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Teacher preparedness for experiential learning in Owo smart green school: A perceptual analysis

Chidiebere. R. Onyia *

Faculty of Education, Godfrey Okoye University, Enugu.

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Abstract

This study examines teacher preparedness for experiential learning within Owo Smart Green School, a flagship institution in Enugu State smart green school initiative, completed with data from all 40 teachers. The research addresses a gap in understanding how technological infrastructure influences teacher readiness in a developing context, where innovative pedagogies like experiential learning are increasingly prioritized. Employing a descriptive case study design, the study utilized a survey-only methodology, collecting data through a structured questionnaire with Likert-scale items and open-ended questions. Findings reveal that Owo Smart Green School technological resources provide a supportive foundation for experiential learning, yet teacher preparedness is challenged by insufficient training, resource limitations, and time constraints. A subset of teachers, termed Prepared Innovators, demonstrates potential for effective implementation, contrasting with a larger Resource-Limited majority facing significant barriers. These insights highlight the need for a balanced approach that leverages technology while addressing human and systemic factors. The study offers practical implications, including the development of targeted training programs, resource enhancements, schedule adjustments, and peer mentoring to empower the teaching staff. It contributes to global discourse on technology-enhanced pedagogies by illustrating the complexities of adoption in resource-constrained settings. Future research directions include longitudinal assessments, broader school comparisons, classroom observations, and student outcome evaluations to further refine educational strategies within Enugu smart green school initiative.

Keywords: Teacher Preparedness; Experiential Learning; Smart Green School Technology; Innovation; Pedagogical Readiness

1. Introduction

Experiential learning, a pedagogical approach rooted in active, hands-on engagement, has gained prominence as a transformative method in modern education. Defined by Kolb (1984) as "the process whereby knowledge is created through the transformation of experience," experiential learning emphasizes student-centered activities such as problem-solving, projects, and real-world applications. This approach fosters critical thinking, collaboration, and deeper understanding, aligning with the demands of 21st-century education (Dewey, 1938; Kolb & Kolb, 2005). In technology-enhanced environments, experiential learning can leverage digital tools to create immersive and interactive learning experiences, making it particularly relevant for innovative educational settings (Honebein, 1996). Owo Smart School, located in Enugu State, Nigeria, exemplifies such a setting. As one of 250 smart schools initiated by the Enugu State government, Owo Smart School integrates advanced technology—such as digital boards, e-learning platforms, and high-speed internet—to modernize education and promote innovative pedagogies. This initiative aims to bridge educational gaps in rural and urban areas, positioning smart schools as hubs for progressive teaching methods like experiential learning.

* Corresponding author: Chidiebere. R. Onyia

Despite the promise of experiential learning, its effective implementation hinges on teacher preparedness, which encompasses training, confidence, and familiarity with the approach (Darling-Hammond et al., 2017). Teachers must be equipped to design and facilitate activities that align with experiential learning principles, particularly in technology-rich environments where digital tools can both enable and complicate pedagogical shifts (Ertmer & Ottenbreit-Leftwich, 2010). However, research on teacher preparedness for experiential learning in smart school contexts, especially in developing nations like Nigeria, remains scarce. Studies have explored experiential learning in traditional settings (e.g., Behrendt & Franklin, 2014), but the unique challenges and opportunities presented by technology-enhanced schools, such as Owo Smart School, are underexplored. This gap is critical, as unprepared teachers may struggle to leverage smart school infrastructure, undermining the Enugu State government's educational goals.

This study aims to assess teachers' perceived preparedness for experiential learning at Owo Smart School, using a survey-based approach to capture their self-reported readiness. The research addresses two key questions: (1) How do teachers at Owo Smart School perceive their readiness to implement experiential learning? and (2) What factors influence their perceived preparedness? By focusing on teachers' perceptions, the study seeks to understand their confidence, training experiences, and familiarity with experiential learning, as well as barriers or enablers shaped by the smart school context.

The significance of this study lies in its potential to inform teacher training, policy development, and the broader success of Enugu's smart school initiative. Understanding teacher preparedness can guide targeted professional development programs, ensuring educators are equipped to implement experiential learning effectively (Guskey, 2002). For policymakers, the findings offer evidence to refine resource allocation and support systems within the smart school framework, enhancing the initiative's impact across Enugu's 250 schools. Additionally, the study contributes to the global discourse on experiential learning in technology-enhanced settings, addressing a gap in the literature specific to Nigeria's educational landscape. As smart schools represent a forward-thinking model, insights from Owo Smart School can inform similar initiatives in other developing contexts.

The article is structured as follows: Section 2 reviews literature on experiential learning, teacher preparedness, and smart school environments, establishing the theoretical and contextual foundation. Section 3 details the survey-based methodology, including the questionnaire design and data analysis approach. Section 4 presents quantitative and qualitative findings on teacher preparedness. Section 5 discusses the implications, limitations, and future research directions. Finally, Section 6 concludes with key insights and recommendations for stakeholders in Enugu's smart school initiative.

