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Teachers' preparedness for the utilization of artificial intelligence in classroom assessment: the contributory effects of attitude toward technology, technological readiness, and pedagogical beliefs with perceived ease of use and perceived usefulness as mediators

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The adoption of Artificial Intelligence (AI) in classroom assessment is widely acknowledged as a game-changer for improving educational outcomes. Despite this, there is a limited body of research addressing the readiness of teachers to implement these technologies. This study bridges that gap by investigating how attitude toward technology, technological readiness, and pedagogical beliefs contribute to teachers' preparedness, with perceived ease of use and perceived usefulness serving as mediating factors. Data were gathered through a cross-sectional survey involving 3,781 respondents from various institutions. Rigorous quantitative validation confirmed the reliability of the findings. The results indicate that both perceived ease of use and perceived usefulness significantly influence teachers' willingness to adopt Artificial intelligence, with pedagogical beliefs and technological readiness being particularly influential. Notably, attitude toward technology was found to have a direct impact on perceived ease of use, while pedagogical beliefs and technological readiness affected both perceived ease of use and perceived usefulness. Furthermore, perceived ease of use acted as a mediator between attitude toward technology and preparedness, while perceived usefulness mediated the link between technological readiness and preparedness. The study concludes with a discussion of the findings' implications and provides actionable recommendations for fostering AI adoption in classroom assessment practices.

KEYWORDS

artificial intelligence (AI), classroom assessment, attitude toward technology, technological readiness, pedagogical beliefs, perceived ease of use and perceived usefulness

Introduction

Classroom assessment serves as a fundamental component of education, offering essential insights into student learning, guiding instructional decisions, and ensuring accountability (Shute and Rahimi, 2022). Traditional methods, such as tests, quizzes, and assignments, have been widely utilized to evaluate student performance but often face challenges such as biases, limited scalability, and inefficiencies in delivering real-time feedback. While effective in some scenarios, these methods typically follow a static, uniform approach that may not adequately address the varied needs of learners or provide timely and actionable insights (Black and Wiliam, 2018). Additionally, traditional assessments impose significant administrative demands on teachers, requiring extensive time for grading and analysis.

AI-powered tools like automated grading systems, adaptive testing platforms, and learning analytics offer solutions to these limitations by enabling more accurate, timely, and personalized evaluations. However, their successful adoption depends on teachers having a strong understanding of AI's capabilities and limitations, alongside the technical skills necessary for effective implementation (Lu et al., 2022).

Recent years have seen a shift toward integrating AI into classroom assessments, driven by its potential to automate processes, personalize learning experiences, and support data-driven decision-making (Holmes et al., 2019). This transition addresses the shortcomings of traditional assessments by promoting innovative practices that align with the demands of 21st-century education. AI-based assessments use advanced algorithms and machine learning to evaluate performance in real time, provide immediate and tailored feedback, and adapt to individual student needs. Adaptive assessments, for instance, adjust their difficulty based on students' responses, offering a precise measure of their abilities (Luckin et al., 2020).

The integration of AI in assessment represents a paradigm shift in evaluating student performance. Unlike traditional approaches, AI tools analyze vast datasets to identify learning patterns, predict outcomes, and recommend tailored interventions. AI-driven systems such as intelligent tutoring platforms and automated essay scoring have enhanced both formative and summative assessments, increasing efficiency and equity (Chassignol et al., 2018). These tools also reduce the administrative burden on teachers, allowing them to focus more on instruction and student engagement. However, challenges such as data privacy, algorithmic bias, and unequal access to digital resources complicate the adoption of AI in education (Zawacki-Richter et al., 2019). Teachers' preparedness and professional development are pivotal in addressing these challenges, ensuring they can integrate AI technologies into their practices effectively (Kim et al., 2021). Despite these hurdles, the scalability, accuracy, and personalized learning potential of AI highlight its transformative educational impact.

Teachers' preparedness is a critical factor in the successful integration of AI in classroom assessments. Preparedness extends beyond technical expertise, encompassing pedagogical readiness, ethical awareness, and the ability to seamlessly incorporate AI tools into the curriculum. Research shows that preparedness is shaped by factors such as access to professional development, institutional support, and personal attitudes toward technology (Zhang et al., 2023). Furthermore, inequities in access to AI training and resources can widen disparities in educational practices, underscoring the need for targeted interventions to ensure fair opportunities for all educators.

When teachers are adequately prepared, they can effectively integrate AI tools into assessment practices, resulting in more personalized and precise evaluations of student progress (Johnson and Williams, 2023). Preparedness also equips teachers to address ethical issues like data privacy and algorithmic fairness, ensuring responsible technology use (Adams and Turner, 2023). By leveraging AI-driven insights, teachers can deliver quicker feedback and adapt their instructional strategies to better meet diverse student needs, fostering a more responsive learning environment (Davis and Lee, 2022). Ultimately, teachers' preparedness to use AI in classroom assessments is essential for maximizing the benefits of these technologies, enhancing learning outcomes, and improving educational quality (Harris and Gomez, 2023).

The potential of AI to transform classroom assessment cannot be realized without addressing systemic barriers to teacher preparedness. Factors such as inadequate technological infrastructure (Zhang et al., 2023), attitude toward AI (Lu et al., 2022), ethical concerns (Smith and Clark, 2023), and resistance to change can hinder the adoption of AI technologies in schools (Petersen et al., 2023), institutional support (Chiu and Huang, 2023), regular access (Holmes et al., 2023), perceived relevance (Shute and Rahimi, 2022). Furthermore, the integration of AI in classroom assessment raises critical ethical considerations, including issues of transparency, accountability, and equity. Teachers must be equipped to navigate these challenges, ensuring that AI tools are used responsibly and that their implementation aligns with broader educational goals. As Chiu and Huang (2023) argue, professional development programs should prioritize not only technical skills but also ethical literacy, empowering teachers to make informed decisions about AI adoption.

Previous research has explored teachers' preparedness to adopt AI in educational contexts (Ofem et al., 2024a; Ofem et al., 2024d). Holmes et al. (2023) observed that while many teachers demonstrated readiness to use AI for assessment, their guiding philosophies varied significantly. Similarly, Johnson and Williams (2023) examined teacher readiness for AI adoption but highlighted that most studies emphasized perceived usefulness and ease of use, often neglecting teachers' attitudes toward technology. Martin and Roberts (2022) investigated teachers' attitudes and readiness for adopting AI in classroom assessments, finding that greater attention is needed to understand how readiness to embrace new technologies influences actual AI usage. Furthermore, Davis and Lee (2022) noted that technology acceptance models (TAM), though commonly applied, lack comprehensiveness in addressing pedagogical beliefs, which substantially impact teachers' perceptions of AI tools.

Other studies have suggested that teachers' preparedness to use AI in classroom settings varies by geographic location and other factors (Adams and Turner, 2023; Harris and Gomez, 2023; Zhang et al., 2023). However, empirical evidence on teachers' preparedness for AI in specific classroom scenarios remains inconsistent. Most studies have been conducted in Europe, where cultural contexts differ significantly from those in Nigeria. Additionally, existing research has not adequately incorporated critical variables such as pedagogical beliefs, attitudes toward technology, and technological readiness into models of AI adoption for classroom assessments.

While significant attention has been given to perceived ease of use and perceived usefulness, these factors are frequently analyzed in isolation, without considering how teachers' intrinsic beliefs and attitudes shape their willingness and ability to use AI for assessments.

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This gap highlights the need for an integrated model combining pedagogical beliefs, attitudes toward technology, and technological readiness as explanatory variables, with perceived usefulness and ease of use serving as mediating factors that influence teacher preparedness in utilizing AI tools for assessment.

This study adopts the Technology Acceptance Model (TAM) due to its proven reliability, conceptual clarity, and extensive use in research on educational technology. Its primary constructs—perceived usefulness and perceived ease of use—are especially pertinent for analyzing teachers' adoption of AI tools for classroom assessment (Venkatesh and Davis, 2000). Although models such as the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Diffusion of Innovations (DOI) provide broader perspectives, they incorporate multiple external factors (e.g., social influence, enabling conditions) that can shift attention away from the internal cognitive and pedagogical factors influencing teacher behavior (Venkatesh et al., 2003; Rogers, 2003). Additionally, TAM's flexible structure permits the incorporation of context-specific variables like pedagogical beliefs and attitudes, making it particularly relevant in regions like Nigeria, where technological infrastructure and educator experiences vary widely (Teo, 2011). As such, TAM presents a concise yet adaptable model that fits the study's objective of exploring teacher preparedness from cognitive, technological, and attitudinal standpoints. Such a model would provide a more comprehensive understanding of teacher preparedness in the context of AI integration. Addressing these gaps is crucial for educators, policymakers, and researchers seeking to leverage AI's potential to enhance learning outcomes effectively.

