Research Article https://doi.org/10.12973/ijem.11.3.335

International Journal of Educational Methodology
Volume 11, Issue 3, 335 - 347.
ISSN: 2469-9632
http://www.ijem.com/

Bringing AI into Teaching: Understanding Vietnamese Teachers' Perspectives and Pedagogical Challenges

Hien Nguyen Van
Hanoi National University of Education, VIETNAM

Duy Tran Thanh*
Saigon University, VIETNAM

Van Pham Dinh
Ho Chi Minh City University of Education, VIETNAM

Received: March 24, 2025 ▪ Revised: May 13, 2025 ▪ Accepted: June 11, 2025

Abstract: Artificial Intelligence (AI) is reshaping education across the Asia-Pacific, yet its integration depends on teachers' readiness and perspectives. This study explores AI adoption among Vietnamese teachers, a critical lens for the region's digital education reforms, using the Unified Theory of Acceptance and Use of Technology (UTAUT). Through Structural Equation Modeling (SEM) and Latent Dirichlet Allocation (LDA), we analyzed responses from 246 teachers nationwide. Results show attitude strongly predicts adoption intention, with privacy and ethical concerns shaping acceptance, though fears of AI dependence hinder uptake. Uniform challenges across urban-rural and STEM-non-STEM contexts suggest systemic barriers in Vietnam's education system. Teachers foresee AI as a pedagogical assistant but highlight insufficient training and privacy risks as key obstacles. These findings underscore the need for Asia-Pacific-relevant policies—AI literacy programs, ethical governance, and equitable access—to foster sustainable integration. This research informs regional educational policy by offering a Vietnam-centric model for balancing technological innovation with pedagogical integrity, addressing shared challenges in the Asia-Pacific's digital transformation.

Keywords: *AI in education, digital transformation, educational policy, pedagogical challenges, teacher perspectives, UTAUT.*

To cite this article: Van, H. N., Thanh, D. T., & Dinh, V. P. (2025). Bringing AI into teaching: understanding Vietnamese teachers' perspectives and pedagogical challenges. *International Journal of Educational Methodology*, *11*(3), 335-347. https://doi.org/10.12973/ijem.11.3.335

Introduction

Artificial Intelligence (AI) is revolutionizing education worldwide, reshaping both instructional methods and institutional operations. Over the past decade, AI tools such as Intelligent Tutoring Systems (ITS), adaptive learning platforms, automated assessment systems, and AI-powered content generators have emerged as integral supports for educators and learners alike (Khlaif et al., 2024; Ma, 2025). These tools enhance personalized learning, streamline administrative tasks, and promise improved learning outcomes and instructional efficiency.

However, the increasing role of AI in education raises concerns about ethics, equity, and pedagogy. Issues such as algorithmic bias, data privacy, and reduced human agency challenge the assumption that technological advancement equates to educational progress (Ogbo-Gebhardt & Ogbo, 2024; Sharma & Singh, 2024). There is growing debate over whether AI should serve as a tool to support educators or if it risks replacing critical human elements of teaching, such as empathy, contextual judgment, and adaptive instruction (Ballenas & Lasco, 2024).

Vietnam, like many Asia-Pacific nations, is promoting digital transformation in education through national strategies such as the Digital Transformation Program (2025–2030), which includes AI integration as a key objective (Government of Vietnam, 2021). These policies aim to modernize instructional delivery, expand access to quality education, and support teacher training in digital tools. Nevertheless, actual implementation has been uneven. Urban schools are better equipped to adopt AI-based platforms, while rural institutions often lack the infrastructure, training programs, and support mechanisms necessary for successful integration (Duong et al., 2024; Tram, 2024).

* **Corresponding author:**
Duy Tran Thanh, Saigon University, Ho Chi Minh City, Vietnam. ✉ ttduy@sgu.edu.vn

Although the national policy landscape supports AI integration, there is a lack of research exploring how Vietnamese teachers perceive and respond to these technologies. Existing studies tend to focus on technological readiness or student outcomes, but relatively little is known about how teachers—who ultimately enact educational change—experience the pedagogical, technical, and ethical challenges of AI in practice. Understanding their perspectives is crucial, particularly as teachers must balance innovation with responsibility, autonomy, and care.

Teachers are not merely users of technology; they are key agents in determining its pedagogical success or failure. Their perceptions shape not only the adoption of AI tools but also how these tools are used to foster or hinder student learning. Prior research shows that teachers generally recognize AI's value in automating tasks, generating materials, and supporting personalized learning (Zaim et al., 2024). Yet concerns remain about AI's limitations in addressing critical thinking, creativity, and moral education (Li et al., 2023). Moreover, the adoption of AI varies by factors such as digital literacy, subject specialization, and access to resources (Haviz et al., 2024; Spante et al., 2018).

