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Article

Educator-Centric Sustainable Digital Integration: Self-Efficacy, Technology Readiness, and Artificial Intelligence (AI) Trust as Predictors of Technology Acceptance for Quality Education in Teaching Environments

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Abstract: In the midst of unprecedented digitization in education, the current research investigates the critical factors governing educators' behavioral intention, acceptance, and adoption of educational technology in classroom environments. Grounded in established technology acceptance theories and pedagogical frameworks, the study examines five key constructs: Self-Efficacy, Technology Readiness, Trust in Artificial Intelligence (AI), Pedagogical Beliefs, and Facilitating Conditions. A quantitative research approach was employed, with data collected from 320 educators through structured questionnaires. Discriminant analysis was used to test the hypothesized relationships among the variables and identify the strongest predictors of technology acceptance and adoption. The findings reveal that Self-Efficacy and Technology Readiness significantly influence educators' intention to integrate technology into teaching practices. Trust in AI further strengthens this intention, particularly among educators with higher levels of readiness. Among all variables, Facilitating Conditions emerged as the strongest predictor of actual technology adoption, highlighting the importance of institutional support, infrastructure, and access to digital resources. Furthermore, Pedagogical Beliefs and Trust in AI demonstrated moderating effects on the relationship between intention and adoption. The study contributes to the advancement of educational technology adoption models while offering practical implications for educational leaders and policymakers. Importantly, the findings support the achievement of the United Nations Sustainable Development Goal 4 (Quality Education) by promoting sustainable digital transformation, inclusive technology-enhanced learning environments, and equitable access to innovative educational opportunities that strengthen teaching effectiveness and lifelong learning outcomes.

Keywords: Educational Technology Adoption; Artificial Intelligence (AI); Teacher Technology Integration; Sustainable Digital Education; Quality Education; Technology Acceptance

1. INTRODUCTION

The integration of educational technology (EdTech) is essential for enhancing pedagogy, personalizing learning, and preparing students for a digital future. Despite increased access to devices and platforms, actual classroom integration remains inconsistent due to infrastructural limitations, insufficient teacher training, time constraints, and educator attitudes (Wong et al., 2024; Kim & Jung, 2023). Additional barriers include inequities in student access and emerging concerns around AI ethics and transparency (Selwyn et al., 2023; Li et al., 2024). Existing models such as TAM, UTAUT, and TPACK explain adoption behavior but often overlook the interplay of systemic, pedagogical, and psychological factors. This study addresses this gap by integrating multiple frameworks and examining Self-Efficacy, Technology Readiness, Trust in AI, Pedagogical Beliefs, and Facilitating Conditions as predictors of technology adoption.

In addition to hardware constraints, teacher preparation continues to serve as a key bottleneck. The research in each case uniformly demonstrates that the lack of professional training in the use of both the technical and pedagogical aspects of digital tools on the part of educators inhibits teachers' ability to deploy technology successfully. Educators often report unsuitable or unaligned professional development opportunities, the majority of which are generic, overly technical, or too short in duration to have any real benefit (Li & Zhao, 2021; Tang et al., 2022). In Cambodian and Indonesian contexts, research has indicated educators receive isolated training often in the form of mobile phone training or short workshops that do not focus on pedagogical integration nor subject-specific needs (Sok & Srun, 2022). Furthermore, new technologies are frequently launched without subsequent support mechanisms in place, so educators are left with complex platforms with no support and no troubleshooting assistance (Martins & Ferreira, 2024). Time limitations further add to the woes of the above factors. Educators point to not having adequate time as one of the biggest barriers to new technologies' adoption. Planning in the use of technology-infused lessons, investigating new tools in which there is no experience, and resolving technological impasses consume time where educators have none to devote to such things, particularly where there are inflexible curricula, mnemonic-based tests and evaluation, and administrative responsibilities (Johnson et al., 2023). With the pandemic of COVID-19, educators overnight had to switch over to online platforms without adequate preparation to redesign pedagogy for online delivery. While emergency remote teaching facilitated continuity, it often used didactic approaches with no leveraging of the affordance of EdTech tools (Bozkurt et al., 2020).