Review of literature

Studies on pedagogical beliefs

Pedagogical beliefs refer to the underlying principles teachers hold about teaching and learning, which profoundly shape their instructional practices, attitudes, and decision-making in educational settings (Pajares, 1992; Richardson, 2003). These beliefs influence not only the choice of instructional strategies and assessment methods but also how educators interact with students, reflecting their values, educational philosophies, and professional experiences. Importantly, pedagogical beliefs play a crucial role in determining teachers' openness to educational innovations, such as the integration of artificial intelligence (AI) tools in classroom assessments. Teachers' conceptualizations of knowledge, learning processes, their roles in the classroom, and the overall purpose of education are key components of pedagogical beliefs. Those who espouse constructivist views typically emphasize student-centered learning and are more likely to incorporate AI to support personalized instruction, critical thinking, and autonomous learning (Ertmer and Ottenbreit-Leftwich, 2010; Zainuddin, 2024a). In contrast, educators holding more traditional or teacher-centered views may resist adopting AI tools, viewing them as disruptive to established instructional norms (Yim and Wegerif, 2024).

The impact of pedagogical beliefs extends beyond instructional methods to affect teaching quality and the adoption of new technologies. As AI-powered assessment tools become more widespread, it is essential to understand how teachers' beliefs shape their preparedness and willingness to implement such innovations. Teachers who perceive technology as beneficial to learning and assessment are generally more receptive to AI integration, whereas those skeptical of technology's role may show resistance (Sadykova and Kayumova, 2024).

Recent empirical studies further support this relationship. For instance, Blömeke et al. (2016) found that teachers who valued student-centered instruction were significantly more open to using technologies, including AI. Similarly, Harris and Hofer (2011) and Thomas and Anderson (2022) observed that educators with strong beliefs in individualized learning were more inclined to use AI-based assessments to meet diverse student needs. These findings suggest that pedagogical beliefs can either facilitate or hinder the adoption of emerging technologies, depending on alignment with the perceived role of technology in the classroom.

Nevertheless, research gaps remain. Much of the existing literature tends to generalize technology adoption without fully accounting for mediating factors such as attitudes toward technology, technological readiness, and key constructs from models like the Technology Acceptance Model (TAM), notably perceived usefulness and perceived ease of use (Teo, 2011). Additionally, variations in pedagogical beliefs across subject areas and educational contexts are underexplored. Addressing these gaps with more recent data will help clarify how cognitive, attitudinal, and contextual factors influence AI adoption in assessment practices. To strengthen current understanding and improve policy and practice, it is recommended to incorporate recent research findings on teachers' preparedness, the efficacy of AI-based assessment tools, and the application of theoretical frameworks like TAM in educational contexts (UNESCO, 2023).

Studies on attitude toward technology

Attitude toward technology refers to an individual's positive or negative perceptions and beliefs about using technology. It includes factors such as perceived usefulness, ease of use, and the potential impact of technology on tasks and the environment. In education, a teacher's attitude toward technology significantly affects their willingness to integrate digital tools into teaching practices. Positive attitudes encourage higher adoption of technology, while negative attitudes often hinder its integration. As AI tools become more prevalent in classroom assessments, understanding teachers' attitudes toward these technologies is crucial for evaluating their preparedness to use them effectively. Teachers with positive attitudes toward technology are more inclined to adopt AI tools, recognizing their potential to enhance student learning outcomes (Teo, 2011). In contrast, those with negative or ambivalent attitudes may resist using AI, fearing it could disrupt traditional methods or reduce their control over the learning process. This highlights the importance of fostering positive attitudes to improve teachers' readiness for AI adoption in assessments.

Research has explored the relationship between teachers' attitudes toward technology and their preparedness to use AI in classrooms. Teo (2011) found that perceived usefulness and ease of use were critical determinants of teachers' readiness to adopt AI tools. Venkatesh et al. (2003) also emphasized the role of attitudes, showing that positive perceptions of ease of use and usefulness significantly influenced teachers' intentions to adopt new technologies. Similarly, Inan and Lowther (2010) reported that teachers with favorable attitudes were more likely to effectively adopt and use digital tools, including AI-based assessment systems.

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Recent studies underscore these findings in the context of emerging technologies. For instance, Yim and Wegerif (2024) found that teachers' attitudes toward AI were closely linked to their perceived self-efficacy and confidence in managing AI-based assessments. Sadykova and Kayumova (2024) highlighted that positive attitudes significantly predict readiness to implement AI tools in culturally diverse classrooms. Furthermore, Zainuddin (2024b) showed that teacher training and exposure to AI-driven platforms contribute to more favorable attitudes, particularly in developing countries where digital literacy varies. Thomas and Anderson (2022) also emphasized that attitudes rooted in constructivist beliefs positively influence the adoption of AI for differentiated instruction and assessment.

Despite these advances, gaps remain in the literature. Much of the existing research has focused on generalized technology use rather than AI-specific applications in classroom assessments. Furthermore, earlier studies often overlook the contextual variations in educational settings, especially in under-resourced regions. As such, there is a need for more targeted studies that explore how teachers' attitudes influence their preparedness to adopt AI in diverse global contexts. Incorporating contemporary research on AI-specific tools and the application of models such as the Technology Acceptance Model (TAM) in these contexts will offer more nuanced and actionable insights into technology integration in education.

Studies on technological readiness

Technological readiness refers to an individual's or organization's capability, willingness, and preparedness to adopt and use new technologies. It encompasses the skills, knowledge, resources, and infrastructure required to facilitate the effective integration of technological innovations, particularly in professional contexts like education. For teachers, technological readiness reflects their ability to effectively utilize tools such as AI in the classroom. This concept is crucial for understanding the integration of AI into classroom assessments, as it indicates teachers' preparedness to adapt to technological changes and address potential challenges.

The role of technological readiness in AI adoption for classroom assessments is significant. Teachers who are technologically prepared are more likely to recognize the value of AI tools and integrate them effectively into their teaching. Readiness impacts their confidence and ability to use AI tools to enhance assessments, ultimately improving student learning outcomes (Teo, 2011). Conversely, a lack of technological readiness may lead to superficial or ineffective adoption of AI tools, limiting their potential benefits. Therefore, identifying the factors that contribute to technological readiness is essential for fostering teacher preparedness for AI adoption in education.

Research highlights the relationship between technological readiness and teachers' preparedness to use AI in the classroom. For instance, Hennessy et al. (2005) found that teachers with higher levels of readiness were more effective in integrating ICT tools into their teaching. Similarly, Inan and Lowther (2010) reported that technologically prepared teachers were more likely to incorporate digital tools into classroom activities. Teo (2011) demonstrated a positive correlation between teachers' readiness and their perceptions of technology's usefulness and ease of use, with readiness acting as a mediating factor between beliefs about technology and its actual implementation. Other studies also support the positive link between technological readiness and teachers' preparedness to adopt AI (Hsu and Ching, 2013; Zhang and Li, 2021; Alharbi and Drew, 2014; Mohammed and Alshareef, 2023).

Despite these findings, research specifically examining how technological readiness influences AI adoption for classroom assessments remains limited. Additionally, while technological readiness is a well-established concept, few studies have explored its interaction with other factors, such as teachers' pedagogical beliefs, attitudes toward technology, and perceptions of AI's usefulness. Developing an integrated model that examines these interrelationships could provide deeper insights into the challenges and opportunities for preparing teachers to use AI in classroom assessments.

Studies on perceived ease

Perceived ease of use refers to the extent to which an individual believes that using a particular technology will require minimal effort. This concept is critical to understanding technology adoption, especially in educational settings. When teachers view AI tools for classroom assessment as user-friendly, they are more likely to integrate these tools into their teaching. The Technology Acceptance Model (TAM) highlights perceived ease of use as a key factor influencing attitudes toward technology and intentions to adopt it (Venkatesh and Davis, 2000). In the context of AI tools, teachers who perceive them as intuitive are more inclined to use them effectively in the classroom.

The significance of perceived ease of use lies in its role in promoting technology adoption. Davis (1989) identified it as a crucial determinant of whether a technology is embraced. Teachers who find AI tools complex or challenging to use may avoid adopting them, regardless of their potential benefits for classroom assessment. Conversely, teachers who perceive these tools as straightforward are more confident in integrating them into their practices. Research supports the idea that ease of use strongly influences the acceptance of educational technologies (Teo, 2011; Venkatesh and Davis, 2000).

In the context of classroom assessments, teachers' perceptions of ease of use are pivotal for the successful adoption of AI tools. For instance, Al-Fahad (2009) found that teachers were more likely to adopt AI tools when they perceived them as easy to use. Similarly, Hennessy et al. (2005) highlighted tool complexity as a significant barrier to technology adoption in sub-Saharan Africa, where limited technological experience often exacerbates this issue. In such settings, perceived ease of use becomes even more critical to ensuring successful implementation.

Despite the wealth of research on perceived ease of use, several gaps remain. Most studies on this topic, including those focusing on AI in education, have been conducted in Western contexts. There is a pressing need to explore how cultural, institutional, and resource-related factors in diverse regions influence teachers' perceptions of ease of use. For instance, educators in low-resource settings often face challenges like unreliable internet connectivity or inadequate technical support, which can shape their views on the usability of AI tools (Inan and Lowther, 2010). Furthermore, while perceived ease of use is commonly treated as an explanatory factor, it also has the potential to either facilitate or hinder technology integration.