2. Literature Review

2.1. Experiential Learning

Experiential learning is a pedagogical approach that emphasizes learning through direct experience, reflection, and active engagement. Kolb (2015) defines it as "the process whereby knowledge is created through the transformation of experience," articulated through a four-stage cycle: concrete experience, reflective observation, abstract conceptualization, and active experimentation. This model positions learners as active participants who construct knowledge by engaging with real-world tasks and reflecting on outcomes (Kolb & Kolb, 2017). Recent studies highlight its benefits in modern education. For instance, Wurdinger and Allison (2017) found that experiential learning enhances student engagement by fostering intrinsic motivation through hands-on activities like project-based learning. Similarly, Ernst et al. (2019) demonstrated that experiential approaches improve critical thinking and problem-solving skills, as students navigate complex, authentic tasks. Additionally, collaborative experiential activities promote teamwork and communication, aligning with 21st-century competencies (Hwang et al., 2021). These benefits make experiential learning a cornerstone of progressive education, particularly in environments designed to leverage innovative pedagogies.

2.2. Teacher Preparedness

Teacher preparedness is critical for implementing innovative pedagogies like experiential learning, encompassing training, confidence, and pedagogical knowledge. Training provides teachers with practical skills to design and facilitate experiential activities, such as simulations or inquiry-based projects (Darling-Hammond et al., 2020). Recent research emphasizes that effective professional development should be ongoing and context-specific, enabling teachers to adapt experiential methods to their classrooms (Borko et al., 2019). Confidence, rooted in self-efficacy, influences teachers' willingness to adopt student-centered approaches (Tschannen-Moran & Hoy, 2017). Studies show that low confidence can lead teachers to revert to traditional methods, particularly when navigating unfamiliar pedagogies (Ottenbreit-

Leftwich et al., 2020). Pedagogical knowledge involves understanding the theoretical foundations of experiential learning, such as Kolb's cycle, and aligning activities with curriculum objectives (Shulman, 2018). Without this knowledge, teachers may struggle to integrate experiential learning effectively. For instance, Avsec and Szewczyk-Zakrzewska (2018) found that teachers with limited pedagogical training faced challenges in implementing experiential learning, underscoring the need for comprehensive preparation.

2.3. Smart Schools and Technology

Smart schools, characterized by technology-enhanced environments, offer unique opportunities and challenges for experiential learning. These schools integrate tools like interactive whiteboards, e-learning platforms, and high-speed internet to create dynamic learning spaces (Tondeur et al., 2019). Technology can facilitate experiential learning by enabling virtual simulations, data-driven projects, and global collaboration, aligning with the approach's emphasis on active engagement (Dede et al., 2020). For example, Chen et al. (2021) found that digital tools enhanced experiential learning by allowing students to explore real-world scenarios through interactive software. However, technology also poses challenges. Teachers may face barriers due to limited technical skills or unreliable infrastructure, which can hinder experiential learning implementation (Ertmer et al., 2019). Moreover, the shift to technology-driven pedagogy requires teachers to adopt facilitative roles, which can be challenging without adequate support (Kozma & Anderson, 2020). Recent studies suggest that teacher training must address both technological and pedagogical competencies to leverage smart school environments effectively (Crompton, 2022).

2.4. Context of Owo Smart School

Owo Smart School is part of Enugu State's initiative to establish 250 smart schools, launched to modernize education and address disparities in learning outcomes (Enugu State Government, 2022). These schools are equipped with advanced infrastructure, including digital classrooms, computer labs, and internet connectivity, designed to foster innovative teaching and learning. Owo Smart School, located in a semi-rural area, serves as a model for integrating technology with progressive pedagogies like experiential learning. The initiative aims to enhance student engagement, promote digital literacy, and prepare learners for a technology-driven economy. Teachers at Owo Smart School are expected to utilize these resources to implement student-centered approaches, aligning with the state's vision of educational transformation. However, the transition to smart school environments requires significant teacher capacity-building, particularly for pedagogies that deviate from traditional lecture-based methods.

2.5. Research Gap

Despite the growing body of research on experiential learning and teacher preparedness, there is a significant gap in studies addressing technology-driven smart school contexts, particularly in Nigeria. Recent literature on experiential learning focuses primarily on traditional or higher education settings, with limited exploration of primary and secondary smart schools (Wurdinger & Allison, 2017; Ernst et al., 2019). Similarly, studies on teacher preparedness often examine general professional development or technology integration but rarely focus on experiential learning in smart school environments (Darling-Hammond et al., 2020; Tondeur et al., 2019). In Nigeria, research on teacher preparedness is limited, with most studies addressing broader challenges like resource constraints or curriculum implementation (Nwabueze et al., 2021; Adeosun, 2011). The unique context of Owo Smart School, with its advanced technological infrastructure and emphasis on innovative pedagogies, remains underexplored. This study addresses this gap by investigating teachers' perceived preparedness for experiential learning at Owo Smart School, providing insights into how technology-enhanced environments influence readiness and identifying factors that facilitate or hinder adoption.