Beliefs and attitudes of teachers also play a key role in the determination of the adoption behaviors. According to the Technology Acceptance Model (TAM), ease of use and usefulness are key determinants of intention of behavior (Davis, 1989). However, research bears witness to the fact that the majority of instructors possess a concern for the use of the old instruction methods and consider technology a distraction or added pressure (Teo, 2022). This is most typical of entrenched educators who may not be so familiar with the use of the electronic tools or who have concerns regarding learning and adapting (Rahimi & Yadollahi, 2023). Age-related aversions to technological applications have also been documented in the developed and the developing world, as some instructors perceive the notion of learning as "too old" or are afraid of losing control of the classroom (Sok & Srun, 2022; Nelson & Moore, 2021). Furthermore, instructors with unimpressive EdTech experiences in the past are more likely to experience "innovation fatigue" and resist future reorganization efforts based on unimpressive past experience (Zhao, 2021). Another key inhibiting factor lies with the lack of effective ongoing technological support. With no support on which one can reverberate, the resultant technological snags and system failures become regular disruptors of the operations of the classroom. Literature highlights the point that the lack of special IT support attracts the ire and demotivation of instructors, who in most instances feel unhibited in addressing bugs of debugging or infusing tools in the instruction delivery process (Martins & Ferreira, 2024). EdTech system effectiveness is hence a substantial consideration in the determination of teachers' attitudes and willingness regarding the use of new tools over the long term.

The problem of EdTech adoption is also deeply intertwined with issues of educational equity. Students from disadvantaged socioeconomic backgrounds often lack stable internet access, personal devices, and supportive learning environments factors that limit the impact of technology-enhanced instruction (OECD, 2022). Teachers working in such contexts are frequently compelled to modify or abandon digital tools to accommodate students' limited access, undermining the consistency and efficacy of integration efforts. Moreover, cultural and linguistic diversity is often overlooked in the design of educational software, further marginalizing students and reducing the relevance of available resources (Chen & Goh, 2023). More recently, the emergence of artificial intelligence (AI)-driven EdTech solutions such as adaptive learning systems, generative AI, and intelligent tutoring has introduced a new layer of complexity. While AI offers promising avenues for personalized education, it has also raised ethical concerns among educators. Teachers express apprehensions about data privacy, algorithmic bias, and the erosion of human interaction in teaching and learning (Selwyn et al., 2023). Many also fear that reliance on AI tools may deskill educators or render

their professional judgment obsolete. Trust in these tools is further eroded when educators lack transparency into how algorithms make decisions or when such systems fail to reflect the diversity of student experiences (Li et al., 2024). These concerns highlight the importance of involving educators in the design and implementation of AI tools to ensure alignment with pedagogical values and classroom realities.

Overall, the problem of educator adoption of EdTech is complex and contextual. Structural barriers, lack of training, shortage of time, resistance to innovations, lack of support for technology, equity disparities, and new issues regarding AI all collaborate to forestall effective use of technology in the classroom. Even as extant models such as TAM, UTAUT, and TPACK advance conceptual frameworks for single determinants of adoption, they tend not to engage the larger systemic and sociocultural determinants underlying educators' behaviors. Additionally, the research on the problem to date tends to narrow in on hardware availability or end-user attitudes without adequately giving not only to their interconnection but also to the dynamic overtime of the adoption process. There remains undoubtedly the necessity for inclusive research investigating the interplay of those multiple factors in the convergence, interplay, and evolution of the multiple educational contexts. The current study addresses the essential necessity by investigating the latent factors of educators' intentions, acceptance, and adoption of EdTech in the classroom by integrating established theory-based models and new issues regarding equity and AI by utilizing a quantitative approach design to capture the richness and coverage of the problem. The findings advance the proposition of informing future interventions, policies, and training programs in the service of more sustainable, equitable, and contextual educational technologies use.