To address this gap, this study investigates the factors influencing AI adoption among Vietnamese teachers using the Unified Theory of Acceptance and Use of Technology (UTAUT) as its theoretical foundation. Originally developed by Venkatesh et al. (2003), UTAUT has been widely applied in educational settings to predict users' behavioral intentions toward new technologies. It includes four core constructs:

- Performance Expectancy (PE): The belief that AI enhances teaching effectiveness,
- Effort Expectancy (EE): The perceived ease of using AI tools,
- Social Influence (SI): The extent to which colleagues and institutions shape usage behavior,
- Facilitating Conditions (FC): The availability of resources, support, and infrastructure.

Recent adaptations of UTAUT have integrated additional constructs that are particularly salient for AI, such as ethical concerns, AI dependence, and algorithmic bias (Hunkenschroer & Luetge, 2022; Rana et al., 2024). In this study, we extend the model by including these dimensions to better reflect the complex realities faced by teachers in AI-enhanced classrooms.

In addition to survey-based modeling, we also incorporate Latent Dirichlet Allocation (LDA) topic modeling to analyze teachers' open-ended responses about their challenges and predictions for AI in education. LDA provides a data-driven lens to identify underlying themes, enriching the understanding of AI adoption beyond structured variables (Blei et al., 2001; Zhang et al., 2023). This mixed-methods design ensures a comprehensive exploration of both the measurable predictors of adoption and the contextual insights that shape teacher behavior.

By combining UTAUT and LDA within a Vietnamese context, this study offers a novel contribution to the emerging discourse on AI in education. It provides actionable insights for policymakers, AI developers, and school leaders seeking to balance innovation with pedagogical integrity, ethical responsibility, and equitable access. Moreover, it situates Vietnam within the broader Asia-Pacific landscape, where systemic challenges and cultural nuances shape the trajectory of AI adoption in teaching and learning.

Methodology

Research Design and Rationale

This study adopts a mixed-methods research design that integrates both quantitative and qualitative approaches to examine teachers' perceptions of AI adoption in education. The rationale for this design lies in the complexity of AI integration, which involves not only measurable attitudes and intentions but also nuanced, context-specific challenges and expectations. Quantitative data allows for statistical validation of hypothesized relationships based on the Unified Theory of Acceptance and Use of Technology (UTAUT), while qualitative data captures emergent concerns that may not be reflected in predefined survey constructs. This design ensures methodological triangulation, offering both breadth and depth in understanding the socio-technical dynamics of AI adoption (Delgado-Rodríguez et al., 2023).

Quantitative Component: UTAUT and Hypothesis Development

The quantitative strand of the study is grounded in the UTAUT framework (Venkatesh et al., 2003), which is frequently used to predict behavioral intention (BI) and actual technology use. This model includes four core constructs:

- Performance expectancy (PE): The belief that AI use will enhance teaching performance.
- Effort expectancy (EE): The perceived ease of using AI tools in instruction.
- Social influence (SI): The degree to which teachers perceive support or expectations from colleagues and institutions.
- Facilitating conditions (FC): The extent to which infrastructure and training are available.

This study extends the model by including additional constructs relevant to AI in education: Attitude toward AI (AT), adoption constraints (AC), privacy concerns (PC), bias & equity concerns (BIAS), AI dependence (DEP), and ethical concerns (EC), all of which reflect deeper socio-pedagogical and ethical dimensions of AI use (Hunkenschroer & Luetge, 2022; Rana et al., 2024).

Nine hypotheses were developed and tested using Structural Equation Modeling (SEM), allowing the evaluation of both direct and indirect pathways among variables. SEM was conducted in R using the 'lavaan' package (Rosseel, 2012) and the Diagonally Weighted Least Squares (DWLS) estimator to accommodate ordinal data and non-normality (Mindrila, 2010). The 'semPlot' package (Epskamp, 2015) was used to visualize SEM models.

Participants and Data Collection

A total of 246 teachers from secondary and tertiary education institutions across Vietnam participated in the study. A stratified random sampling method ensured balanced representation by teaching level (secondary/higher education), subject area (STEM/non-STEM), and geographic location (urban/rural). All participants completed a validated questionnaire and responded to open-ended questions about AI challenges and expectations.

