictors of adopting sustainable practices in chemistry teaching in higher education, further reinforcing the centrality of the role of context in instructional reform.

Personal factors, such as teachers' prior experiences, training, and academic background, are equally influential in determining teachers' readiness to adopt innovation in their classrooms. Teachers' readiness to adopt new practices depends not only on what they know but also on their willingness and confidence to try new approaches. Capps and Crawford (2013) highlighted the importance of encouraging teachers to reflect on their classroom practices, while Melville and Bartley (2010) emphasized the power of community-

based professional development in enhancing teacher learning and innovation adoption, particularly in inquiry-based teaching and learning. Teachers who participate in such initiatives, especially those involving mentoring and peer learning, develop deeper pedagogical understanding and are more likely to internalize and implement inquiry-based approaches. As Ogegbo (2021) and Herranen et al. (2019) noted, teachers' conceptual clarity about what constitutes inquiry-based teaching is a key predictor of the successful implementation of inquiry-based teaching. Teachers lacking this clarity often perceive inquiry as difficult or impractical, which reinforces their reliance on traditional methods. Similarly, Kundu and Roy (2023) discovered that teachers with higher education levels tend to show greater confidence in implementing inquiry-based instructional strategies, further supporting the idea that expertise and continuous learning are essential personal enablers of reform.

The third pillar of the TCSR model, teachers' thinking, relates to their beliefs, knowledge, and attitudes about teaching and learning. These internal dispositions shape not only how teachers interpret educational reforms but also whether they choose to engage with them. Teachers' beliefs about how students learn have a direct bearing on their choice of teaching strategies. For instance, Voet and De Wever (2019) identified three epistemological orientations teachers may have that could potentially affect their teaching practices: objectivism, subjectivism, and criterialism. Teachers holding objectivist views often perceive knowledge as fixed and favor teacher-centered approaches. In contrast, those aligned with subjectivism or criterialism are more likely to value student agency and evidence-based reasoning, making them more receptive to inquiry-based pedagogy. Similarly, Lotter et al. (2013) explained that science teachers' instructional choices were largely shaped by their beliefs about student learning, reinforcing the idea that pedagogical reform cannot occur without addressing teachers' perspectives. These studies explicate the significant importance of teachers' training in instilling in teachers an understanding of how people learn and strategies to support that learning. Additionally, such training opens for teachers an opportunity to recognize their role as facilitators and co-learners, a perspective that puts the teacher on the right track for effective instructional delivery. Understanding how teachers perceive how their students learn is essential in determining how to support them. Figure 1 below indicates the factors considered in this study and their connections to the dependent variable.