Recent studies have further emphasized the importance of perceived ease of use in AI adoption in education. For example, Alharbi and Drew (2014) identified that AI tools designed with user-friendly interfaces significantly increased teacher adoption rates, especially in K-12 settings. Mohammed and Alshareef (2023) found that perceived ease of use directly influenced teachers' intention to integrate AI-driven assessments, mediated by their confidence and training in the technology. These findings underline the ongoing need to design AI assessment tools that reduce complexity and enhance usability to support broader adoption, particularly in under-resourced educational contexts. Therefore, more research in varied educational contexts is necessary to fully understand the role of perceived ease of use in technology adoption and to develop targeted strategies that address contextual challenges and foster effective AI integration in classroom assessments.

Studies on perceived usefulness

Perceived usefulness refers to the extent to which an individual believes that using a particular technology will enhance their job performance. In the context of AI tools for classroom assessment, it reflects teachers' belief that AI can improve the accuracy, efficiency, and effectiveness of assessing student performance. This concept is central to the Technology Acceptance Model (TAM), which suggests that perceived usefulness influences the intention to adopt technology (Davis, 1989). Perceived usefulness, as a cognitive belief about technology, is crucial for determining whether teachers are willing to integrate AI tools into their teaching practices, especially for student assessments.

The significance of perceived usefulness lies in its ability to drive technology adoption, particularly in education. Research has shown that when teachers perceive a technology as valuable for enhancing teaching, they are more likely to incorporate it into their practices (Venkatesh and Davis, 2000). Regarding AI tools, teachers' perceptions of their usefulness may affect how they view AI as a resource for classroom assessments, enabling them to track student progress in real time or through advanced data analysis. Thus, perceived usefulness influences not only adoption but also teachers' preparedness to use the technology effectively. Teachers who find AI useful are more likely to develop proficiency and confidence in utilizing it for assessments (Almalki and Williams, 2021; Azawei et al., 2022).

Numerous studies have explored the relationship between perceived usefulness and teachers' preparedness to use technology. For example, Hennessy et al. (2005) found that teachers' views on the usefulness of technology were closely tied to their willingness to adopt it. Teachers who saw technology as beneficial to their teaching were more likely to incorporate it into their classrooms. Similarly, Davis (1989) demonstrated that perceived usefulness was a key predictor of technology adoption. The study showed that teachers who believed AI tools could improve student assessments were more likely to prepare themselves to use these tools. Other research (Zhang and Li, 2021; Teo, 2011; Al-Fahad, 2009) highlighted that teachers' perceptions of the utility of AI tools in assessing student progress influenced their intention to adopt them. When teachers recognized AI as enhancing their assessment practices, they were more inclined to acquire the necessary skills to use these tools effectively. This demonstrates the strong link between teachers' preparedness to use AI and their perception of its usefulness for improving assessment outcomes. More recent findings also suggest that the usefulness of AI-driven analytics tools for formative assessment is increasingly valued by educators who seek individualized feedback and timely insights (Umar and Nordin, 2022; Chatterjee and Bhattacharjee, 2021).

While these studies offer valuable insights into the connection between perceived usefulness and teachers' preparedness, gaps remain. Most research focuses on perceived usefulness in general terms, without exploring how different AI tools might be perceived based on their specific features. The current literature does not fully address how particular functionalities of AI tools, such as data analytics or personalized feedback, may influence teachers' perceptions of their usefulness and, in turn, their readiness to use these tools for assessments (Lu and Zhang, 2022). Additionally, perceived usefulness does not operate independently. A teacher with a positive view of personalized learning may see AI tools as highly useful for classroom assessment, while another teacher with different pedagogical beliefs may not. The interaction between perceived usefulness and these other factors has not been sufficiently explored. Therefore, further research is needed to examine how perceived usefulness relates to other variables, providing more empirical evidence to guide policy decisions regarding the use of technology in assessments (Hamdan and Al-Debei, 2021).

Conceptual/theoretical framework

This study is built on the theoretical framework developed by the researcher, drawing upon insights from prior research. The researchers hypothesize that teachers' preparedness to use artificial intelligence (AI) tools for classroom assessments is influenced by their pedagogical beliefs, attitude toward technology, and technological readiness, with perceived ease of use and perceived usefulness acting as mediators. The study is rooted in the Technology Acceptance Model (TAM), a well-established framework for understanding technology adoption. Originally proposed by Davis (1989), TAM suggests that two main factors perceived ease of use and perceived usefulness determine an individual's intention to adopt technology. These factors shape users' attitudes toward technology and, in turn, influence their intentions and actual usage.

In this context, the TAM serves as the theoretical foundation for exploring the factors that affect teachers' preparedness to use AI tools for classroom assessments. The researchers argue that pedagogical beliefs, attitude toward technology, and technological readiness are crucial factors that, when influenced by ease of use and perceived usefulness, can encourage teachers to adopt AI tools in their teaching practices. Pedagogical beliefs reflect teachers' core views on teaching and learning, while their attitude toward technology indicates how open they are to incorporating digital tools. Technological readiness refers to their confidence and competence in using new technologies.

The TAM's relevance to this study is significant, as it emphasizes the role of perceived ease of use and perceived usefulness in shaping teachers' willingness to integrate AI tools into their classrooms. If teachers perceive AI tools as simple to use and beneficial for enhancing classroom assessments, they are more likely to adopt them. On the other hand, if they view AI as difficult to use or not aligned with their educational goals, they may be reluctant to embrace these tools, regardless of their pedagogical beliefs or technological readiness. This intricate relationship is depicted in Figure 1, with the corresponding hypothesis based on the proposed model outlined below.

H1: Attitude to technology has no direct effect on perceived ease of use, perceived usefulness, and utilization of AI in classroom assessment.

H2: Pedagogical belief has no direct effect on perceived ease of use, perceived usefulness, and teachers' preparedness for utilization of AI in classroom assessment.

H3: Technological readiness has on perceived ease of use, perceived usefulness, and teachers' preparedness for utilization of AI in classroom assessment.

H4: Perceived ease of use and perceived usefulness has significant effect on teachers' preparedness for utilization of AI in classroom assessment.

H5: Attitude to technology when mediated by perceived ease of use and perceived usefulness do not significantly affect teachers' preparedness for utilization of AI in classroom assessment.

H6: Pedagogical beliefs when mediated by perceived ease of use and perceived usefulness do not significantly affect teachers' preparedness for utilization of AI in classroom assessment.

H7: Technological readiness when mediated by perceived ease of use and perceived usefulness significantly affect teachers' preparedness for utilization of AI in classroom assessment.

Methods

A cross-sectional survey design was utilized to collect data from a diverse population at a single point in time using various methods (Ofem et al., 2024a, 2024c). The study included 18 institutions from three regions in Nigeria, with a total population of 18,907 academic staff. Respondents were selected through cluster sampling, with institutions grouped by state. This resulted in a sample size of 3,781 academic staff from universities, colleges of education, and polytechnics, representing 20% of the total population. The sample was divided into the following clusters: Cluster 1 ($N = 212$), Cluster 2 ($N = 231$), Cluster 3 ($N = 299$), Cluster 4 ($N = 199$), Cluster 5 ($N = 183$), Cluster 6 ($N = 293$), Cluster 7 ($N = 148$), Cluster 8 ($N = 198$), Cluster 9 ($N = 149$), Cluster 10 ($N = 221$), Cluster 11 ($N = 134$), Cluster 12 ($N = 206$), Cluster 13 ($N = 302$), Cluster 14 ($N = 190$), Cluster 15 ($N = 200$), Cluster 17 ($N = 293$), and Cluster 18 ($N = 233$).

Demographic analysis of the respondents revealed that 2,015 (53.29%) were male, while 1,766 (46.71%) were female. Age distribution showed that 443 (11.72%) were under 35 years, 2,761 (73.02%) were aged between 36 and 50 years, and 577 (15.26%) were over 50 years old. Regarding academic disciplines, 433 (11.45%) were from Arts and Social Sciences, 1,032 (27.29%) were from Management, 678 (17.93%) were in Science, 1,221 (32.29%) were in Humanities, and 417 (11.03%) were from Engineering. In terms of geographic location, 1,084 (28.67%) were from rural areas, 1,119 (29.59%) were from semi-urban schools, and 1,578 (41.73%) were from urban schools.

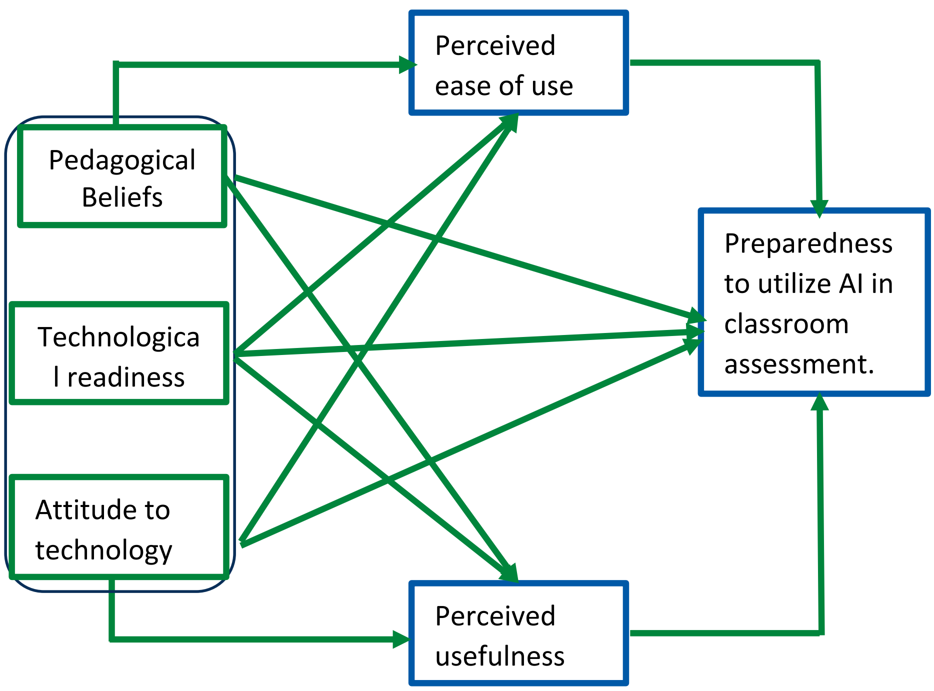

FIGURE 1
Conceptual framework of the nexus between explanatory factors and preparedness to utilize AI in classroom assessment in the presence of two mediators.