Quantitative Instrument

The structured survey instrument measured the following constructs on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree):

- PE, EE, AT, BI, AC, PC, BIAS, DEP, and EC, as operationalized through multi-item scales adapted from prior research.
- Each item set was tested for internal reliability and construct validity using Cronbach's Alpha, Confirmatory Factor Analysis (CFA), and Composite Reliability.

Qualitative Component: LDA Topic Modeling

To explore deeper insights, the study incorporated LDA, a topic modeling method that extracts latent themes from large text corpora (Blei et al., 2001). Participants responded to two open-ended questions:

1. *What challenges do you foresee in integrating AI into education?*
2. *What are your predictions for the future of AI in education?*

Text responses were pre-processed using R: all words were converted to lowercase, and punctuation, stopwords, and numerical data were removed. Lemmatization was applied to unify word forms. Only key parts of speech (nouns, verbs, adjectives) were retained for modeling. The 'tidytext' package (Silge & Robinson, 2016) managed data preprocessing, 'tm' (Feinerer et al., 2008) and 'SnowballC' (Bouchet-Valat, 2020) supported text cleaning.

Determining Topic Number and Limitations

The optimal number of topics (k = 3) was selected based on coherence scores and perplexity metrics (Mimno et al., 2011). While LDA provides meaningful structure to unstructured text, it has limitations. It does not account for semantic nuance or context beyond word frequency. Furthermore, interpretability of topics relies on subjective labeling, and important emotional or pedagogical subtleties may be missed. These limitations were mitigated by triangulating LDA results with UTAUT-based quantitative findings to form a coherent analytical narrative.

Ethical Considerations

All participants provided informed consent. The study was approved by the ethics committee at Hanoi National University of Education. Participant anonymity and data confidentiality were ensured throughout the research process.

Results

Quantitative Findings

Demographics

To explore differences in AI adoption perceptions across demographic variables, we conducted Kruskal-Wallis and Mann-Whitney U tests on the nine latent constructs derived from the UTAUT and extended model. These included: PE, EE, AT, BI, AC, PC, BIAS, DEP, and EC.(Table 1).

Table 1. Kruskal – Wallis Test Results on Area and Years of Experience across Perceptions of AI

Variable	Area		Year	
	Chi-Square	P-value	Chi-Square	P-value
PE	0.228	0.8923	6.781	0.0792
EE	1.406	0.4952	4.379	0.2233
AT	0.586	0.7459	2.900	0.4073
BI	0.791	0.6735	4.790	0.1879
AC	0.859	0.6507	2.252	0.5217
PC	0.083	0.9592	2.345	0.5039
BIAS	0.291	0.8647	0.595	0.8976
DEP	0.278	0.8701	1.256	0.7396
EC	1.561	0.4582	2.937	0.4014

Results indicated no significant differences across geographical area (urban, suburban, rural), years of teaching experience, or subject specialization (STEM vs. non-STEM) ($p > 0.05$). This suggests a consistent perception of AI-related factors across diverse teacher demographics, emphasizing the systemic nature of barriers and motivators. (**Table 2**)

Table 2. Mann Whitney U Test Results for STEM vs. Non-STEM Groups

Variable	W Statistic	P-value	Lower CI	Upper CI
PE	6,849.0	0.4567	-0.385	0.171
EE	7,171.0	0.8819	-0.329	0.230
AT	7,229.5	0.9674	-0.318	0.260
BI	7,378.0	0.8156	-0.242	0.304
AC	7,350.5	0.8566	-0.291	0.315
PC	7,063.5	0.7270	-0.335	0.217
BIAS	6,642.0	0.2568	-0.437	0.120
DEP	6,899.5	0.5112	-0.416	0.189
EC	6,699.0	0.3029	-0.450	0.128

Reliability Analysis (Cronbach's Alpha) and Construct Validity (CFA)

All constructs showed strong internal reliability, with Cronbach's alpha values ranging from 0.79 to 0.91 and composite reliability (CR) scores exceeding the 0.70 threshold (Table 3).

Table 3. Cronbach's Alpha and Composite Reliability (CR)

Construct	Items	Cronbach's Alpha (α)	Composite Reliability (CR)
PE	4	.89	.92
EE	4	.86	.90
AT	3	.88	.91
BI	3	.91	.94
AC	3	.80	.85
PC	3	.83	.87
BIAS	3	.81	.86
DEP	2	.79	.84
EC	2	.82	.87

CFA supported convergent validity, with all factor loadings above 0.70 and Average Variance Extracted (AVE) values exceeding 0.50. Model fit indices met recommended cutoffs (CFI = 0.926; TLI = 0.912; RMSEA = 0.031; SRMR = 0.031), validating the measurement model (Table 4).