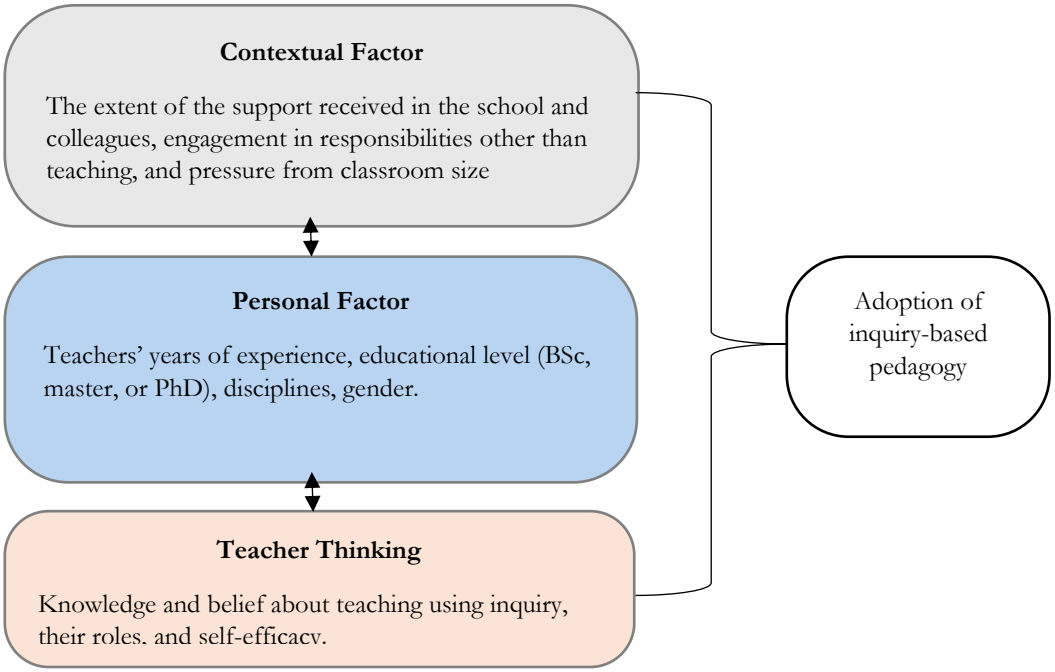

Figure 1. An Adapted Framework of Teacher-Centered Systemic Reform (TCSR) Model Used in This Study

The practical application of the TCSR model in educational research further demonstrates its explanatory power. Shi (2022), for example, applied the model to investigate how STEM faculty members across U.S universities negotiated departmental expectations, evaluation systems, and personal teaching beliefs when attempting to implement learner-centered strategies. Their study showed that instructors faced

significant institutional constraints that undermined their ability to translate inquiry principles into practice, despite valuing those principles. Similarly, Idsardi et al. (2023), in a quantitative study across multiple institutions, found that all three TCSR dimensions were instrumental in predicting the extent to which instructors used active learning in their classrooms. Notably, the study expanded the model to include faculty status, evaluation pressure, and workload, highlighting the model's adaptive nature in different contexts. Moreover, reviews by Glessmer (2021) and Harris and Jones (2019) point to the importance of agency, teachers' perceived control over their teaching decisions, as a vital, though often underexplored, component of reform readiness.

This review suggests that the Teacher-Centered Systemic Reform model offers a comprehensive and nuanced framework for understanding the adoption of inquiry-based teaching practices in diverse contexts. Additionally, it demonstrates that educational reform efforts must be holistic, addressing not only external conditions and structural barriers but also the internal dispositions and lived experiences of teachers. Importantly, the model emphasizes that systemic change in education begins with empowering teachers through well-supported, community-based professional development, clarity of pedagogical purpose, and institutional environments that value innovation and collaboration, which seems to be limited in Nigerian educational systems. This study, therefore, sought to understand which factors included in the TCSR model play a role in determining science teachers' readiness to adopt inquiry pedagogy practices in their teaching.

The model was used to guide the study in identifying the three main factors, while the key elements of each factor were derived from the literature as prominent issues teachers face in the school context that may hinder effective teaching. Furthermore, these key variables were used to construct the survey to gather data from the teachers.

2. METHODS

This study adopted a quantitative research design to investigate how contextual, personal, and cognitive (teacher thinking) factors predict science teachers' adoption of inquiry-based pedagogy in Lagos State, Nigeria. Specifically, the study employed multiple linear regression analysis to examine how each independent variable contributed to predicting teachers' adoption of inquiry-based pedagogy in teaching science subjects. This methodological approach is appropriate for identifying key predictors in behavioral and educational research (Uyanık & Güler, 2013) and aligns with the study's goal of providing empirical insights into what factors influence teachers' ability to adopt and implement innovative pedagogical strategies in teaching science. The research was guided by the Teacher-Centered Systemic Reform (TCSR) model (Gess-Newsome et al., 2003), which positions teachers at the center of innovative reforms in school and emphasizes the interplay between personal, contextual, and cognitive factors in shaping pedagogical behavior. The independent variables tested in this study were directly derived from this model to illustrate their impact on science teachers in the Nigerian context.