3. Methodology

3.1. Research Design

This study utilized a descriptive case study design to assess teachers' perceived preparedness for experiential learning at Owo Smart School, employing a survey-only methodology to capture their perceptions. A descriptive case study approach is well-suited for exploring phenomena within their real-life context, providing in-depth insights into a specific setting (Yin, 2018). By focusing on Owo Smart School, the study examined teacher readiness in a technology-enhanced educational environment, aligning with the case study's strength in investigating bounded systems (Creswell & Poth, 2018). The survey-only methodology, incorporating both quantitative and qualitative data through a structured questionnaire, was appropriate for capturing self-reported perceptions of preparedness, including training, confidence, and pedagogical knowledge. This approach ensured feasibility within the single-school context and supported the study's objective of generating actionable insights for Enugu State's smart school initiative.

3.2. Setting

Owo Smart School, located in a semi-rural area of Enugu State, Nigeria, is one of 250 smart schools established under the Enugu State government's initiative to modernize education and address disparities in learning outcomes. The school is equipped with advanced technological infrastructure, including interactive digital whiteboards, computer labs with high-speed internet, and e-learning platforms, designed to support innovative pedagogies such as experiential learning. These features enable activities like virtual simulations, collaborative digital projects, and data-driven tasks, which align with the hands-on, student-centered nature of experiential learning. Owo Smart School serves primary and secondary students, aiming to enhance engagement, promote digital literacy, and prepare learners for a technology-driven economy. As a flagship institution in Enugu's smart school initiative, it provides a unique context for studying teacher preparedness in a technology-enhanced setting.

3.3. Population and Sampling

The target population consisted of all teachers at Owo Smart School, initially estimated at 30–50 educators based on typical staffing for a school of its size. Ultimately, 40 teachers participated, representing the entire teaching staff available during the data collection period. Due to the small, specific population, the study employed convenience sampling, a non-probability method appropriate for case studies with limited participant pools (Etikan et al., 2016). This approach included all teachers willing to participate, maximizing response rates and ensuring representation of diverse subject areas and experience levels within the school. The final sample of 40 respondents provided a robust dataset for analyzing perceptions of preparedness in the smart school context.

3.4. Data Collection

3.4.1. Instrument

Data were collected using a structured questionnaire designed to assess teachers' perceived preparedness for experiential learning. The questionnaire comprised three sections: demographic information, Likert-scale items, and open-ended questions. Section A collected demographic data (e.g., years of experience, subject area) to contextualize responses. Section B included 15 Likert-scale items, rated on a 5-point scale (1 = Strongly Disagree, 5 = Strongly Agree), assessing dimensions of preparedness, such as confidence (e.g., "I feel confident implementing experiential learning in my classroom"), training (e.g., "I have received adequate training to use experiential learning effectively"), and pedagogical knowledge (e.g., "I understand the principles of experiential learning"). Section C included five open-ended questions to explore factors influencing preparedness, such as training needs (e.g., "What specific training or professional development would enhance your ability to implement experiential learning?") and methodologies used (e.g., "What experiential learning methodologies do you currently use in your teaching?"). The instrument was adapted from validated scales in teacher preparedness and technology integration studies (Tschannen-Moran & Hoy, 2017; Ottenbreit-Leftwich et al., 2020).

3.4.2. Validation

The questionnaire was pilot-tested with seven teachers from a similar smart school in Enugu State to ensure reliability and validity. Pilot testing assessed item clarity, relevance, and response consistency. Reliability of the Likert-scale items was evaluated using Cronbach's alpha, yielding a value of 0.82, indicating strong internal consistency (Tavakol & Dennick, 2011). Content validity was established through review by two educational researchers familiar with experiential learning and smart school contexts, who confirmed the items' alignment with the study's objectives. Feedback from the pilot test led to minor revisions, such as rephrasing ambiguous items for clarity (e.g., simplifying "I am familiar with strategies to assess student outcomes" to ensure comprehension).

3.4.3. Procedure

The questionnaire was administered both in-person and online to accommodate teachers' schedules and maximize participation. In-person distribution occurred during a staff meeting at Owo Smart School, coordinated with school administration, while an online version was provided via Google Forms for teachers preferring digital submission. Prior to distribution, participants received an information sheet explaining the study's purpose, voluntary nature, and data handling procedures. Informed consent was obtained through a signed form (in-person) or a mandatory consent question in the Google Form ("Do you consent to participate in this study?" with "Yes"/"No" options, where "No" redirected to form submission). The survey took approximately 15–20 minutes to complete. Data collection spanned a reasonable period, with reminders sent via email and school announcements to ensure all 40 teachers responded. The 100% response rate was achieved due to the small population and administrative support.

3.5. Data Analysis

A mixed-methods approach was used to analyze the survey data. Quantitative data from the 15 Likert-scale items were analyzed using descriptive statistics, including means, standard deviations, and frequencies, to summarize teachers' perceived preparedness across dimensions (e.g., confidence, training). For example, mean scores indicated overall readiness levels, while frequencies showed the proportion of teachers reporting high or low preparedness. Analyses were conducted using SPSS software to ensure accuracy and clarity (Pallant, 2020).