Table 4. Factor Loadings and Average Variance Extracted (AVE)

Construct	Item	Factor Loading	AVE
PE	PE1	.92	.73
	PE2	.89	
	PE3	.85	
	PE4	.86	
EE	EE1	.88	.70
	EE2	.84	
	EE3	.82	
	EE4	.80	
AT	AT1	.91	.76
	AT2	.87	
	AT3	.89	

Structural Equation Model (SEM) and Hypothesis Testing

In the structural model, AT emerged as the strongest predictor of BI (β = 1.023, $p < .001$). Interestingly, traditional UTAUT predictors such as PE (PE → BI; $p = .112$) and EE (EE → BI; $p = .098$) were not statistically significant (Table 5).

Table 5. Structural Model Path Coefficients

Hypothesis	Relationship	Estimate (β)	Std. Error	*p*-value	Supported
H1	PE → BI	0.120	0.076	.112	No
H2	EE → BI	-0.310	0.187	.098	No
H3	AT → BI	1.023	0.154	<.001	Yes
H4	PC → BI	0.136	0.061	.026	Yes
H5	AC → BI	-0.079	0.057	.166	No
H6	BIAS → BI	-0.048	0.064	.455	No
H7	DEP → BI	-0.136	0.061	.026	Yes
H8	EC → BI	0.156	0.077	.045	Yes
H9	BI → UB	0.188	0.063	.003	Yes

Model Fit Statistics

The evaluation of model fit indices confirmed that the measurement model adequately represented the data (Figure 1). The Comparative Fit Index (CFI) was reported at 0.926, exceeding the commonly accepted threshold of 0.90, indicating a good fit between the hypothesized model and the observed data. Similarly, the Tucker-Lewis Index (TLI) yielded a value of 0.912, further supporting the model's validity.

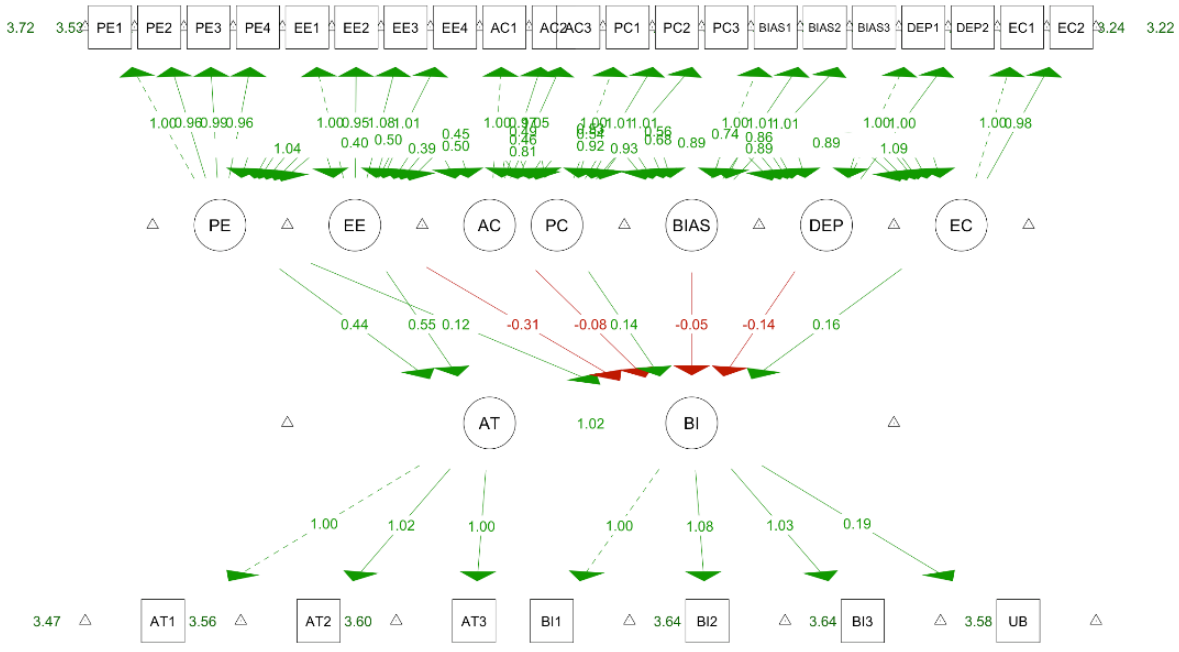

Figure 1. SEM Plot of Teachers' Perspective on AI Usage

In terms of absolute fit indices, the Root Mean Square Error of Approximation (RMSEA) was 0.031, well below the acceptable threshold of 0.08, suggesting a close fit of the model to the data with minimal error. Additionally, the Standardized Root Mean Square Residual (SRMR) was 0.031, further confirming that the model effectively captured the relationships among the observed and latent variables.