Measures/instruments

The study examined seven variables: the utilization of artificial intelligence (AI) in classroom assessment, pedagogical belief, technological readiness, attitude toward technology, perceived ease of use, and perceived usefulness. The data collection instrument was divided into two sections. Section A gathered demographic information, such as gender, age, geographic location, and academic discipline, using categorical scales with mutually exclusive options. It also provided fields for written informed consent, email addresses, and phone numbers for online submission via Google Forms.

Section B focused on measuring the explanatory and response variables. Items related to AI utilization in research were adapted from a scale developed by Ofem et al. (2024a), which showed strong psychometric properties and had been used in a similar context. This scale included six items rated on a four-point linear scale. The attitude toward technology referred to individuals' predisposition to accept, utilize, and integrate information and communication technologies into daily tasks or professional activities. This construct encompassed both positive and negative feelings, beliefs, and behaviors toward technology use, measured with items adapted from Abdullah et al. (2014). A sample item included, "I enjoy exploring new features in software applications." Pedagogical belief, which pertains to personal convictions guiding teachers' approaches to teaching and learning, was assessed with six items that examine beliefs regarding the role of the teacher, the nature of student learning, and the use of instructional strategies. A sample item was, "Students learn best when they actively participate in their own learning process." Technological readiness, defined as an individual's willingness and ability to effectively use new technologies in personal or professional contexts, was measured using six items that assess dimensions such as optimism, innovativeness, discomfort, and insecurity. A sample item was, "I am comfortable using technology to solve problems in my daily life."

Perceived ease of use, which refers to the extent to which a person believes using a particular system or technology would be effortless, was measured with six items adapted from Davis (1989) original scale. A sample item was, "I find the technology easy to use." Perceived usefulness, defined as the degree to which a person believes using a particular system or technology would improve their job performance or help achieve their goals, was measured with six items. A sample item included, "Using this technology improves my work efficiency." All items were rated on a four-point Likert scale, ranging from strongly agree to strongly disagree (SD).

The utilization of AI in classroom assessment was assessed in terms of how teachers incorporate AI tools and technologies into evaluating and assessing students' performance. This includes the use of AI for grading, providing feedback, personalized learning assessments, and data analysis to improve instructional practices. It was measured with ten items, such as, "How often do you use AI tools like Turnitin or Grammarly for grading assignments or exams?" and "How often do you use AI tools like Google Classroom's AI-powered analytics or Knewton to analyze students' learning patterns or behaviors?" These items were rated on a four-point Likert scale: Very Often (VO), Often (O), Sometimes (S), and Never (N).

Content validity

The scale items were quantitatively validated by five experts from diverse fields, including Educational Technology and Measurement and Evaluation, who had substantial experience and had published in respected journals. These experts assessed the relevance, clarity, and appropriateness of the items for the constructs being studied. The initial set of 40 items was developed based on an extensive literature review and modifications of previous research. After an initial screening, seven items were removed, including four related to the utilization of AI in classroom assessment. The exclusion was based not on quality but on the availability of AI tools in Nigeria that teachers could currently use for assessments.

The experts were provided with a questionnaire and an assessment rubric following guidelines recommended by specialists. Each item was rated on a scale of 1 to 4, where 1 indicated irrelevance and 4 indicated high relevance. The Item-Content Validity Index (I-CVI) was calculated to determine which items should remain. I-CVI values range from 0 to 1, with a threshold of 0.78 or higher considered acceptable, signifying strong agreement among the experts regarding the relevance and clarity of the items. Some researchers accept lower values, such as 0.70, under certain conditions like smaller panel sizes or more rigorous item development criteria.

For the Scale-Level Content Validity Index (S-CVI), two common methods were employed: the average method (S-CVI/Ave) and the universal agreement method (S-CVI/UA). An S-CVI/Ave value of 0.80 or higher is typically regarded as acceptable, indicating that at least 80% of the items were considered relevant or clear by the expert panel. In this study, the I-CVI values for the three criteria ranged from 0.79 to 0.97, while the S-CVI values ranged from 0.89 to 0.94, reflecting a high level of relevance and clarity. As a result, seven items were deemed unsuitable and removed, leaving 29 items for the final instrument. To assess the instrument's reliability, internal consistency was evaluated using data from 200 students who were not part of the main study. The results of the quantitative validity and reliability tests are provided in Table 1.

Procedure for data collection

The data collection process adhered to strict ethical guidelines. While the Nigerian Code for Health Research Ethics permits the waiver of consent for harmless survey research, participants in this study were required to provide written consent. The study protocol was reviewed and approved by the institutional review board of Alex Ekwueme Federal University (IRB/FUNAI/2024/4533). Participants were fully informed about the study's objectives, how their data would be used, and assured of its security through encryption accessible only to the lead researcher. Participation was voluntary, and there were no penalties for non-participation. As per the instructions in Section A of the questionnaire, participants signed written consent forms.

Eighteen research assistants, who were Heads of Academic Staff Unions at various universities, were recruited for the study. They were financially incentivized to aid in data collection via their academic staff networks. Their contact details were provided by institutional heads, who were also informed of the study's purpose and the approval granted. The research assistants were trained through a dedicated Telegram group to ensure the questionnaires were distributed strictly within their academic staff groups and not in clubs or associations. The questionnaires were distributed across 152 WhatsApp platforms for academic staff, generating 3,544 responses. After screening, 3,501 valid and complete responses were used for analysis.

TABLE 1 Quantitative content validity indices and Cronbach reliability estimates of the variables in the instrument used for data collection.

Variables	N	I-CVI S	I-CVI R	I-CVI P	S-CVI S	S-CVI R	S-CVI P	α
Utilization of AI	6	0.80–0.90	0.83–0.89	0.79–0.85	0.94	0.95	0.89	0.74
Pedagogical beliefs	5	0.81–0.87	0.82–0.91	0.81–0.87	0.93	0.88	0.90	0.80
Attitude to technology	5	0.82–0.90	0.84–0.90	0.78–0.89	0.95	0.89	0.91	0.81
Technological readiness	5	0.78–89	0.82–0.93	0.81–0.97	0.89	0.93	0.96	0.77
Perceived ease of use	6	0.83–0.91	0.83–0.89	0.70–0.83	0.95	0.90	0.97	0.83
Perceived usefulness	6	0.84–0.90	0.80–0.90	0.87–0.95	0.94	0.90	0.93	0.81
Total items	33	0.93–0.95	0.97–0.93	0.90–0.97	0.98	0.95	0.91	0.92

I-CVCS, Item Content Validity Index for Suitability; I-CVI R, Item Content Validity Index for Relevance; I-CVI P, Item Content Validity Index for Precision; S-CVI S, Scale Content Validity Index for suitability; S-CVI R, Scale Content Validity Index for Relevance; S-CVI P, Scale Content Validity Index for Precision; α, Cronbach Alpha reliability estimate.

Result/findings

Measurement model

The measurement model was evaluated to assess the quality of item loadings for each factor. Research suggests that item loadings above 0.70 are preferable. Table 2 shows that all item loadings exceeded 0.70, except for items UT2, TECH4, PEU6, PU5, and PU6. Experts recommend that items with loadings below 0.70 may still be retained if the overall construct is valid and reliable, and content validity is met. Minor deviations from this threshold are acceptable in exploratory research as long as the overall model fit remains intact. Theoretical justifications can help maintain the conceptual integrity of the model. However, future researchers may wish to revalidate or reconsider such items.

At the scale level, Cronbach's alpha values for all constructs were above 0.70, indicating good internal consistency. Convergent validity was assessed using the average variance extracted (AVE), with an AVE value of 0.50 or higher signifying sufficient evidence. Table 3 shows that all variables met the convergent validity criterion. Discriminant validity was confirmed using the Fornell-Larcker criterion, which ensures that constructs are distinct from each other. This criterion compares the square root of the AVE with the correlation of each construct with others in the model. Table 3 confirms that discriminant validity was achieved, as the diagonal values (square root of the AVE) were higher than the correlation coefficients below them.