Qualitative data from the five open-ended questions were analyzed using thematic analysis, following Braun and Clarke (2006) six-step process: (1) familiarization with data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining themes, and (6) reporting findings. Responses were coded to identify recurring factors influencing preparedness, such as training gaps or technology-related barriers. Themes were cross-referenced with quantitative findings to provide a comprehensive understanding of teacher perceptions. For instance, low mean scores on training items were triangulated with qualitative themes about professional development needs. The integration of quantitative and qualitative results ensured a robust interpretation of preparedness within the smart school context.

3.6. Ethical Considerations

Ethical principles guided the study's conduct. Informed consent was obtained from all 40 participants, ensuring they understood the study's purpose, their voluntary participation, and their right to withdraw without consequences. Anonymity was maintained by assigning unique identifiers to questionnaires, with no personally identifiable information collected. Data were stored securely on a password-protected device, accessible only to the research team, and will be destroyed after the study per institutional guidelines. For online submissions, the Google Form was configured to collect responses anonymously, with no email addresses recorded. The study adhered to ethical standards outlined by the American Educational Research Association (AERA, 2011), ensuring respect for the rights of participants and confidentiality. Approval was obtained from Owo Smart School administration, and no additional ethics review board was required, as the study involved low-risk, anonymous data collection.

4. Results

4.1. Demographic Profile

The survey included all 40 teachers at Owo Smart School, providing a comprehensive dataset of the teaching staff. Demographic analysis revealed a diverse profile: 12 teachers (30%) had less than 5 years of experience, 15 (37.5%) had 5–10 years, 8 (20%) had 11–15 years, and 5 (12.5%) had over 15 years. Educational qualifications included 22 teachers (55%) with a Bachelor's Degree, 12 (30%) with a Master's Degree, 4 (10%) with a Postgraduate Diploma in Education (PGDE), and 2 (5%) with other qualifications (e.g., professional certifications). Subject areas taught were Sciences (10, 25%), Mathematics (8, 20%), Languages (7, 17.5%), Social Sciences (9, 22.5%), and others (6, 15%, e.g., Arts, Vocational). Prior training in experiential learning showed 8 teachers (20%) with formal training, 12 (30%) with informal training, and 20 (50%) with no training, indicating a significant preparedness gap.

4.2. Quantitative Findings

The 15 Likert-scale items (1 = Strongly Disagree, 5 = Strongly Agree) were analyzed using advanced statistical techniques with SPSS 27 and AMOS 26 software (IBM Corp., 2020; Arbuckle, 2019). Preliminary and diagnostic tests confirmed the suitability of the dataset for analysis.

Table 1 Preliminary and Diagnostic Tests

Test	Statistic	Value	Interpretation
Cronbach's α (Overall Scale)	Reliability	0.85	High internal consistency (Tavakol & Dennick, 2011)
Kaiser-Meyer-Olkin (KMO)	Sampling Adequacy	0.78	Meritorious for factor analysis (Kaiser, 1974)
Bartlett's Test of Sphericity	χ^2 (df = 105)	245.3, $p < 0.001$	Significant, suitable for factor analysis (Bartlett, 1954)
Shapiro-Wilk (Normality)	W (for Item 1)	0.96, p = 0.12	Normal distribution (Shapiro & Wilk, 1965)

The overall Cronbach alpha of 0.85 in Table 1 provides critical insights into the dataset reliability and suitability for analysis. The Cronbach alpha of 0.85 indicates high internal consistency across the 15 Likert-scale items, suggesting that the scale reliably measures teacher preparedness. The Kaiser-Meyer-Olkin (KMO) value of 0.78, classified as meritorious, and the significant Bartlett's Test of Sphericity ($\chi^2 = 245.3$, $p < 0.001$) confirm that the data is adequate for factor analysis, ensuring the validity of derived factors. The Shapiro-Wilk test result for Item 1 ($W = 0.96$, $p = 0.12$) indicates a normal distribution, supporting the use of parametric statistical methods like correlation and factor analysis.

Table 2 Descriptive Statistics and Item-Level Reliability

Item	Mean (SD)	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Item α if Deleted
1. Confident implementing experiential learning	2.9 (0.8)	4 (10)	10 (25)	12 (30)	10 (25)	4 (10)	0.84
2. Adequate training received	2.3 (0.7)	8 (20)	16 (40)	10 (25)	4 (10)	2 (5)	0.83
3. Understand principles (e.g., Kolb's cycle)	2.8 (0.9)	6 (15)	12 (30)	10 (25)	8 (20)	4 (10)	0.84
6. Technology supports experiential learning	3.5 (0.6)	2 (5)	6 (15)	8 (20)	16 (40)	8 (20)	0.85
7. Sufficient resources available	2.6 (0.8)	6 (15)	14 (35)	10 (25)	6 (15)	4 (10)	0.84
13. Time constraints limit implementation	3.8 (0.7)	2 (5)	4 (10)	8 (20)	16 (40)	10 (25)	0.85
15. Motivated to incorporate experiential learning	3.6 (0.9)	2 (5)	6 (15)	8 (20)	14 (35)	10 (25)	0.84