These fit statistics collectively demonstrate that the proposed model provides a robust representation of AI adoption factors among teachers, validating the constructs used in the analysis and ensuring the reliability of the SEM results.

- AT had the strongest impact on BI ($\beta = 1.023$, $p < .001$), confirming that teachers' positive attitudes drive AI adoption.
- PC and EC positively influenced BI, suggesting that ethical awareness encourages adoption.
- DEP negatively affected BI, indicating that concerns about over-reliance on AI discourage adoption.
- BI significantly influences actual AI usage behavior among teachers, reinforcing that teachers who express a higher intention to adopt AI are more likely to integrate AI tools into their teaching practices.

The SEM results further demonstrated that AT was the strongest predictor of teachers' behavioral intentions to adopt AI, indicating that educators who perceived AI as beneficial and aligned with their teaching practices were significantly more likely to integrate AI technologies into their classrooms.

Beyond attitudinal factors, concerns related to privacy (PC) and ethics (EC) were found to have a positive effect on AI adoption, suggesting that teachers who were aware of data security and ethical considerations tended to engage more critically with AI and sought ways to implement it responsibly. However, the perception of DEP negatively influenced adoption, with teachers expressing apprehensions that excessive reliance on AI tools might undermine traditional pedagogical roles and student engagement in learning processes.

Qualitative findings

Qualitative Analysis (LDA Topic Modeling)

LDA was applied to Challenges and Predictions (k = 3 topics each), revealing key themes (Table 6). The qualitative analysis, conducted using LDA topic modeling, identified key challenges associated with AI adoption. Teachers frequently cited a lack of AI training programs, data privacy concerns, and fears that AI could diminish the role of educators in the classroom. These findings highlight the necessity of comprehensive teacher training initiatives and ethical AI governance to support responsible adoption. Conversely, the predictions extracted from LDA revealed optimism about AI's role as an instructional assistant, its potential to facilitate personalized learning experiences, and the expectation that regulatory measures will ensure ethical AI deployment in education.

Table 6. Challenges and Prediction in AI Adoption

Topic	Theme	Description	Top Words
Challenges topic 1	Lack of AI Training & Support	Teachers struggle with limited training resources.	*limitations, teachers, teaching, support, advantage*
Challenges topic 2	Privacy & Ethical Concerns	Data security and bias issues raise adoption barriers.	*security, dependent, knowledge, advantage, information*
Challenges topic 3	AI vs. Teacher Role	Fear of AI replacing teachers and reducing pedagogical control.	*students, comments, will, thinking, available*
Prediction topic 1	AI as a Teaching Assistant	AI expected to assist in grading and administration.	*teaching, teachers, develop, education*
Prediction topic 2	Personalized Learning	AI-driven adaptive education for student needs.	*support, students, learning, trend, future*
Prediction topic 3	Need for Ethical AI Policies	Calls for regulatory oversight and bias reduction.	*develop, regulations, fairness, and transparency*