2.1. Participants

The population for this study comprised science teachers (N = 206) responsible for teaching chemistry, biology, physics, and integrated science in public secondary schools across Lagos State, Nigeria. Participants were recruited through a combination of purposive and snowball sampling techniques. Purposive sampling was employed to ensure the inclusion of teachers who met the study's eligibility criteria, particularly those actively engaged in science instruction at the secondary school level. Snowball sampling complemented this approach by leveraging teachers' professional networks to reach additional eligible participants whom the researchers could not reach during the data collection process. This dual strategy was adopted to enhance the representativeness of the sample while addressing potential challenges associated with participant accessibility and recruitment. Invitations were distributed via email and WhatsApp, and participants were encouraged to share the survey link with colleagues. Ultimately, 206 fully completed responses were collected and analyzed.

2.2. Research Instrument and Validation

A structured questionnaire was developed based on the Teacher-Centered Systemic Reform (TCSR) framework, with items tailored to measure three primary domains: contextual factors, personal factors, and teacher thinking. The literature indicated that these domains are essential in determining teachers' responsiveness to teaching innovation. The questionnaire, adapted from Enderle et al. (2013), was structured to include four main sections.

2.2.1. Contextual Factors

Included three subscales: professional responsibilities (e.g., number of subjects taught), classroom challenges (e.g., managing large class sizes), and school support (e.g., access to resources or mentorship). Each subscale contained three items. Each subscale consists of three items probing science teachers' opinions about their responsibility, classroom challenges, and the support they receive.

2.2.2. Personal Factors

Captured demographic and professional information, such as years of teaching experience, educational qualification (B.Sc. Ed, PGDE, M.Ed, or Ph.D.), and subject specialization.

2.2.3. Teacher Thinking

Assessed self-efficacy and beliefs regarding inquiry-based pedagogy. This section contained seven Likert-scale items (e.g., "I can teach any topic using inquiry-based strategies"), exploring science teachers' self-efficacy and beliefs about inquiry-based pedagogy. The teachers respond to the Likert scale based on their level of agreement with each of the statements.

2.2.4. Inquiry-Based Teaching Practice

Measured actual classroom practices using five Likert-scale items (e.g., "I frequently use group discussions, debates, or projects to foster student engagement"). Five items were included in this section to explore actual teacher practice about inquiry-based pedagogy. All items in each of the sections, except the personal factor, were rated on a 4-point Likert scale ranging from Strongly Disagree to Strongly Agree. According to South et al. (2022), the Likert scale is a good fit for quantifying participants' opinions and subjective attributes about a certain phenomenon. The four-point Likert scale instrument was scored by assigning numerical values ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). Higher scores indicated stronger agreement with the statements, reflecting more positive perceptions and experiences related to the construct under investigation.

2.2.5. Validation Procedure

Although the instrument was adapted, it underwent a two-stage validation process to ensure its content validity and face validity.

2.2.6. Expert Review

The initial version of the instrument was reviewed by two experts in science education and educational measurement. The reviewers assessed the alignment of each item with the TCSR framework and the research objectives. Their feedback led to the rewording of unclear statements, refinement of item categories, and the removal of redundant questions. Items were revised to better reflect the constructs of classroom support, pedagogical confidence, and instructional practice.

2.2.7. Pilot Testing

A pilot test was conducted with 15 science teachers from schools not included in the final sample. Responses were analyzed to assess item clarity, response patterns, and reliability. The Cronbach's alpha coefficients for each section were as follows:

Contextual Factors = 0.78

Teacher Thinking = 0.83

Inquiry-Based Pedagogy = 0.81

These values indicated acceptable to good internal consistency for all scales. Based on the expert feedback and pilot data, minor modifications were made before the instrument was finalized and deployed.

2.3. Data Collection Procedure

The validated questionnaire was digitized using Google Forms and disseminated electronically via email and WhatsApp to science teachers across Lagos State, Nigeria. A total of 206 complete responses were received and recorded. Data was first compiled in Microsoft Excel for cleaning and then exported to SPSS for analysis.

2.4. Data Analysis

The Statistical Package for Social Sciences (SPSS) was used to analyze the data for this study. Before the regression analysis, a descriptive data analysis of the participants' demographics was carried out. These demographics include their years of experience, gender, educational discipline, and educational background. Additionally, the data were tested to ensure that they met the statistical assumptions of regression analysis, including normality, linearity, and homoscedasticity of residuals. Examination of skewness, kurtosis, and residual plots indicated that the data adequately satisfied these assumptions, supporting the appropriateness of regression analysis for the study.