To assess predictive relevance, the potential for collinearity within the structural model was examined. Table 2 shows that the outer variance inflation factors (VIFs) for all constructs were below the recommended threshold of 5.00, ranging from 1.54 to 5.00. Similarly, the inner model VIFs were all within acceptable limits, ranging from 1.00 to 1.05, indicating no significant collinearity among predictor constructs. The proportion of variance explained by the exogenous variables in the criterion variables was then analyzed to evaluate the model's in-sample fit and predictive accuracy. Table 2 reveals that technological readiness, pedagogical belief, and attitude toward technology collectively explained 34.6% ($R^2 = 0.346$) of the variance in perceived ease of use. These same variables explained 1.3% ($R^2 = 0.013$) of the variance in perceived usefulness. Moreover, technological readiness, pedagogical belief, attitude toward technology, perceived ease of use, and perceived usefulness collectively explained 11.2% ($R^2 = 0.112$) of the variance in AI utilization in classroom assessment, leaving 88.8% of the variance unexplained. To evaluate the out-of-sample model fit, PLSpredict with 10 folds and a single repetition was employed. This approach simulates the real-world application of the PLS model for forecasting new data, without relying on averaging from multiple models. It utilizes both training and holdout samples to independently estimate the model's parameters and assess its predictive accuracy (Sharma et al., 2023).

To evaluate the model's predictive performance, we divided the dataset into two subsets: a training set for estimating key parameters and a holdout set for testing predictions. The parameters derived from the training set were then applied to predict the indicators of dependent constructs (Shmueli et al., 2019), allowing for an evaluation of prediction accuracy at both the indicator and composite score levels. The Q^2 values obtained from the PLSpredict procedure, which ranged from 0.012 to 0.339, were all positive and above zero (see Table 4). A Q^2 value greater than zero suggests that the model effectively reconstructs the data, confirming its predictive relevance. Furthermore, a positive Q^2 indicates that the predictive error in PLS-SEM is lower than when using mean values alone, highlighting the model's superior predictive power (Hair et al., 2022; Shmueli et al., 2019).

A deeper analysis of prediction errors followed to identify key prediction statistics. The graphical analysis in Figure 2 showed that the PLS-SEM errors did not conform to a normal distribution. As a result, the mean absolute error (MAE) was used instead of the root mean squared error (RMSE) to evaluate predictive performance, given the asymmetric distribution patterns shown in Figure 2. The analysis revealed that the PLS-SEM approach produced similar results to the LM method for most items. However, the PLS-SEM yielded slightly higher MAEs for a few items, with variances ranging from 0.00 to 0.05, but these differences were not statistically significant. Since the PLS-SEM model includes a mediating variable, unlike the LM model, these small discrepancies in MAEs may further support the model's predictive capability, especially as all other quality criteria strongly affirm its robustness (Shmueli et al., 2019).

Structural model and test of hypotheses

Test of hypothesis

The result for H1 as presented in Figure 3 and Table 5, indicates a significant direct effect of attitude to technology perceived ease of use ($\beta = 0.58$, $t = 49.27$, $p < 0.001$), but the nexus between

TABLE 2 Quality criteria assessment of the factor of the study.

Linkages	α	CR	AVE	EFA	VIF	R^2	Q^2 predict
ATT2				0.864	3.500		
ATT3				0.795	2.943		
ATT4				0.842	2.743		
ATT5				0.852	2.782		
Attitude to technology	0.859	0.904	0.703				
PED1				0.777	1.556		
PED2				0.839	1.955		
PED3				0.835	2.031		
PED4				0.753	2.218		
PED5				0.739	2.174		
Pedagogical beliefs	0.864	0.873	0.623				
PEU1				0.889	4.185		
PEU2				0.82	3.022		
PEU3				0.734	1.72		
PEU4				0.9	3.958		
PEU5				0.865	3.185		
Perceived ease of use	0.897	0.925	0.712			0.342	0.312
PUU1				0.848	1.949		
PUU2				0.833	1.73		
PUU3				0.805	1.663		
PUU4				0.76	1.813		
Perceived usefulness	0.832	0.885				0.013	0.010
TECH1				0.621	1.26		
TECH2				0.835	2.083		
TECH3				0.815	1.983		
TECH5				0.678	1.354		
Technological readiness	0.72	0.829	0.552				
UTI1				0.891	2.361		
UTI3				0.85	2.037		
UTI4				0.621	2.153		
UTI5				0.88	3.89		
UTI6				0.779	3.001		
Preparedness to utilize of AI	0.89	0.904	0.657			0.011	0.009

ATT, Attitude to technology; TECH, Technological readiness; PED, Pedagogical beliefs; PEU, Perceived ease of use; PUU, Perceived usefulness; UTI, Utilization of AI in Classroom Assessment.

attitude to technology has no significant direct effect on perceived usefulness ($\beta = -0.01$, $t = 0.813$, $p > 0.05$), and preparedness to utilize AI in classroom assessment ($\beta = -0.01$, $t = 1.01$, $p > 0.05$).

TABLE 3 Discriminant validity evidence through the Fornell–Larcker.

Constructs	1	2	3	4	5	6
Pedagogical belief (1)	0.79					
Perceived ease of use (2)	0.022	0.844				
Technologyical readiness (3)	0.113	−0.056	0.743			
Perceived usefulness(4)	−0.075	−0.006	0.078	0.812		
Preparedness to utilize of AI (5)	−0.212	0.066	0.214	0.087	0.811	
Attitude to technology (6)	−0.02	0.582	−0.105	−0.019	0.018	0.839

Square roots of AVE are bolded along the diagonal; Factor correlations are below the leading diagonal.

TABLE 4 Predictive model fit assessment using the MAEs derived from the PLS-SEM and LM procedures.

PLS	MAE	Q^2_predict	MAE	Q^2_predict	D
PEU3	0.373	0.206	0.325	0.285	0.048
PEU4	0.363	0.255	0.341	0.314	0.022
PEU2	0.374	0.23	0.354	0.268	0.020
PEU5	0.371	0.22	0.369	0.238	0.002
PEU1	0.362	0.29	0.346	0.311	0.016
PUU2	1.034	0.011	1.018	0.026	0.016
PUU4	0.884	0.005	0.878	0.014	0.006
PUU3	0.971	0.005	0.958	0.021	0.013
PUU1	0.977	0.01	0.97	0.017	0.007
UTI6	0.444	0.02	0.413	0.109	0.031
UTI1	0.475	0.101	0.422	0.207	0.053
UTI4	0.426	−0.07	0.371	0.113	0.055
UTI3	0.573	0.074	0.541	0.188	0.032
UTI5	0.443	0.053	0.421	0.113	0.022

Thus, hypothesis 1 is rejected for only attitude to technology and perceived ease of use but retained for others. For H2 the result revealed a significant direct effect of pedagogical belief on perceived ease of use ($\beta = 0.03$, $t = 2.94$, $p < 0.001$), perceived usefulness ($\beta = 0.08$, $t = 6.11$, $p < 0.001$) and preparedness to utilize AI in classroom assessment ($\beta = -0.23$, $t = 20.309$, $p < 0.001$). This is implying that the hypothesis is rejected. H3 result revealed that technological readiness has no direct effect on perceived ease of use ($\beta = 0.00$, $t = 0\ l10$, $p > 0.05$) but significantly had a direct effect on perceived usefulness ($\beta = 0.08$, $t = 5.782$, $p < 0.001$), and preparedness to utilize AI in classroom assessment ($\beta = 0.24$, $t = 16.292$, $p < 0.001$). For H4, the result revealed that perceived ease of use has significant effect on utilization of AI in classroom research ($\beta = 0.09$, $t = 26.36$, $p < 0.001$) while perceived usefulness also has a direct effect on preparedness to utilize AI in classroom assessment ($\beta = 0.05$, $t = 3.67$, $p < 0.001$). Thus, hypothesis 4 is rejected.