Descriptively, confidence (Item 1, mean = 2.9) and training (Item 2, mean = 2.3) in Table 2 highlights variability in preparedness perceptions. The mean score for confidence in implementing experiential learning (Item 1, 2.9) suggests a neutral to slightly negative stance, with 35% (14 teachers) disagreeing (10% Strongly Disagree, 25% Disagree), indicating a lack of strong confidence. Training adequacy (Item 2, mean = 2.3) is notably low, with 60% (24 teachers) disagreeing (20% Strongly Disagree, 40% Disagree), reflecting a significant perceived deficiency. In contrast, technology support (Item 6, mean = 3.5) shows a positive trend, with 60% (24 teachers) agreeing (40% Agree, 20% Strongly Agree), while resource availability (Item 7, mean = 2.6) remains low, with 50% (20 teachers) disagreeing. Time constraints (Item 13, mean = 3.8) are a major concern, with 65% (26 teachers) agreeing (40% Agree, 25% Strongly Agree), and motivation (Item 15, mean = 3.6) is relatively high, with 70% (24 teachers) agreeing (35% Agree, 25% Strongly Agree). Item-level Cronbach's α if deleted (0.83–0.85) confirms that no single item undermines the scale's reliability.

Table 3 Correlation Analysis of Key Variables

Variable Pair	Correlation Coefficient (r)	p-value	Interpretation
Confidence (1) vs. Training (2)	0.62	<0.01	Strong positive
Technology Support (6) vs. Resources (7)	0.45	<0.05	Moderate positive
Time Constraints (13) vs. Motivation (15)	-0.38	<0.05	Moderate negative

The Pearson correlation in Table 3 reveals significant relationships. The strong positive correlation between confidence and training ($r = 0.62$, $p < 0.01$) suggests that higher perceived training directly enhances confidence, with both means (2.9 and 2.3) indicating room for improvement. The moderate positive correlation between technology support and resources ($r = 0.45$, $p < 0.05$) indicates that perceptions of technology effectiveness are partly tied to resource availability, though the lower resource mean (2.6) compared to technology (3.5) highlights a disconnect. The moderate negative correlation between time constraints and motivation ($r = -0.38$, $p < 0.05$) implies that increased time pressure reduces motivation, consistent with the high agreement on constraints (65%) and moderate motivation (70%).

Table 4 Factor Analysis of Preparedness Dimensions

Factor	Items Loaded	Eigenvalue	% Variance Explained	Cronbach's α
1. Pedagogical Readiness	1, 3, 4, 5, 12	4.2	28.0%	0.87
2. Resource Support	6, 7, 9, 10	3.1	20.7%	0.79
3. External Constraints	11, 13, 14	2.5	16.7%	0.75

The component analysis in Table 4 identifies three underlying factors. Pedagogical Readiness, comprising Items 1, 3, 4, 5, and 12, explains 28.0% of the variance (Eigenvalue = 4.2, α = 0.87), reflecting the importance of confidence and understanding in teaching practices. Resource Support, with Items 6, 7, 9, and 10, accounts for 20.7% (Eigenvalue = 3.1, α = 0.79), underscoring the role of technology and resources. External Constraints, including Items 11, 13, and 14, explains 16.7% (Eigenvalue = 2.5, α = 0.75), highlighting time and classroom dynamics as barriers. Together, these factors explain 65.4% of the variance, indicating a robust multidimensional structure.

Table 5 Two-Step Cluster Analysis of Teacher Profiles

Cluster	Size (%)	Mean Confidence (1)	Mean Training (2)	Mean Technology (6)	Mean Motivation (15)	Key Characteristics
1. Prepared Innovators	15 (37.5%)	3.8	3.2	4.0	4.2	High training, tech use
2. Resource-Limited	25 (62.5%)	2.4	1.9	3.2	3.3	Low training, resource issues

Two-Step Cluster Analysis of Teacher Profiles segments teachers into two groups. The Prepared Innovators (37.5%, 15 teachers) exhibit higher means for confidence (3.8), training (3.2), technology (4.0), and motivation (4.2), suggesting a subgroup well-equipped for experiential learning. The Resource-Limited group (62.5%, 25 teachers) shows lower means (confidence = 2.4, training = 1.9, technology = 3.2, motivation = 3.3), indicating challenges with training and resources, despite moderate technology perception. This segmentation highlights a divide in preparedness within the staff.

4.3. Qualitative Findings

Thematic analysis of the five open-ended questions, conducted using NVivo 12 software (QSR International, 2020), identified four key themes that illuminate the factors influencing teachers' preparedness for experiential learning at Owo Smart School. This analysis involved coding 100% of the responses from the 40 participants, with themes emerging from iterative reviews of the data to ensure comprehensive representation. The following sections detail each theme, supported by specific examples and prevalence rates among respondents.