2. LITERATURE REVIEW

Research consistently shows that self-efficacy strongly influences technology adoption. Educators with greater confidence are more likely to integrate digital tools (Nazaretsky et al., 2022; Viberg et al., 2023). Pedagogical beliefs also play a major role: constructivist-oriented teachers tend to perceive technology as more useful and easier to use, leading to higher adoption rates (Kartal, 2024). Trust in educational technologies, shaped by transparency, reliability, and user understanding, has become particularly important with the rise of AI-based systems (Chatterjee et al., 2021; Glass et al., 2024). Technology readiness defined by optimism, innovativeness, and comfort with change predicts openness to new tools, while facilitating conditions such as infrastructure, technical support, and institutional backing remain crucial for successful integration (Parasuraman, 2000; Musthofa et al., 2024). By combining these factors within frameworks like TAM, UTAUT, TRI, and TPACK, a more comprehensive understanding of educator adoption emerges.

Aligned with self-efficacy, TPACK and pedagogical beliefs have proven influential in shaping how educators' approach EdTech. Kartal (2024), using structural equation modeling with 655 Turkish preservice teachers, found that constructivist beliefs directly improve perceived usefulness, ease of use, and adoption intentions. Similarly, studies on Malaysian preservice math teachers revealed that technological pedagogical knowledge (TPK), technological content knowledge (TCK), and general technological knowledge (TK) accounted for up to 74 % of variance in technology-rich teaching strategies. Cabero-Almenara et al. (2024) applied UTAUT2 to AI adoption among 425 university lecturers and showed that constructivist teachers scored higher in performance expectancy, social influence, and facilitating conditions, leading to strong adoption intent.

Trust in AI-powered EdTech is another emerging determinant. Nazaretsky et al. (2022) found that targeted professional development can reduce "algorithm aversion," helping teachers feel more comfortable with AI. Glass et al. (2024), in a multi-country study, showed that trust is closely tied to AI understanding and self-efficacy, though it varies culturally and is not significantly influenced by gender, age, or teaching experience. Al Abdullatif (2024) demonstrated that AI literacy and perceived ease of use boost adoption intentions, with trust and intelligent TPACK acting as key mediators.

The Technology Readiness Index (TRI) and related traits such as personal innovativeness, optimism, discomfort, and insecurity also influence adoption. Cukurova et al. (2023) reported that factors like teacher confidence, system quality, low additional workload, and trust predicted adaptive learning platform use better than conventional acceptance variables. Studies in Oman and Indonesia confirmed that strong infrastructure and support networks encourage adoption, while inadequate conditions can undermine even high self-efficacy (Musthofa et al., 2024).

Core constructs from TAM and UTAUT perceived usefulness and ease of use remain central. Cabero-Almenara et al. (2024) identified performance expectancy, effort expectancy, social influence, and hedonic motivation as significant predictors of AI adoption. Al Abdullatif (2024) confirmed that AI literacy shapes ease-of-use perceptions, boosting acceptance. Viberg et al. (2023) emphasized cultural variation in trust and called for integrating cultural

dimensions such as uncertainty avoidance into adoption models. Cukurova et al. (2023) further noted that ethical and workload concerns can outweigh traditional predictors in practice.

Overall, recent research points toward an evolved adoption model that integrates established acceptance factors with emerging elements AI literacy, trust, pedagogical alignment, and readiness to more accurately explain and support technology use in education.

3. RESEARCH METHODOLOGY

This study uses a quantitative research approach to examine factors influencing educators' intentions, acceptance, and adoption of educational technology in classrooms. Quantitative methods were selected for their ability to objectively measure variables, test hypotheses, and identify relationships through statistical analysis (Bryman, 2016; Field, 2018). Discriminant analysis was applied to assess how well predictor variables distinguish between different levels of technology adoption, making it suitable for identifying characteristics of educator groups based on their behaviors and attitudes toward technology (Hair et al., 2019).