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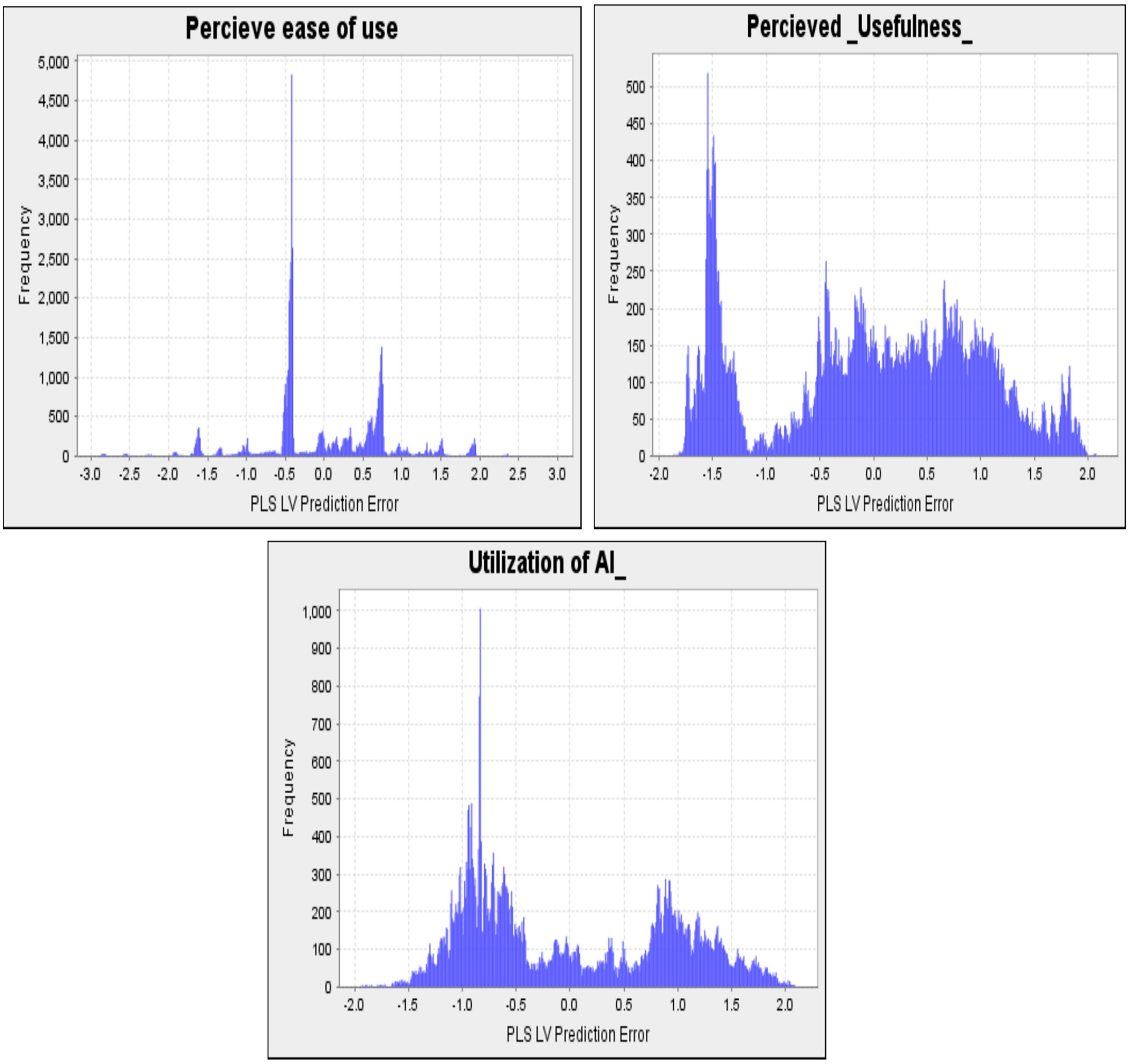

FIGURE 2
Prediction error distributions for the latent variables in the PLS Mode.

Indirect effect

The result for H5 as presented in Figure 3 and Table 6, indicates attitude to technology when mediated by perceived ease of use significantly affect preparedness to utilize AI in classroom assessment ($\beta = 0.05$, $t = 6.363$, $p < 0.000$) but not significant for the nexus when mediated by perceived usefulness ($\beta = 0.00$, $t = 0.779$, $p > 0.05$). For H6, the result showed that the nexus between pedagogical belief and preparedness to utilize AI in classroom assessment is significant when mediated by perceived ease of use ($\beta = 0.00$, $t = 2.628$, $p < 0.000$) and when mediated by perceived usefulness ($\beta = -0.00$, $t = 3.191$, $p < 0.000$) was significant. Thus, H6 was rejected. For H7, the nexus between technological readiness and preparedness to utilize AI in classroom assessment when mediated by ease of use was not significant ($\beta = 0.00$, $t = 0.01$, $p > 0.05$) but significant when mediated by perceived usefulness ($\beta = 0.01$, $t = 3.01$, $p < 0.001$).

Discussion of findings

The study's results show that attitude toward technology has a significant impact on perceived ease of use, suggesting that individuals with a favorable view of technology are more likely to perceive technological tools as user-friendly. Such positive attitudes promote engagement and motivation to use technology, reducing complexity and enhancing adaptability. This finding aligns with the Technology Acceptance Model (TAM) by Davis (1989), which posits that users' attitudes influence their perceptions of ease of use and usefulness. Positive attitudes encourage exploration, boosting confidence and ease in using technology. Venkatesh and Bala (2008) also found that favorable attitudes increase user confidence, reduce anxiety, and foster a perception of ease, while Teo et al. (2009) showed that individuals with positive attitudes engage more deeply with technology. Similarly, Park (2009) confirmed that educators with positive attitudes find

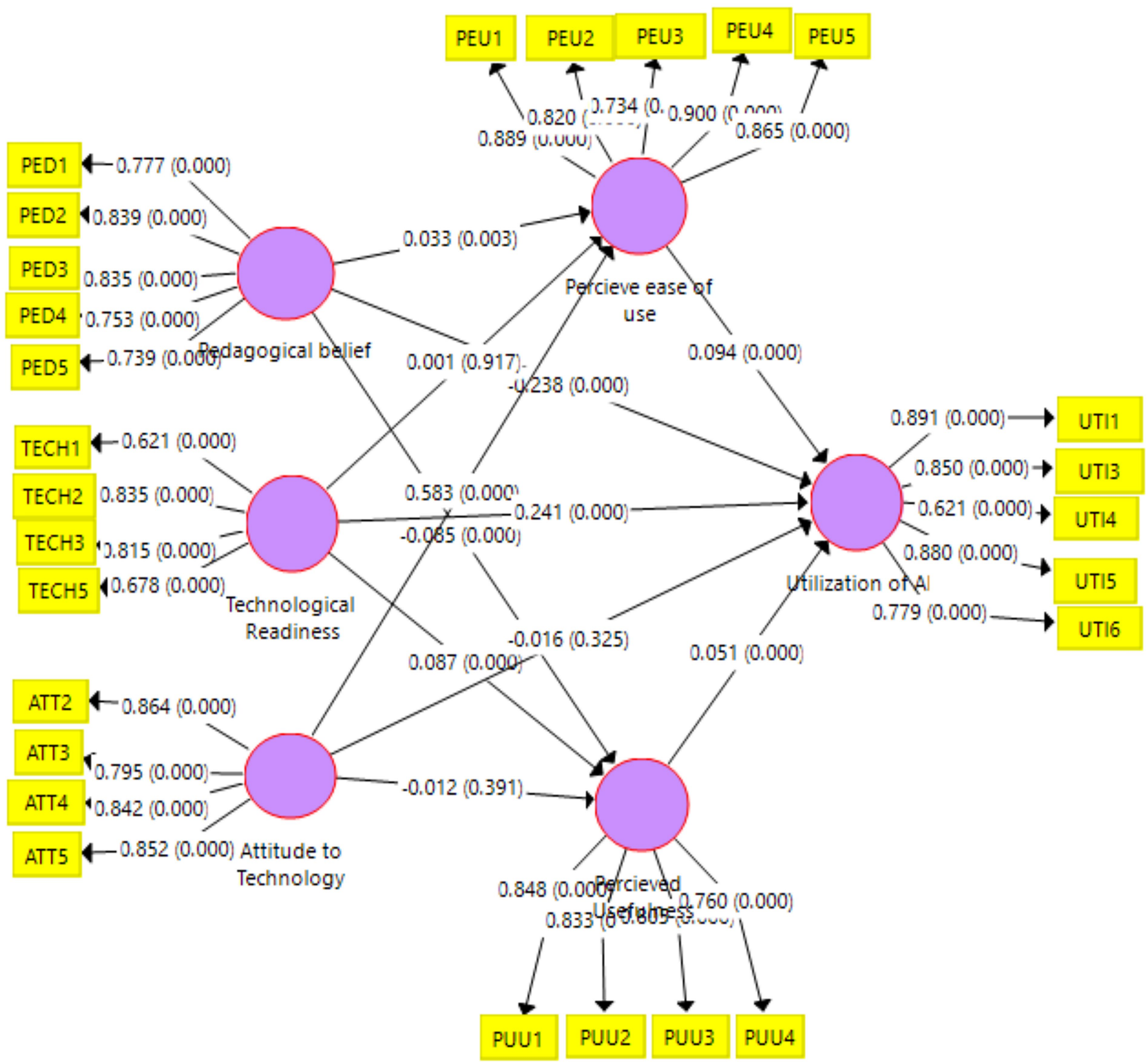

FIGURE 3
Structural equation modeling of the nexus among the variables.

TABLE 5 Direct effect.

Hypothesis	Linkages	β	M	CI 5%	95%	SD	t-value	p-value	Remark
H1	ATT → PEU	0.583	0.582	0.561	0.606	0.012	49.276	0.000	S
H1	ATT → PUU	−0.012	−0.012	−0.039	0.016	0.014	0.813	0.417	NS
H1	ATT → UTI	−0.016	−0.016	−0.044	0.017	0.015	1.018	0.309	NS
H2	PED → PEU	0.033	0.033	0.011	0.055	0.011	2.948	0.003	S
H2	PED → PUU	−0.085	−0.086	−0.112	−0.058	0.014	6.117	0.000	S
H2	PED → UTI	−0.238	−0.237	−0.26	−0.215	0.012	20.309	0.000	S
H3	TECH → PEU	0.001	0.001	−0.023	0.023	0.012	0.103	0.918	NS
H3	TECH → PUU	0.087	0.087	0.055	0.114	0.015	5.782	0.000	S
H3	TECH → UTI	0.241	0.241	0.212	0.27	0.015	16.292	0.000	S
H4	PEU → UTI	0.094	0.095	0.064	0.122	0.015	6.365	0.000	S
H4	PUU → UTI	0.051	0.051	0.022	0.076	0.014	3.676	0.000	S

ATT, Attitude to technology; TECH, Technological readiness; PED, Pedagogical beliefs; PEU, Perceived ease of use; PUU, Perceived usefulness; UTI, Preparedness to utilize of AI in Classroom Assessment; M, Mean; SD, Standard deviation; CI, Confidence interval; S, Significant; NS, Not significant.