Table 1. Demography of the Participants

Category	Subcategory	Percentage (%)
Gender	Male	35.9
	Female	64.1
Years of Experience	0 to 5 Years	32.5
	6 to 10 Years	40.0
	11 to 15 Years	22.5
	20 and above	5.0
Educational Qualification	Post Graduate Diploma in Education (PGDE)	17.5
	PhD in Education	5.0
	Bachelor of Science Education	40.0
	Master of Science Education	37.5
Educational Discipline/Teaching Subject	Chemistry	17.5
	Biology	22.5
	Physics	30.0
	Integrated Science	30.0

Table 1 shows that the majority of science teachers were female (64.1%), with the most common years of experience being 6 to 10 years (40%). The predominant educational qualification is a bachelor's degree in education (40%), followed by a master's in education (37.5%), while a smaller proportion holds a Ph.D. (5%). In terms of the educational discipline of the teachers, Integrated science and physics teachers took (30%) each, followed by biology (22.5%) and chemistry (17.5%), being the least represented. Overall, the data highlights a dominance of female science teachers with mid-level experience, primarily specializing in physics and integrated science.

2.4.1. Preparation for Regression Analysis

As presented in Table 2 below, the mean and standard deviation of the independent variables provide a descriptive significance of the variable. The contextual variables, classroom management, support, and responsibility, were each derived from three items. Each contextual variable was included in the linear regression model to independently assess its influence on teachers' adoption of inquiry-based pedagogy. This approach was informed by prior research suggesting that factors such as support and class size significantly predict teachers' adoption of classroom innovations (Grieger et al., 2022). Additionally, seven items representing the teacher thinking factor were combined into a composite variable, labeled as teacher thinking (TTt), and included in the model. Composite variables were created for each major construct:

Teacher Thinking (TTt): Derived from the seven items measuring beliefs and self-efficacy of the teachers in implementing inquiry-based pedagogy.

Contextual Factors: Three separate predictor variables were used: support received, responsibility in school, and classroom management, each averaged from its three constituent items.

Teacher Inquiry-Based Pedagogy (TIPt): Created from the five items measuring teachers' actual instructional practices.

These composite variables with their mean (M) value were entered into a multiple linear regression model to examine their predictive value on Teacher Inquiry-based pedagogy. This approach allowed for a systematic analysis of the relative contribution of each factor to teachers' adoption of inquiry-based science instruction.

Table 2. Summary of the Independent Variables (Context Factor, Teacher Thinking) Indicating Their Mean and Standard Deviation

Variables	Types of Variables	M	SD
Years of Experiences	Independent (YoF)	7.23	4.12
Teachers' Responsibilities (combined the following) *TR1, TR2, TR3*	Independents (TRt)	9.12	1.91
Teachers Support (combined the following) *TS1, TS2, TS3*	Independent (TSt)	9.12	2.03
Classroom Management (combined the following) *CM1, CM2, CM3*	Independent (CMt)	8.87	1.76
Teacher Thinking (combined the following) *TT1, TT2, TT3, TT4,TT5, TT6, TT7, TT8*	Independent (TTt)	20.15	2.89
Teacher Inquiry-Based Pedagogy (combined the following) TIP1—TIP5	Dependent (TIPt)	16.32	2.27

Predicted Model:

$$TIPt = \beta_0 + \beta_1 TRt_1 + \beta_2 TSt_2 + \beta_3 CMt_3 + \beta_4 TTt_4 + \beta_5 YoE_5 + u$$

3. RESULTS

This section presents the study's results. The results were presented based on the research question: How do contextual factors, personal factors, and teachers' thinking influence or predict teachers' adoption of inquiry-based pedagogy in their teaching? This question was answered by obtaining the weights and p-values for each of the variables included in the regression model.