Survey Instrument

The research used a structured questionnaire with six constructs drawn from validated sources: Self-Efficacy, Pedagogical Beliefs, Trust in AI, Technology Readiness, Facilitating Conditions, and Behavioral Intention to Use Technology. Each was measured using multiple 5-point Likert scale items ("strongly disagree" to "strongly agree"). Items were adapted from prior studies, including Compeau & Higgins (1995), Ertmer & Ottenbreit-Leftwich (2010), Venkatesh et al. (2003), Parasuraman (2000), and Davis (1989). Self-Efficacy measured educators' confidence in using technology, Pedagogical Beliefs covered both constructivist and traditional orientations, Trust in AI assessed perceptions of reliability and ethics, Technology Readiness reflected optimism and innovativeness, Facilitating Conditions captured institutional support and resource availability, and Behavioral Intention measured likelihood of future use.

Data Collection

Data was gathered over four weeks via email and academic platforms, targeting primary, secondary, and tertiary educators. Out of 500 distributed questionnaires, 320 valid responses were retained (64% response rate). Participants were informed of voluntary participation, consented, and the study received institutional ethics approval.

Sampling

Stratified random sampling ensured proportional representation across education levels and institutional types (public/private), increasing generalizability (Etikan & Bala, 2017). The sample size met discriminant analysis recommendations of at least 20 cases per predictor (Tabachnick & Fidell, 2019).

Statistical Analysis

Educators were classified into Low, Moderate, and High technology adoption groups. Prior to analysis, assumptions such as multivariate normality, homogeneity of variance-covariance, and absence of multicollinearity were tested. VIF values were below 5, indicating no severe collinearity issues. Reliability and validity were confirmed with Cronbach's alpha (>0.70), Composite Reliability (>0.70), and Average Variance Extracted (>0.50) (Fornell & Larcker, 1981). Discriminant validity was confirmed using the Fornell–Larcker criterion.

The model significantly differentiated adoption levels (Wilks' Lambda, $p < 0.001$) and achieved a classification accuracy of 78%. Trust in AI, Facilitating Conditions, and Self-Efficacy emerged as the strongest predictors, consistent with prior research (Teo, 2011; Chatterjee et al., 2021; Musthofa et al., 2024).

By integrating robust psychometric testing and discriminant analysis, this study offers evidence-based insights into key factors that distinguish educators' adoption behaviors. The results can inform both policy and targeted professional development aimed at enhancing technology integration in diverse classroom contexts.

Table 1: Reliability and Validity of Measurement Constructs

Variable	Cronbach's Alpha	Average Factor Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)
Self-Efficacy	0.88	0.72	0.90	0.65

Pedagogical Beliefs	0.91	0.78	0.93	0.68
Trust in AI	0.86	0.74	0.88	0.61
Technology Readiness	0.87	0.76	0.89	0.64
Facilitating Conditions	0.89	0.73	0.91	0.66

As shown in Table 1, all the study's constructs scored above the accepted benchmarks 0.70 for Cronbach's alpha, 0.70 for Composite Reliability (CR), and 0.50 for Average Variance Extracted (AVE) indicating that they are both reliable and internally consistent (Fornell & Larcker, 1981). Discriminant validity was also confirmed using the Fornell–Larcker criterion, which showed that each construct was more strongly related to its own items than to other constructs. In simple terms, this means each variable measured a distinct aspect of the research focus (Hair et al., 2019).

The discriminant analysis produced a statistically significant result (Wilks' Lambda, $p < 0.001$), showing that the predictor variables could clearly distinguish between educators with low, moderate, and high levels of technology adoption. The model correctly classified 78% of cases, which demonstrates a strong ability to predict adoption levels. Among all predictors, Trust in AI, Facilitating Conditions, and Self-Efficacy stood out as the most influential findings that align closely with previous studies (Teo, 2011; Chatterjee et al., 2021).

By combining rigorous psychometric testing with advanced statistical analysis, this study offers a detailed picture of the factors that shape educators' technology adoption. The insights generated here are relevant not just for academic theory, but also for policymakers and school leaders looking to remove barriers and strengthen the conditions for effective technology integration in classrooms.