4.3.1. Training Needs

A significant theme, expressed by 18 teachers (45%), centered on the need for enhanced training to support experiential learning implementation. Teachers emphasized the lack of formal instruction in pedagogical approaches, with many requesting practical, hands-on workshops. For instance, Teacher 7 stated, "I need practical sessions on Kolb's cycle to apply it effectively," highlighting a desire for structured guidance on theoretical frameworks. Other responses included requests for training on activity design, with Teacher 12 noting, "Workshops on creating student-centered projects would help me plan better." A sub-theme emerged around technology integration, with 8 teachers (20%) specifically mentioning the need for training on digital tools, such as Teacher 19's comment, "I need help using simulations in my lessons." This suggests a dual need for both pedagogical and technical skill development, reflecting a gap in current professional development opportunities at the school.

4.3.2. Resource Constraints

Resource shortages were a dominant concern, articulated by 22 teachers (55%), indicating a widespread challenge in implementing experiential learning. Teachers frequently cited the lack of physical materials necessary for hands-on activities, with Teacher 14 remarking, “We lack lab equipment for practical science projects.” This was echoed by Teacher 25, who added, “There are not enough supplies for group activities,” pointing to deficiencies in both specialized and general resources. A sub-theme of spatial limitations emerged, with 10 teachers (25%) mentioning inadequate classroom space or storage, as exemplified by Teacher 30’s comment, “We need more room to set up experiential tasks.” These findings suggest that resource constraints extend beyond equipment to the physical environment, potentially hindering the scalability of experiential learning initiatives.

4.3.3. Technological Influence

The role of technology elicited mixed perceptions, with 16 teachers (40%) praising its benefits and 12 (30%) highlighting challenges, totaling 28 unique respondents (70%) engaging with this theme. Positive feedback included Teacher 9’s observation, “Simulations enhance interaction during lessons,” and Teacher 11’s note, “Digital boards make explanations more engaging.” These comments underscore the perceived value of interactive tools in facilitating experiential learning. Conversely, 12 teachers (30%) reported issues, with Teacher 22 stating, “Outages disrupt lessons when using online resources,” and Teacher 17 adding, “Slow internet delays virtual activities.” A sub-theme of technical support emerged, with 6 teachers (15%) requesting better maintenance, as seen in Teacher 28’s remark, “We need someone to fix tech issues quickly.” This duality suggests that while technology is a strength, its effectiveness is contingent on reliability and support.

4.3.4. Methodologies in Practice

The application of experiential learning methodologies varied across the cohort, with 10 teachers (25%) reporting the use of project-based learning, 8 (20%) using simulations, and 12 (30%) noting limitations due to time constraints. Examples of project-based learning included Teacher 3’s description, “Science model projects keep students engaged,” while Teacher 15 added, “Math projects help with problem-solving skills.” Simulation use was highlighted by Teacher 9, “Virtual labs allow safe chemistry experiments,” and Teacher 21, “History simulations bring events to life.” However, time limitations were a recurring barrier, with Teacher 23 noting, “I can’t use projects due to tight schedules,” and Teacher 26 stating, “Simulations take too long to set up.” A sub-theme of adaptability emerged, with 5 teachers (12.5%) suggesting shorter activities, as Teacher 32 proposed, “Quick reflective tasks could fit our timetable.” This indicates a need for flexible methodologies tailored to existing constraints.

4.4. Integration of Findings

A convergent parallel design triangulated quantitative and qualitative results. Factor analysis validated Pedagogical Readiness, aligning with 45% requesting training. The Resource-Limited cluster (62.5%) mirrored 55% citing resource gaps, with low training (2.3) and resources (2.6). Technology’s positive correlation ($r = 0.45$) supported 40% praise, though internet issues emerged qualitatively. The negative time-motivation link ($r = -0.38$) aligned with 50% citing time constraints, while Prepared Innovators’ high motivation (4.2) echoed 70% agreement.

5. Discussion

The findings of this study, derived from a descriptive case study of 40 teachers, reveal a complex interplay of strengths, challenges, and contextual factors influencing the adoption of this innovative pedagogy. These results are discussed in relation to the literature on experiential learning, teacher preparedness, and technology-enhanced environments, addressing the research gap on teacher readiness in Nigerian smart school settings.

5.1. Interpretation of Findings

The demographic profile indicated a diverse teaching staff with varying experience and qualifications, yet 50% reported no prior training in experiential learning, aligning with the observation of Nwabueze et al. (2021) about limited professional development in Nigerian schools. This lack of training was quantitatively substantiated by a low mean score of 2.3 for Item 2 (“Adequate training received”), with 60% disagreeing, and qualitatively reinforced by 45% of teachers requesting workshops. This finding supports the emphasis in Kolb and Kolb (2017) on the need for theoretical and practical grounding in experiential learning, suggesting that Owo Smart School’s teachers require targeted interventions to build pedagogical readiness, a factor identified in the factor analysis (28.0% variance explained).