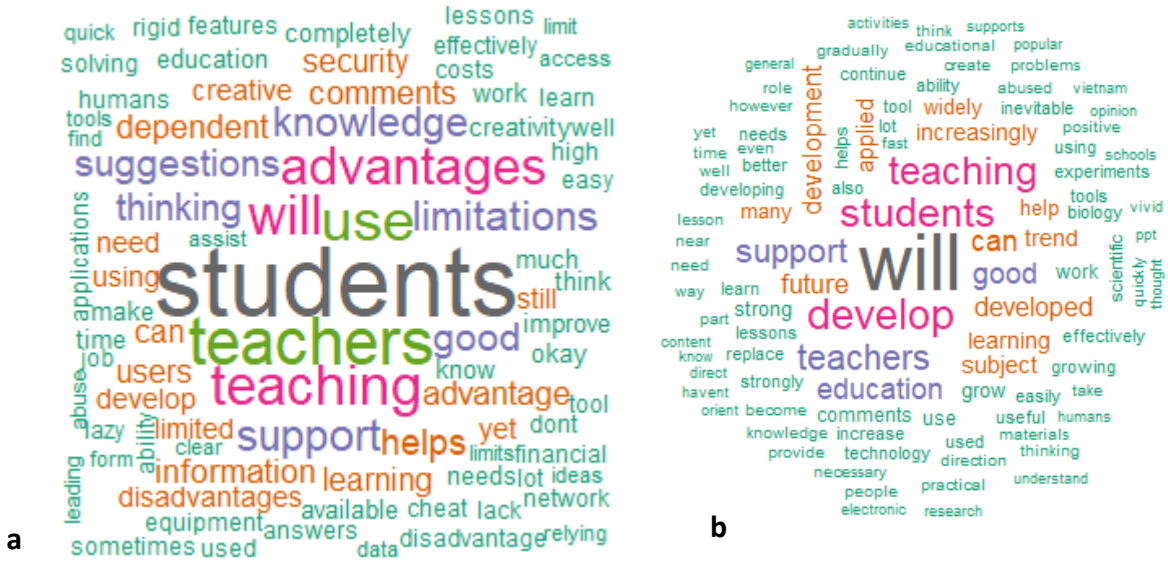

Figure 1. Word Cloud of Challenges and Prediction: (a) Teacher's Comments on Challenges, (b) Predictions of Teachers on AI in Education

Word Cloud Insights on Challenges and Predictions

The word clouds illustrate the most frequently used words in teachers' responses regarding AI adoption. In the Challenges responses, key terms such as *students, teachers, limitations, support, knowledge, security,* and *thinking* dominate, indicating major concerns around technical difficulties, ethical implications, and AI integration in education. The Predictions word cloud highlights terms such as *develop, will, teaching, education, students, support, future*, suggesting an optimistic outlook on AI's role in educational enhancement, personalized learning, and professional development for teachers (Figure 2).

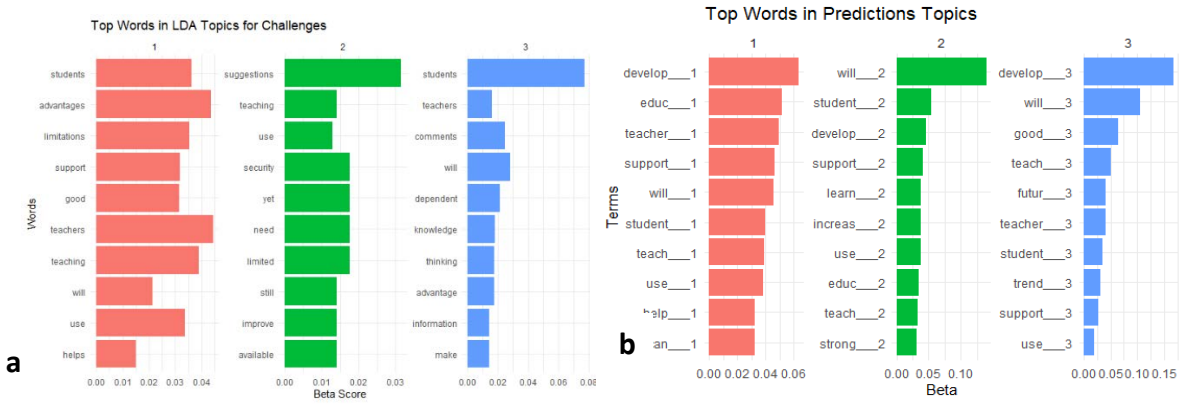

Figure 2: Topic Models of Challenges and Predictions: (a) Challenges Theme and (b) Predictions Theme

LDA Topic Modeling Analysis for Challenges

The three major themes identified through LDA for *Challenges* are: (1) *Technical and Pedagogical Barriers:* Words like *limitations, teachers, teaching, support, and advantages* indicate that teachers face difficulties in integrating AI due to lack of training, limited infrastructure, and uncertainty about AI's role in lesson planning; (2) *Ethical and Privacy Concerns:* The presence of *security, dependent, knowledge, advantage, and information* in one topic suggests concerns over AI data privacy, algorithm bias, and dependence on AI in assessment; (3) *Skepticism and Resistance to AI Adoption*: Words like *students, comments, will, thinking, and available* indicate doubts about AI's ability to replace or complement teachers' roles in education (Figure 3).

LDA Topic Modeling Analysis for Predictions

The Predictions LDA topics indicate three major expectations: (1) *AI as a Pedagogical Assistant*: The presence of *teaching, teachers, develop, and education* suggests that AI is expected to support rather than replace educators; (2) *Expansion of Personalized Learning*: Keywords such as *support, students, learning, trend,* and *future* imply expectations of adaptive AI-

driven educational content to support student engagement; (3) *AI Governance and Ethical Implementation*: Words like *develop, regulations, fairness, and transparency* suggest that teachers predict the need for AI policies and regulatory frameworks to ensure equitable AI usage.