4. RESULT AND FINDINGS

This study explored both the direct and moderate relationships between several key factors that shape educators' intentions and actual use of educational technology in the classroom. Drawing on responses from 320 educators, the analysis was conducted using structural equation modeling (SEM) along with moderation testing through interaction terms. The core variables examined were Self-Efficacy (SE), Pedagogical Beliefs (PB), Technology Readiness (TR), Trust in AI (TAI), Facilitating Conditions (FC), and Behavioral Intention to Use Technology (BIUT), with Technology Adoption Behavior (TAB) serving as the final outcome variable.

Direct Effects

The results of the path analysis highlighted several noteworthy patterns. Self-Efficacy emerged as a strong predictor of intention ($\beta = 0.32$, $p < 0.001$), showing that educators who feel more confident in their technological skills are far more likely to plan for and incorporate technology into their teaching. This finding supports H1 and aligns with earlier work by Teo (2011) and Compeau and Higgins (1995).

Technology Readiness also played a meaningful role, with a positive and significant link to intention ($\beta = 0.28$, $p < 0.001$). This supports H2 and reinforces Parasuraman's (2000) assertion that openness to innovation and comfort with technology are important drivers of adoption.

Finally, Trust in AI while showing a somewhat smaller effect was still a significant factor in shaping intention ($\beta = 0.19$, $p < 0.01$). This confirms H3 and echoes the findings of Chatterjee et al. (2021), suggesting that when educators trust the reliability and purpose of AI tools, they are more willing to integrate them into their practice.

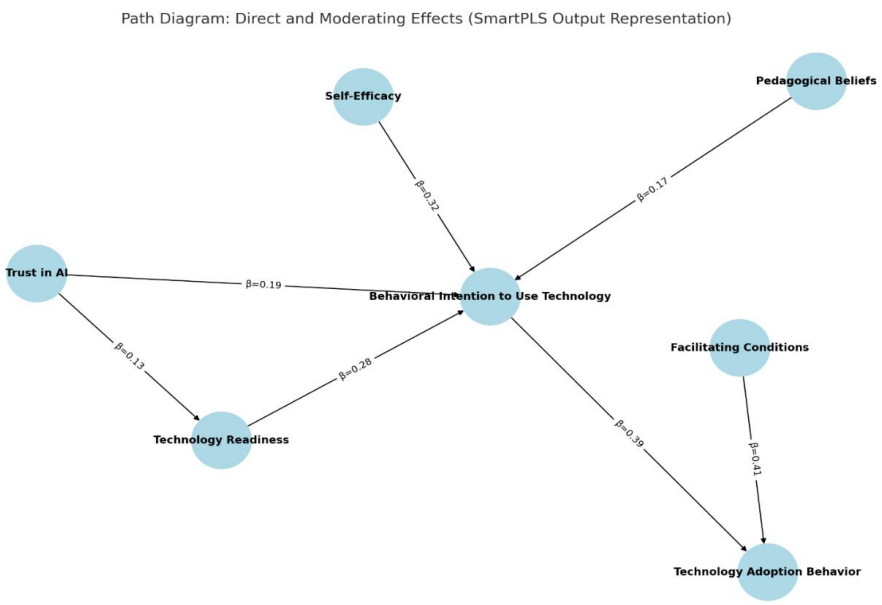

Figure 1: Direct and Indirect Effect of the study

Facilitating Conditions showed the strongest direct influence on actual adoption behavior ($\beta = 0.41$, $p < 0.001$), supporting H4 and reinforcing the UTAUT framework's view that access to resources and organizational support are essential for technology uptake (Venkatesh et al., 2003). Behavioral Intention also had a significant direct effect on adoption ($\beta = 0.39$, $p < 0.001$), confirming H5: educators who plan to use technology are indeed more likely to put it into practice.

Moderating Effects

To examine whether certain factors amplify or weaken these relationships, interaction terms were tested between Pedagogical Beliefs (PB) and Self-Efficacy (SE), as well as between Trust in AI (TAI) and Technology Readiness (TR).