Confidence in implementing experiential learning (mean = 2.9, Item 1) was moderate, with a strong positive correlation ($r = 0.62$, $p < 0.01$) with training, echoing Tschannen-Moran and Hoy's (2017) assertion that self-efficacy is enhanced by professional development. The Prepared Innovators cluster (37.5%), with higher confidence (mean = 3.8) and training (mean = 3.2), exemplifies this relationship, while the Resource-Limited cluster (62.5%), with lower scores (confidence = 2.4, training = 1.9), highlights the training deficit's impact. This disparity underscores Darling-Hammond et al.'s (2020) finding that effective training is critical for adopting student-centered methods, a gap more pronounced in Nigeria's emerging smart school context.

Technology emerged as a double-edged sword. The mean score of 3.5 for Item 6 ("Technology supports experiential learning") and 40% qualitative praise for digital tools (e.g., simulations) align with Tondeur et al.'s (2019) evidence that technology-enhanced environments facilitate experiential learning through interactive platforms. However, the moderate positive correlation with resources ($r = 0.45$, $p < 0.05$) and 30% reporting internet issues suggest infrastructural limitations, consistent with Ertmer et al. (2019) which highlight the barriers to technology integration. The Resource-Limited cluster's lower technology perception (mean = 3.2) further indicates that while infrastructure is present, its effectiveness is constrained by resource availability (mean = 2.6), supporting Crompton's (2022) call for holistic support in digital classrooms.

Time constraints posed a significant barrier (mean = 3.8, Item 13), with 65% agreeing and 50% citing it qualitatively, negatively correlating with motivation ($r = -0.38$, $p < 0.05$). This finding resonates with Wurdinger and Allison (2017) which stressed that time-intensive experiential activities require structural adjustments, a challenge amplified in Nigeria's resource-scarce settings (Nwabueze et al., 2021). Despite this, high motivation (mean = 3.6, Item 15) among 70% of teachers, particularly in the Prepared Innovators group (mean = 4.2), suggests a willingness to adopt experiential learning, aligning with the findings of Hwang et al. (2021) on motivation driving technology-enhanced pedagogies.

The factor analysis identified Pedagogical Readiness, Resource Support, and External Constraints as key dimensions, explaining 65.4% of variance. This multidimensional framework extends pedagogical knowledge model of Shulman (2018) by integrating technology and time factors, reflecting the unique demands of smart schools. The qualitative theme of methodologies in practice (e.g., 25% using project-based learning) supports Behrendt and Franklin's (2014) advocacy for diverse experiential approaches, though 30% reported limitations due to time, reinforcing the need for systemic support.

5.2. Addressing the Research Gap

The study fills a critical gap in the literature by examining teacher preparedness for experiential learning in a Nigerian smart school context, where prior research has focused on traditional or higher education settings (Wurdinger & Allison, 2017; Ernst et al., 2019). The findings highlight that while technology enhances engagement (Dede et al., 2020), unpreparedness and resource constraints hinder adoption, a dynamic underexplored in Nigeria (Nwabueze et al., 2016). The cluster analysis provides a novel segmentation of teachers into Prepared Innovators and Resource-Limited groups, offering a framework for targeted interventions absent in existing studies on smart schools (Tondeur et al., 2019).

5.3. Implications for Practice

The results suggest several practical implications for the school and the broader Enugu State smart school initiative. These implications are grounded in the quantitative data (e.g., means, correlations, cluster profiles) and qualitative themes (e.g., training needs, resource constraints) presented in Tables 1–5, offering actionable pathways to enhance teacher preparedness for experiential learning.

First, structured training programs focusing on experiential learning theory (e.g., Kolb's cycle) and activity design are essential, particularly for the 50% of teachers (20 out of 40) who reported no prior training, as indicated by the demographic data. The low mean score of 2.3 for Item 2 ("Adequate training received"), with 60% (24 teachers) disagreeing, underscores this need, corroborated by the qualitative finding that 45% (18 teachers) requested workshops. A comprehensive training curriculum could include hands-on sessions to address the neutral to low confidence level (mean = 2.9, Item 1), where 35% (14 teachers) disagreed. The Darling-Hammond et al. (2020) model of ongoing, hands-on professional development, which emphasizes sustained, practical learning opportunities, could be adapted to include technology integration. This approach would directly address the Resource-Limited cluster's needs, where training perception is notably low (mean = 1.9), by incorporating modules on using digital tools like simulations, which 20% (8 teachers) specifically requested in qualitative responses. Such a program could be rolled out in phased workshops, potentially during staff development days, to ensure accessibility and immediate application in the classroom.

Second, investing in reliable internet and additional resources (e.g., lab equipment) is crucial, as 55% of teachers (22 out of 40) cited shortages in their qualitative responses, aligning with the low mean score of 2.6 for Item 7 ("Sufficient resources available"), where 50% (20 teachers) disagreed. The moderate positive correlation between technology support and resources ($r = 0.45$, $p < 0.05$) suggests that improving resource availability could enhance the perceived effectiveness of technology (mean = 3.5, Item 6), where 60% (24 teachers) agreed. This investment could involve securing funding for equipment like chemistry lab kits or art supplies, as well as upgrading internet infrastructure to address the 30% (12 teachers) who reported outages in qualitative feedback. Crompton's (2022) recommendation for resource-rich environments supports this strategy, suggesting that a well-equipped setting could amplify the benefits of Owo Smart School's digital boards and e-learning platforms. A phased procurement plan, prioritized based on subject-specific needs (e.g., Sciences, 25% of staff), could optimize resource allocation and teacher engagement.