Table 2 shows the regression results, which indicate that only the years of experience of science teachers ($\beta = .91$, $p < .005$) were a statistically significant contributor to the adoption of inquiry-based pedagogy. The study revealed that teacher responsibility, which includes factors such as teaching multiple subjects, managing extracurricular activities, or holding administrative duties, did not significantly predict science teachers' adoption of inquiry-based pedagogy. This result suggests that the presence of additional roles and responsibilities does not necessarily influence a teacher's instructional decisions related to adopting innovative, student-centered methods like inquiry-based learning. Teacher support had a negative and insignificant effect, indicating that a lack of support from school leadership, peers, or institutional

resources may discourage science teachers' readiness to adopt inquiry-based strategies in their instruction. Although insignificant, the finding negates other assertions in the literature indicating that teachers' instructional effectiveness improved based on their perception of the support they receive from colleagues and the school environment.

Table 2. Multiple Regression Analysis Results of Teacher Responsibility, Teacher Support, Classroom Management, Teacher Thinking, and Years of Experience on Adoption of Inquiry-based Pedagogy.

Model Summary
R =.814
R^2 =.662
R^2 (Adjusted) =.655
Standard Error of Estimate = 3.36426
F = 95.97, p <0.05

		Unstandard Coefficients	Standardized Coefficient			
Model		B	Std.Error	Beta	T	P
1	(Constant)	12.791	3.82		3.344	.002
	Teacher Responsibility	0.34	0.11	.268	3.091	.246
	Teacher Support	-0.30	0.16	-.299	-1.842	.074
	Classroom management	0.25	0.22	.163	1.108	.276
	Teacher Thinking	-0.08	0.14	-.080	-.554	.583
	Years of Experience	0.91	0.31	.428	2.966	.005

a. Predictors: (Constant), Teacher Responsibility, Teacher Support, Classroom Management, Teacher Thinking, Years of Experience
b. Dependent Variable: Inquiry-Based Pedagogy
c. Significance level $\alpha = 0.05$

Actual Model:

$$TIPt = 12.76 + 0.34TRt - 0.30TSt + 0.25CMt - 0.08TTt + 0.91YoE$$

The Final Accepted Model:

$$\text{Teacher Inquiry-Based Pedagogy (TIPt)} = 12.76 + 0.91YoE$$

Classroom management produced a positive but insignificant predictor of teachers' adoption of inquiry-based strategies in their classroom ($\beta = .25$, $p = .276$), suggesting that managing classroom dynamics is important in general; it is insufficient to claim that classroom management, devoid of other factors, such as support and experience, is sufficient to influence the science teacher's ability to adopt inquiry-based pedagogy. Teacher thinking ($\beta = -.08$, $p = .583$) was not a significant predictor in this model, indicating that beliefs and self-perceived competence regarding inquiry-based pedagogy, though important, did not explain significant variance in actual adoption when controlling for other factors. Years of experience emerged as the strongest predictor ($\beta = .91$, $p < .005$), implying that more experienced teachers are more likely to implement inquiry-based teaching. This may reflect increased confidence, pedagogical flexibility, and exposure to professional development over time.

4. DISCUSSION

This study examined how contextual factors, personal factors, and teacher thinking predict the adoption of inquiry-based pedagogy (IBP) among science teachers in Nigeria, framed with the Teacher-Centered Systemic Reform (TCSR) model. With the TCSR model, the factors driving science teachers to effectively prepare students for the complex society within the Nigerian educational system were identified and discussed. In this case, the focus was on teachers' readiness to adopt inquiry-based pedagogy, which is critical for preparing critical thinkers and problem solvers, as different societies need a competitive advantage among nations driven by their citizens.