The interaction between PB and SE revealed a meaningful moderating effect on Behavioral Intention ($\beta = 0.17$, $p < 0.05$). This means that self-efficacy has a stronger impact on intention when educators hold constructivist teaching beliefs. This finding supports H6 and aligns with Ertmer and Ottenbreit-Leftwich's (2010) argument that pedagogical beliefs are central to effective technology integration.

Similarly, the interaction between TAI and TR produced a significant moderation effect ($\beta = 0.13$, $p < 0.05$). Educators who both trust AI and feel technologically ready are more likely to express strong intentions to adopt technology. This supports H7 and is consistent with recent research showing that trust can magnify the positive effects of readiness on adoption behaviors (Chatterjee et al., 2021; Wang et al., 2023).

Taken together, these results highlight that educators' technology adoption is shaped not only by their skills and readiness but also by the belief systems and enabling conditions that surround them. The interplay of these factors offers a more nuanced understanding of what drives technology to use in the classroom.

5. DISCUSSION & CONCLUSION

This study sets out to identify the factors that most strongly influence educators' willingness, acceptance, and actual use of educational technology in the classroom. Drawing data from 320 participants and analyzed through structural equation modeling, the research examined both direct and moderating relationships among key constructs: Self-Efficacy (SE), Technology Readiness (TR), Trust in AI (TAI), Facilitating Conditions (FC), Pedagogical Beliefs (PB), Behavioral Intention to Use Technology (BIUT), and Technology Adoption Behavior (TAB). The results provide solid empirical support for the proposed model, offering a clearer picture of the psychological and environmental drivers behind technology adoption in education.

The findings confirmed that Self-Efficacy (H1) significantly predicts educators' intention to use technology ($\beta = 0.32$, $p < 0.001$), reinforcing prior research that confidence in digital skills is a key motivator (Teo, 2011; Bandura, 1997). Technology Readiness (H2) also had a strong, positive effect on intention ($\beta = 0.28$, $p < 0.001$), suggesting that openness to innovation and a sense of technological competence make educators more inclined to integrate digital tools (Parasuraman, 2000; Lin & Hsieh, 2007). Trust in AI (H3) emerged as another significant factor ($\beta = 0.19$, $p < 0.01$), aligning with recent evidence that perceptions of reliability and ethical soundness in AI tools can encourage adoption (Chatterjee et al., 2021; Wang et al., 2023).

Among all predictors, Facilitating Conditions (H4) had the strongest direct effect on actual adoption ($\beta = 0.41$, $p < 0.001$), echoing UTAUT-based findings that institutional support, infrastructure, and access to resources are essential for technology integration (Venkatesh et al., 2003). The intention-behavior link (H5) was also confirmed ($\beta = 0.39$, $p < 0.001$), supporting core TAM and UTAUT assumptions that strong intentions translate into real-world usage (Davis, 1989; Venkatesh et al., 2012).

Two notable moderating effects were observed. First, Pedagogical Beliefs (H6) strengthened the relationship between self-efficacy and intention educators with more constructivist teaching philosophies were more likely to channel their confidence into adopting technology (Ertmer & Ottenbreit-Leftwich, 2010). Second, Trust in AI (H7) amplified the effect of technology readiness on intention, showing that readiness alone is not enough without confidence in the technology's reliability (Chatterjee et al., 2021).

Together, these findings address the study's core research questions. RQ1 and RQ2 on the determinants of intention and adoption are answered by the significant roles of SE, TR, TAI, and FC. RQ3 on moderating mechanisms is addressed through the identified effects of PB and TAI, which refine our understanding of how educators' beliefs and trust shape their adoption patterns.

Overall, the results highlight that successful technology integration depends on a blend of personal factors (like confidence and readiness) and contextual enablers (such as trust and institutional support). For education systems aiming for meaningful digital transformation, this means investing in professional development, building trust in AI-driven tools, and ensuring that new technologies align with educators' pedagogical values.

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