These findings underscore the intricate balance between the perceived advantages and challenges associated with AI adoption in educational contexts. While educators acknowledge AI's capacity to enhance instructional efficiency and foster personalized student learning experiences, persistent concerns surrounding data privacy, ethical considerations, and the risks of over-reliance on AI-driven automation continue to pose significant barriers to widespread adoption. To facilitate a more sustainable and pedagogically sound integration of AI in education, it is imperative to implement comprehensive policy frameworks, strengthen institutional support mechanisms, and develop targeted professional development initiatives that equip educators with the necessary competencies to effectively leverage AI while maintaining pedagogical autonomy and ethical oversight.

Integrated Interpretation

The convergence of SEM and LDA findings highlights that attitudinal and ethical dimensions dominate Vietnamese teachers' AI adoption landscape. The fact that Performance Expectancy and Effort Expectancy did not significantly predict Behavioral Intention suggests that macro-level infrastructural and policy barriers may overshadow these individual-level factors. Furthermore, both quantitative and qualitative analyses reflect teachers' nuanced stance: cautiously optimistic yet ethically vigilant.

Discussion

Homogeneity in Teachers' Perceptions of AI Adoption Across Demographic Groups

The statistical analysis using Kruskal-Wallis and Mann-Whitney U tests aimed to examine whether teachers' perceptions of AI adoption varied by Area (Urban, Suburban, Rural), Subject Group (STEM and Non-STEM), and Years of Experience. The results indicated no significant differences ($p > .05$) across all latent variables—including PE, EE, AT, BI, AC, PC, BIAS, DEP, and EC. These findings suggest that teachers, regardless of their geographical location, subject expertise, or experience, share similar perceptions of AI adoption. The lack of statistical differences implies that concerns related to ethical AI use, privacy, and AI's role in education are widespread and not confined to specific teacher demographics. Moreover, the absence of significant variation highlights system-wide challenges in AI adoption rather than disparities between teacher groups.

Given that these results do not provide critical distinctions in this study, further analyses will focus on SEM and topic modeling (LDA), which offer deeper insights into the key determinants of AI adoption and teachers' perceptions of AI's future role in education.

AI Adoption in Education: The Vietnamese Context

Vietnam has seen rapid digital transformation efforts in education, aligning with national strategies promoting AI and technology integration (Maheshwari, 2024). The Vietnamese government has actively encouraged the adoption of AI-driven tools in teaching and learning, particularly in response to the digitalization push following the COVID-19 pandemic. AI-powered platforms have been deployed for classroom management, adaptive learning, and student engagement, yet concerns remain about their implementation and ethical implications (A. H. D. Nguyen et al., 2024).

The SEM results reveal that PE and EE positively influence AT towards AI adoption. This aligns with previous studies indicating that teachers are more likely to embrace AI if they perceive it as beneficial for teaching efficiency and student learning outcomes (Kim et al., 2020). However, our findings suggest that PE does not have a direct significant impact on BI, implying that even if AI is perceived as useful, other moderating factors may influence adoption behavior. Furthermore, the findings highlight that PE and EE significantly shape teachers' AT, reinforcing the notion that AI is perceived as beneficial when it enhances teaching efficiency and learning outcomes (Bergdahl & Sjöberg, 2025; Velli & Zafiropoulos, 2024).

The significant relationship between BI and UB suggests that fostering positive attitudes and confidence in AI technology will directly impact actual AI usage in classrooms. This implies that while external challenges such as privacy concerns, AI dependence, and bias were notable barriers, teachers who perceive AI as beneficial (high BI) are still likely to use it despite these concerns. This aligns with prior studies indicating that strong behavioral intention predicts the actual adoption of educational technologies (Venkatesh et al., 2012).

Challenges in AI Integration: Teachers' Concerns and Barriers

The LDA results for Challenges reveal three dominant themes: Technical Limitations, Pedagogical Challenges, and Ethical & Privacy Concerns. These themes reflect the broader discussions on AI adoption challenges in Vietnam.

Technical Limitations:

Teachers frequently cited issues such as inadequate infrastructure, lack of reliable AI training, and technical glitches as barriers. Despite government efforts, AI technology remains inconsistent across different educational institutions, with urban schools having more access to AI tools compared to rural ones (Le et al., 2024). This finding is consistent with previous studies highlighting Vietnam's digital divide in AI access (Duong et al., 2024).