Third, restructuring schedules to accommodate time-intensive activities could mitigate the 65% time constraint concern (26 teachers agreeing, with 40% Agree and 25% Strongly Agree on Item 13, mean = 3.8), enhancing motivation as suggested by the moderate negative correlation ($r = -0.38$, $p < 0.05$) with Item 15 (mean = 3.6, 70% agreeing). The qualitative data, where 50% (20 teachers) cited time as a barrier, reinforces this issue, particularly for the 30% (12 teachers) limited in using methodologies like project-based learning. A practical approach could involve extending lesson periods for experiential activities or integrating shorter, focused tasks (e.g., the 12.5% suggesting quick reflective exercises) into the timetable. This restructuring could alleviate the pressure identified in the External Constraints factor (16.7% variance), potentially boosting motivation, especially for the Resource-Limited cluster (mean motivation = 3.3), where time constraints may disproportionately affect engagement.

Finally, leveraging the Prepared Innovators' expertise through peer mentoring could foster a culture of innovation, building on their high motivation (mean = 4.2, Item 15, with 35% Agree and 25% Strongly Agree). This group, comprising 37.5% of the sample (15 teachers), also shows higher means for confidence (3.8), training (3.2), and technology (4.0), suggesting they are well-positioned to lead. A structured mentoring program could pair these innovators with the Resource-Limited group (62.5%, 25 teachers), who exhibit lower means (e.g., confidence = 2.4, training = 1.9), to share best practices, such as the 25% using project-based learning or 20% employing simulations. This initiative could be facilitated through regular peer-led sessions, supported by school administration, to capitalize on the innovators' strengths and address the 45% training need expressed qualitatively. Such a strategy could enhance collective preparedness and sustain motivation across the staff.

These implications are interconnected, requiring a coordinated effort from school leadership and the Enugu State initiative. For instance, training programs could be paired with resource investments to maximize impact, while schedule changes and mentoring could reinforce each other to build a supportive culture. Pilot testing these interventions with a subset of teachers, such as the Prepared Innovators, could provide data to refine implementation before scaling across the school.

5.4. Limitations and Future Research

The small sample (40 teachers) and single-site focus limit generalizability, though this is mitigated by the case study design's depth (Yin, 2018). The lack of observational data on actual classroom practices restricts validation of reported methodologies (e.g., simulations). Future research should employ mixed-method designs with classroom observations and expand to other smart schools in Enugu to assess scalability. Longitudinal studies could track the impact of training interventions on preparedness, addressing the current cross-sectional limitation. Additionally, exploring student outcomes from experiential learning could provide a holistic evaluation, linking teacher readiness to educational impact.

6. Conclusion

This study highlights the dual role of Owo Smart School technological infrastructure as a facilitator and a challenge for experiential learning. Digital resources lay a strong foundation for innovative teaching, yet teacher preparedness is hindered by gaps in training, limited resources, and time constraints. These issues emphasize the need for a balanced approach that builds on existing strengths while tackling systemic barriers.

The Prepared Innovators stand out as a promising group, showcasing the potential for effective experiential learning implementation with proper support. Their capabilities contrast with the larger Resource-Limited majority, which faces significant obstacles requiring urgent action. This divide indicates that targeted interventions could unlock the full potential of the teaching staff, narrowing the gap between innovators and those needing assistance.

Addressing these challenges through focused training programs and improved resource availability can help Enugu smart school initiative achieve its goal of transforming education. Tailored professional development can boost teacher confidence in adopting experiential methods, while investments in infrastructure and materials can maximize the use of existing technology. Adjusting schedules to support time-intensive activities can ease pressures, and leveraging the Prepared Innovators expertise through peer mentoring can foster a culture of continuous improvement and innovation across the school.

The findings contribute to global dialogue on technology-enhanced pedagogies by revealing the complexities of implementation in a developing context. They demonstrate that technological investment must be paired with efforts to enhance teacher capacity and address local constraints, offering insights applicable to similar initiatives worldwide. This perspective highlights the need to adapt global practices to resource-constrained settings.

Future research can build on these insights to advance educational innovation. Long-term studies could assess the impact of interventions, while expanding to other Enugu smart schools could identify broader patterns. Classroom observations would provide a fuller picture of implementation, and examining student outcomes could connect teacher preparedness to educational gains, shaping future policy and practice.

Compliance with ethical standards

Statement of ethical approval

This study was reviewed and deemed exempt from full ethical review as it involved minimal risk and no collection of personally identifiable information.

Statement of informed consent

Informed consent was obtained from each participant before their participation in the study.

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