The findings revealed that among the factors examined, only years of experience emerged as a significant predictor of teachers' adoption of inquiry-based pedagogy ($\beta = 0.91$, $p < 0.05$). This result indicates a positive relationship between teachers' years of experience and their readiness to implement inquiry-based teaching, suggesting that more years of experience are linked to skill development. This positive relationship likely results from the gradual accumulation of pedagogical skills, classroom management techniques, and deeper content mastery over time. Experienced teachers may have had greater exposure to professional development opportunities, which enable them to better integrate new pedagogical approaches and build confidence and adaptability, helping them navigate the challenges of fostering inquiry in the classroom (Brand & Moore, 2011). Conversely, less experienced teachers often require more hands-on training or mentorship to effectively adopt inquiry-based strategies (Lee et al., 2004; Luft, 2001). The tendency for newer teachers to rely on traditional, simpler, and more structured methods could explain the gap in adopting inquiry-based pedagogy (Ocak et al., 2024). Furthermore, the result aligns with other studies that emphasize the importance of experience in successful pedagogical innovation. For example, Lotter et al. (2013) explained that experienced teachers are more likely to incorporate inquiry-based teaching practices because of greater pedagogical autonomy and confidence developed over time. Similarly, Moju and Fashakin (2024) highlighted that teachers with more extensive experience are better at managing systemic challenges, increasing their likelihood of adopting student-centered methods. Additionally, the finding supports the assertion of Woodbury and Gess-Newsome (2002), who stated that teachers' teaching experience plays a key role in predicting their adoption of innovative pedagogical practices, such as inquiry-based approaches, in school, grounding the TCSR framework in the Nigerian context.

However, the important insight gleaned from the insignificant positive relationship outcomes of the other variables is worth mentioning. First, the result showed that teacher responsibility, such as teaching multiple subjects or managing extracurricular activities, was not a significant factor influencing teachers' readiness to adopt inquiry-based pedagogy in their instructional practices. Assuming other factors remain constant, this finding negates an established argument about the influence of teachers' workload on their pedagogical practices (Pandita et al., 2025). This could be because the teachers have viewed these administrative and extracurricular duties as general responsibilities and separate from instructional responsibilities, and may not directly affect how teachers approach classroom teaching. Furthermore, the inherent nature of these tasks might not demand a shift in teaching strategies, allowing teachers to maintain their established routines regardless of additional responsibilities. This view corroborates the argument that administrative tasks, while burdensome, are unlikely to be the primary barriers to adoption of innovative teaching practices in the classroom (Kraft et al., 2015).

For the teacher support explanatory variable, previous studies, such as those by Jamal et al. (2023), have emphasized the importance of administrative and resource support in facilitating teachers' adoption of innovative practices. In contrast, the current study found that teacher support did not significantly predict inquiry-based pedagogy adoption. This discrepancy may be attributed to the systemic challenges prevalent in some schools, where inadequate resource allocation and minimal administrative backing are standard. Such a context minimizes the perceived impact of available support, making teachers more reliant on their ingenuity rather than systemic structures to navigate pedagogical reforms. The teachers no longer wait for support from either the administrators or colleagues. This is an indication that teachers have resorted to self-help. Consequently, even if some support is present, it may need to be more substantial to motivate the teachers to associate their change in teaching methodology with the support they received from the school context. Additionally, based on years of experience, some teachers may have reached a level where they no longer expect support from the school administration for their pedagogical practices (Tickle et al., 2011). Therefore, teachers who find themselves in this comfort zone are constantly struggling and are more likely to seek a favorable, teacher-centered pedagogical approach compared to those who regularly receive professional development.

Furthermore, effective classroom management has been widely acknowledged as crucial in implementing inquiry-based pedagogy, especially in environments with large class sizes or limited resources (Voet et al., 2018). Surprisingly, this study did not find that classroom management influenced inquiry-based pedagogy adoption significantly. A plausible explanation might be that experienced teachers have developed adaptive strategies to cope with the challenges of overcrowded classrooms over the years. These adaptive strategies include teachers' ability to focus on effectively maintaining discipline and order in the

classroom. Additionally, this adaptive nature might be associated with teachers' experiences in teaching. Consequently, the prioritization of discipline over pedagogical innovation might reflect teachers' efforts to align with examination-focused curricula, where maintaining control in the classroom is seen as a prerequisite for academic success rather than fostering inquiry-based learning skills, such as observation and asking questions.