TABLE 6 Indirect effect.

Hypothesis	Linkages	β	M	CI5%	95%	SD	*t*-value	*p*-value	Remarks
H5	ATT → PEU → UTI	0.055	0.055	0.039	0.072	0.009	6.363	0	S
H5	ATT → PUU → UTI	−0.001	−0.001	−0.002	0.001	0.001	0.779	0.436	NS
H6	PED → PEU → UTI	0.003	0.003	0.001	0.006	0.001	2.628	0.009	S
H6	PED → PUU → UTI	−0.004	−0.004	−0.007	−0.002	0.001	3.191	0.001	S
H7	TECH → PEU → UTI	0	0	−0.002	0.002	0.001	0.1	0.92	NS
H7	TECH → PUU → UTI	0.004	0.004	0.002	0.007	0.001	3.016	0.003	S

ATT, Attitude to technology; TECH, Technological readiness; PED, Pedagogical beliefs; PEU, Perceived ease of use; PUU, Perceived usefulness; UTI, Preparedness to utilize AI in Classroom Assessment; M, Mean; SD, Standard deviation; CI, Confidence interval.

technology less intimidating and more easily integrated into their teaching practices.

However, the study found that attitude toward technology does not directly influence perceived usefulness or teachers' preparedness to use AI for classroom assessment. This suggests that while a positive attitude may affect other variables like perceived ease of use, it does not necessarily lead to viewing technology as useful or feeling prepared to implement it in the classroom. This finding contrasts with the TAM, which argues that attitudes can influence perceived usefulness and behavioral intentions (Davis, 1989). It is worth noting that factors such as technological readiness, training, and institutional support may mediate or outweigh the direct effect of attitudes on perceived usefulness or preparedness. Venkatesh and Bala (2008) also noted that perceived usefulness is influenced by factors such as system quality and user experience, rather than just attitudes.

Other empirical studies provide additional context. Teo et al. (2009) found that while attitudes influenced ease of use, they did not always correlate directly with perceived usefulness, particularly when users lacked practical experience. Park (2009) also emphasized that educators assess the usefulness of technology based on its alignment with pedagogical goals and prior usage, rather than initial attitudes. This is consistent with Ajzen's (1991) theory of planned behavior, which stresses the role of external influences such as subjective norms and perceived behavioral control in shaping technology use. The findings imply that improving teachers' preparedness to use AI in classroom assessments requires more than fostering positive attitudes. Providing hands-on training, showcasing the practical benefits of AI, and ensuring alignment with existing teaching practices are essential. These strategies align with previous research that highlights the importance of structured interventions to enhance perceived usefulness and confidence in using technology for education (Venkatesh et al., 2012).

The study also found that pedagogical beliefs play a significant role in teachers' readiness to use AI in classroom assessments. This emphasizes the importance of educators' core beliefs about teaching and learning in determining their willingness to adopt innovative tools like AI. Teachers who adhere to constructivist or progressive pedagogical views, which focus on student-centered learning, are more inclined to adopt AI tools that support personalized learning and formative assessment.

This finding aligns with Ertmer (2005) research, which highlighted that pedagogical beliefs are a key factor in technology integration in education. Ertmer argued that teachers with beliefs supporting active and collaborative learning were more likely to use technology effectively in their classrooms. Similarly, Kim et al. (2013) discovered that teachers' belief systems played a crucial role in their adoption of educational technology, with those holding progressive beliefs demonstrating greater readiness to embrace innovative tools. Liu et al. (2018) further showed that teachers' pedagogical beliefs shape their views on the value and applicability of digital tools in assessment practices. Teachers with a learner-centered focus tend to view AI as a tool to enhance learning outcomes and improve assessments, leading to greater adoption. This aligns with Ajzen's (1991) Theory of Planned Behavior, which suggests that underlying beliefs directly influence intentions and behaviors.

The study also found that pedagogical beliefs significantly impact perceived ease of use, indicating that teachers with strong pedagogical beliefs are more likely to perceive technological tools as intuitive and easy to use. These beliefs shape teachers' approaches to teaching and learning, influencing their openness to adopting new technologies. When educators are confident that technology aligns with their teaching goals, they are more likely to view it as user-friendly and adaptable. This aligns with Ertmer's (2005) assertion that teachers' pedagogical beliefs are critical for effective technology integration. Teachers who prioritize student-centered approaches often see technology as a way to enhance teaching effectiveness, leading to a positive perception of ease in its use. Likewise, Teo (2011) found that educators with strong beliefs about the utility of technology are less likely to feel anxious, which helps facilitate smoother adoption. Liu et al. (2018) emphasized that teachers with constructive pedagogical beliefs are better equipped to experiment with technology, viewing it as supportive of their teaching methods. Ajzen's (1991) theory also supports this, suggesting that beliefs influence perceptions, which in turn shape attitudes toward ease of use.

Additionally, the study revealed that pedagogical beliefs directly affect perceived usefulness, showing that teachers who believe in the importance of effective teaching practices recognize the value of technology in enhancing learning outcomes. Teachers who see technology as aligned with their teaching goals are more likely to appreciate its utility in achieving desired educational results. Venkatesh and Bala (2008) also argued that individual beliefs about technology influence perceptions of its usefulness. Teachers with a constructivist orientation often view technology as a facilitator of interactive and engaging learning environments, leading them to perceive it as highly beneficial. Ertmer (2005) similarly found that pedagogical beliefs significantly influence how teachers assess the utility of technological tools in achieving their teaching goals. Kim et al. (2013) demonstrated that teachers with strong pedagogical beliefs recognize technology's potential to transform traditional teaching methods, enhancing both teacher effectiveness and student outcomes. These results are grounded in the Technology Acceptance

Model (TAM) by Davis (1989), which highlights that perceived usefulness is a key factor in technology adoption.

Finally, the study showed that technological readiness significantly impacts teachers' preparedness to use AI for classroom assessment. This finding suggests that teachers with higher technological readiness are more likely to adopt and integrate AI tools into their teaching practices. Technological readiness refers to an individual's ability and willingness to use technology effectively, playing a crucial role in determining how well teachers can adapt to new educational technologies (Parasuraman, 2000). Teachers with high technological readiness are generally more confident in using technology, which reduces barriers such as anxiety and resistance, making them more willing to incorporate AI tools in their assessments.

Supporting this finding, Al-Emran et al. (2018) demonstrated that technological readiness impacts teachers' willingness to adopt educational technologies. Teachers who are comfortable with and ready to use technology are more likely to view new tools as both useful and easy to integrate into their teaching. Similarly, Kim et al. (2013) found that teachers' readiness to use technology is a key factor in their ability to adopt new tools, such as AI, in their teaching. Teo (2011) also affirmed that teachers with higher technological readiness exhibit more favorable attitudes toward using digital tools in education. This study reveals that technological readiness has a significant impact on perceived usefulness, meaning that individuals who are more technologically prepared are more likely to see tools like AI as valuable. Technological readiness refers to an individual's readiness—both cognitive and emotional—to adopt and use technology (Parasuraman, 2000). Teachers who are ready to use technology are likely to view it as a resource that can improve their teaching practices, including enhancing classroom assessments with AI tools.

This finding aligns with earlier studies emphasizing the importance of technological readiness in shaping perceptions of technology's usefulness. For instance, Venkatesh and Bala (2008) found that individuals who are ready to use technology are more likely to perceive it as useful and relevant. Similarly, Al-Emran et al. (2018) noted that users with technological readiness are more likely to adopt mobile learning tools, seeing them as more beneficial to their educational practices. Kim et al. (2013) also highlighted that teachers' technological readiness positively influences their perceptions of the usefulness of new educational technologies. These studies suggest that enhancing technological readiness among educators can improve their perceptions of AI's value in classroom assessments. By providing proper training and support, educators are more likely to adopt and integrate AI into their teaching methods.

The study also revealed that both perceived usefulness and perceived ease of use are strongly related to teachers' preparedness to use AI in classroom assessments. This indicates that when teachers believe AI tools will improve their teaching practices and are easy to use, they are more likely to be ready and willing to adopt them. This finding supports the Technology Acceptance Model (TAM) developed by Davis (1989), which argues that perceived ease of use and perceived usefulness are critical factors in technology adoption.

Perceived usefulness refers to the extent to which teachers believe AI tools will enhance their classroom assessment outcomes, while perceived ease of use reflects how easily teachers believe they can integrate AI into their teaching practices. The study suggests that both of these factors are essential for cultivating positive attitudes and increasing teachers' willingness to use AI tools in education.

This conclusion is supported by previous research. For example, Teo et al. (2008) found that perceived usefulness and ease of use were crucial factors influencing teachers' intentions to incorporate technology into their classrooms. Venkatesh and Davis (2000) similarly argued that these two factors are essential in determining users' decisions to adopt technology. In the context of AI, Akinsola and Akinbode (2020) found that teachers' perceptions of the usefulness and ease of use of technology tools were significant predictors of their willingness to incorporate them into their teaching practices.