Lastly, Teachers' beliefs and attitudes toward teaching and learning are often considered central to the adoption of new pedagogical practices (Grieger et al., 2022; Voet & De Wever, 2019). Contrary to expectations, this study found no significant relationship between teacher thinking and inquiry-based pedagogy adoption. This outcome suggests that science teachers understand that positive beliefs and knowledge about inquiry-based pedagogy are important, but do not see it as a needed criterion to overcome systemic challenges caused by other factors, such as inadequate resources, lack of professional development opportunities, or rigid exam-driven educational systems. Even motivated and well-informed teachers may feel constrained by structural barriers, limiting the translation of their beliefs into practice. This finding highlights the need for comprehensive systemic reforms that address external barriers alongside efforts to cultivate positive teacher attitudes.

Overall, the inability of the contextual and teacher thinking variables to explain the adoption of inquiry-based teaching in this current study contradicts other findings that emphasize the critical role of these variables in adopting innovative pedagogical practices in schools (Ogegbo, 2021; Young et al., 2022). This is not to suggest that these factors are not influential in the context where this study was conducted. Furthermore, the non-significance of teacher support in this study could reflect a broader systemic issue within Nigerian secondary schools, where limited professional development and resource allocation diminish the impact of administrative backing, leading teachers to feel less concerned about improving their pedagogical skills. However, the significance of years of experience may provide a strong explanation for why other variables, such as teacher support, teacher thinking, and classroom challenges, are not significant in this study. The findings suggest that as teachers gain more experience in teaching their subject, they tend to better manage other factors that might limit their instructional effectiveness. Additionally, it appears that teachers have effortlessly adapted to a pattern of pedagogical practices to the point where they no longer require support and have developed the self-efficacy needed to be effective in their teaching as they stay longer in the classroom.

5. CONCLUSION AND IMPLICATIONS

This study concludes that, among the factors examined, years of teaching experience emerged as the strongest and most consistent predictor of science teachers' adoption of inquiry-based pedagogy. While contextual variables such as institutional support, workload, and resource availability, as well as teacher thinking-related factors, showed limited predictive power, their influence appears to be constrained by persistent systemic barriers. In contrast, experienced teachers seem better equipped to navigate these barriers, drawing on their professional expertise and adaptive practices to integrate inquiry more effectively into their science instruction. This highlights the critical role of accumulated teaching experience in shaping pedagogical choices, suggesting that sustained classroom practice may cultivate resilience and strategies that enable teachers to implement inquiry teaching even within challenging educational environments.

By implication, teacher preparation programs should emphasize practical, hands-on training that mimics real-world teaching scenarios to enhance the adoption of inquiry-based pedagogy, which will prepare the teachers in training to understand the techniques of implementing inquiry pedagogy in their classrooms. Furthermore, professional development initiatives must prioritize mentorship opportunities, pairing less experienced teachers with seasoned educators who successfully implement inquiry-based pedagogy. Policymakers should also focus on creating supportive school environments by allocating adequate resources and reducing administrative burdens, enabling teachers to engage more effectively with innovative practices. By addressing these gaps, the Nigerian education system can foster an environment where all teachers, regardless of experience level, are empowered to adopt innovative pedagogical approaches, particularly inquiry-based pedagogy in all its forms, that align with the demands of 21st-century education.

6. LIMITATIONS OF THE STUDY

This study is not without limitations. First, it relied primarily on self-reported data, which may be subject to social desirability bias and inaccuracies in participants' perceptions of their own practices. Second, the research was conducted within a limited geographical scope, focusing on a single region, which may restrict the generalizability of the findings to broader educational contexts. Finally, the study excluded qualitative insights, such as classroom observations or interviews, that could have provided richer contextual understanding of how teachers interpret and enact inquiry-based pedagogy within their unique school environments.

Therefore, future research should consider integrating multiple data sources, such as classroom observations and in-depth interviews, to complement self-reported measures and provide a more comprehensive account of teachers' practices. Expanding the geographical scope to include diverse educational settings would also enhance the generalizability of findings and capture variations across regions. In addition, employing mixed-methods designs could yield deeper insights into the contextual and experiential factors that shape teachers' adoption of inquiry-based pedagogy, thereby offering richer evidence to inform both policy and professional development initiatives.

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