The findings of this study also align with Park (2009) work, which highlighted that teachers are more likely to integrate technological tools into their practices when they perceive them as both useful and easy to use. Therefore, promoting teachers' perceptions of AI's usefulness and ease of use is crucial for encouraging their preparedness and willingness to use AI in classroom assessments.

Finally, the study revealed that perceived ease of use mediates the relationship between teachers' attitude toward technology and their readiness to use AI in classroom assessments, while perceived usefulness does not. This suggests that while positive attitudes toward technology help foster readiness to adopt AI, it is the perception of ease of use that plays a more significant role in this process, unlike perceived usefulness, which does not influence this relationship in the same way.

This outcome is consistent with the Technology Acceptance Model (TAM) proposed by Davis (1989), which suggests that both perceived ease of use and perceived usefulness are critical factors in technology adoption. However, our findings highlight the more significant role that ease of use plays in enhancing teachers' preparedness. Teachers who have a positive attitude toward technology are more likely to find AI tools easy to use, which, in turn, boosts their readiness to incorporate these tools into their classroom assessments. This aligns with Karadeniz and Ozdemir's (2018) findings, which showed that ease of use was a significant factor influencing teachers' intentions to adopt educational technologies. The lack of mediating influence from perceived usefulness in this study could be attributed to the fact that teachers may need hands-on experience with AI tools to fully recognize their usefulness. This is supported by Basyal and Xie (2020), who found that teachers' perceptions of ease of use were more important than perceived benefits in determining technology adoption. Additionally, Avidov-Ungar (2021) confirmed that ease of use was a stronger predictor of technology integration in education than perceived usefulness.

The results of this study suggest that perceived usefulness mediates the relationship between technological readiness and teachers' preparedness to use AI in classroom instruction, whereas perceived ease of use does not. This indicates that teachers' readiness to adopt technology, including their confidence in using it, directly influences their perception of AI's usefulness, which, in turn, affects their preparedness to use AI tools in teaching. However, perceived ease of use, which refers to how easy and user-friendly technology is perceived to be, does not appear to play a significant mediating role in this relationship.

This aligns with Davis (1989) TAM framework, which suggests that perceived usefulness is a more influential factor in technology adoption than perceived ease of use. In this study, teachers' technological readiness—marked by their comfort and confidence with technology—shapes how they perceive the utility of AI in improving teaching practices. Teachers who feel technologically prepared are more likely to view AI as a valuable tool, which positively impacts their readiness to integrate it into their instruction. The absence of a mediating role for perceived ease of use suggests that the perceived value and effectiveness of AI tools may be more important than their perceived simplicity. This aligns with research by Venkatesh and Bala (2008), who argued that perceived usefulness plays a stronger role in technology acceptance than ease of use. Teachers with higher technological readiness are more willing to adapt to the complexities of AI tools, recognizing the benefits as outweighing the challenges involved in learning how to use them.

This conclusion is also supported by previous studies. For instance, Hwang and Chang (2015) found that perceived usefulness was the primary factor driving teachers' adoption of technology, with perceived ease of use having a lesser impact. Similarly, Al-Azawei et al. (2017) found that teachers' perceptions of the usefulness of educational technologies were a strong predictor of their intention to use them, especially when they felt confident in their technological abilities. This suggests that when teachers are technologically ready, they are more likely to focus on the benefits AI can bring to learning outcomes, rather than being discouraged by the initial learning curve. In contrast, perceived ease of use may not mediate the relationship because it may be a less important factor in situations where teachers already possess the necessary technological readiness. As technological readiness increases, teachers may prioritize the practical applications of AI over ease of use, which may explain why perceived usefulness emerges as the primary mediator.

Limitations of the study

While this study provides valuable insights into the factors that influence teachers' preparedness to use AI in classroom assessments, there are several limitations to consider. The research focused on a specific group of teachers within higher education institutions, which may limit the ability to generalize the findings to other educational contexts. A broader and more diverse sample, including various geographical locations and educational settings, would improve the external validity of the results. The data collection relied on self-reported measures, which are prone to biases such as social desirability or response bias. Teachers may have overestimated their readiness to adopt AI or their attitudes toward technology, potentially affecting the accuracy of the findings. Additionally, the study used a cross-sectional design, meaning data was collected at only one point in time. This design prevents the drawing of causal conclusions or the examination of how teachers' attitudes or preparedness may evolve over time as they gain more exposure to AI tools or engage in professional development. While the study explored key psychological factors such as attitudes, beliefs, and readiness, it did not account for external factors like institutional support, resources, or access to technology, which could significantly influence teachers' preparedness to use AI in classroom assessments. Furthermore, the study did not distinguish between different types of AI tools, and teachers may vary in their preparedness depending on the complexity and features of the AI tools they are using.

Conclusion

This study has provided valuable insights into the factors influencing teachers' preparedness to use artificial intelligence (AI) for classroom assessments. The findings indicate that both perceived ease of use and perceived usefulness have a significant impact on teachers' readiness to adopt AI, with pedagogical beliefs and technological readiness playing essential roles. Specifically, the study found that attitude toward technology directly influenced perceived ease of use, while pedagogical beliefs and technological readiness had direct effects on both perceived ease of use and perceived usefulness. Additionally, the study revealed that perceived ease of use mediated the relationship between attitude toward technology and teachers' preparedness, while perceived usefulness mediated the relationship between technological readiness and preparedness. These findings highlight the importance of enhancing not only teachers' technological readiness but also aligning their pedagogical beliefs with the capabilities of AI to encourage greater adoption in classroom assessments.

Theoretical/practical implications

The results of this study contribute to the existing body of knowledge by deepening the understanding of the factors that affect teachers' preparedness to use AI in classroom assessments. The study supports and expands the Technology Acceptance Model (TAM) by emphasizing the significant roles of perceived ease of use and perceived usefulness in shaping teachers' adoption of technology. Additionally, the findings highlight the mediating effects of these constructs, suggesting that pedagogical beliefs and technological readiness not only directly influence preparedness but also operate through perceived ease of use and perceived usefulness. This emphasizes the importance of addressing teachers' attitudes and beliefs when promoting AI integration in education.

From a practical standpoint, the findings underscore the need for targeted interventions in professional development programs aimed at enhancing teachers' preparedness to use AI. Training programs should focus on improving teachers' technological readiness by addressing their perceptions of AI's usefulness and ease of use. Furthermore, the study highlights the need for pedagogical training that helps teachers align their teaching beliefs with the capabilities of AI, which will facilitate broader adoption. The research also suggests that perceived ease of use is crucial for overcoming barriers to AI adoption, and providing practical support to help teachers overcome technological challenges should be prioritized to ease their learning curve.

Recommendations

The following recommendations were made for the study.

i Educational institutions should invest in ongoing professional development that focuses on enhancing teachers' technological readiness and pedagogical beliefs related to AI. Training should emphasize the practical benefits of AI tools, addressing concerns about complexity, and demonstrating their potential to improve classroom assessment processes.

ii Schools and educational bodies should provide accessible resources, including tutorials, tech support, and peer mentorship programs, to help teachers overcome initial barriers related to the perceived ease of use of AI tools. Providing hands-on experience with AI applications in assessments will help reduce resistance and increase perceived ease of use.

iii To ensure effective integration of AI in classroom assessments, teachers should be encouraged to align their pedagogical beliefs with the capabilities of AI. Workshops and seminars could be designed to demonstrate how AI complements various teaching methodologies and how it can enhance existing pedagogical practices.

iv Given the significant role of perceived usefulness in shaping teachers' preparedness, it is critical to focus on demonstrating the tangible benefits AI can bring to the classroom. Case studies and evidence-based practices should be used to illustrate how AI.

v Future research should explore the long-term effects of AI integration in the classroom, particularly in relation to teachers' evolving beliefs and practices. Continuous feedback mechanisms should be established to assess the effectiveness of AI tools and training programs, allowing for adjustments to better meet the needs of educators.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The data collection process adhered to strict ethical guidelines. While the Nigerian Code forHealth Research Ethics permits the waiver of consent for harmless survey research, participants in this study were required to provide written consent. The study protocol was reviewed and approved by the institutional review board of Alex Ekwueme Federal University (IRB/FUNAI/2024/4533). Participants were fully informed about the study's objectives, how their data would be used, and assured of its security through encryption accessible only to the lead researcher. Participation was voluntary, and there were no penalties for non-participation. As per the instructions in Section A of the questionnaire, participants signed written consent forms.

Author contributions

UO: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Writing – original draft. FO: Conceptualization, Data curation, Methodology, Writing – original draft. IE-A: Conceptualization, Methodology, Resources, Writing – original draft. EA: Formal analysis, Methodology, Validation, Writing – original draft. EE: Conceptualization, Project administration, Supervision, Writing – original draft. JU: Methodology, Project administration, Supervision, Writing – original draft. SO: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft. AO: Conceptualization, Data curation, Formal analysis, Writing – original draft. CD: Writing – original draft, Conceptualization, Data curation, Formal analysis. CA: Conceptualization, Data curation, Formal analysis, Validation, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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