Pedagogical Challenges:

Many educators expressed concerns about AI replacing essential teaching functions rather than complementing them. The DEP factor in SEM negatively influenced BI, indicating that excessive reliance on AI may diminish traditional teaching effectiveness. Similar concerns have been raised in international literature, where teachers fear AI-driven automation might reduce personalized student interactions (A. H. D. Nguyen et al., 2024). Furthermore, the study finds that DEP negatively correlates with BI, as over-reliance on AI is viewed as a threat to the teacher-student relationship and traditional pedagogical engagement (Delello et al., 2025; Roberts, 2024).

Ethical & Privacy Concerns:

The SEM results show that PC and EC significantly impact BI, reinforcing that data security and algorithmic fairness are crucial to AI acceptance. Vietnamese teachers are particularly skeptical about AI collecting and processing student data, an issue also emphasized in global debates on AI ethics in education (A. Nguyen et al., 2023). Teachers' concerns about PC and EC emerged as major inhibitors of AI adoption, reflecting broader apprehensions about data security, algorithmic bias, and the perceived erosion of pedagogical control (Abadie et al., 2024; Niemi, 2024; Tram, 2024).

Predicting Future AI Adoption Trends in Vietnamese Education

The LDA analysis of Predictions identified three key themes: AI as a Pedagogical Assistant, the Future of Automated Learning, and Policy-driven AI Implementation.

AI as a Pedagogical Assistant:

The qualitative findings from LDA topic modeling further substantiate these concerns, revealing that teachers primarily view AI adoption through three critical lenses: technical and pedagogical limitations, ethical and privacy issues, and fears of professional displacement. However, teachers also predict that AI will function as a pedagogical assistant rather than a replacement, emphasizing the necessity of policy-driven, ethically regulated AI integration in education.

Future of Automated Learning:

While automation is expected to streamline education, concerns about over-reliance persist. This resonates with our SEM findings where DEP negatively correlates with BI, emphasizing the need for balanced AI integration.

Policy-driven AI Implementation:

The Vietnamese government has initiated AI-driven education reforms, yet policy inconsistencies remain a challenge. A recent report highlights the need for regulatory frameworks ensuring AI deployment aligns with ethical considerations and pedagogical best practices (Tram, 2024). Our research reinforces this by demonstrating that teachers' concerns about bias and ethics significantly shape their AI adoption behavior.

The Role of UTAUT in Understanding AI Adoption in Vietnam

UTAUT has proven to be an effective framework for understanding AI adoption among Vietnamese teachers. The model confirms that PE, EE, and AT significantly shape AI adoption intentions, yet other contextual factors, such as ethical concerns and policy regulations, exert a strong influence. Our study expands UTAUT by incorporating AI-specific constraints, such as BIAS and DEP, which are often overlooked in traditional technology adoption models.

Given these findings, several policy recommendations emerge:

- Targeted AI Training Programs for Educators: Addressing EE is crucial. Professional development programs should equip teachers with AI competencies to reduce perceived difficulty in AI integration. Providing hands-on AI training to increase familiarity and perceived ease of use.

- Regulatory Frameworks for AI Ethics in Education: Governments must enforce data privacy laws and ethical AI policies to alleviate teacher concerns regarding AI-driven surveillance and bias in assessment systems.
- Infrastructure Development for Equitable AI Access: The digital divide must be addressed through government investments in AI-friendly infrastructure, particularly in rural schools.
- Teacher-AI Collaboration Frameworks: AI should be positioned as a pedagogical support system rather than a replacement. This involves designing AI solutions that complement rather than undermine teachers' roles.

Furthermore, the findings suggest that policy interventions should prioritize addressing AI skepticism, ensuring transparent AI data usage, and offering professional development programs that enhance teachers' confidence in utilizing AI tools. This study also raises important implications for AI developers and educational institutions, emphasizing the need to design AI-driven teaching tools that are pedagogically meaningful, ethically sound, and adaptable to diverse educational contexts.

Conclusion

This study advances a multidimensional understanding of how Vietnamese educators perceive and respond to the integration of artificial intelligence (AI) into instructional practice. By combining SEM and LDA, the research captures both the structural determinants of adoption and the nuanced concerns expressed by teachers themselves. Contrary to assumptions that demographic factors such as location, discipline, or teaching tenure would shape differing perceptions, the findings reveal a notable convergence. This suggests that systemic factors—rather than individual variation—play a more decisive role in shaping AI-related attitudes across the national education context.

The SEM results confirm the influence of PE and EE in shaping AT. However, the lack of a direct path from PE to BI indicates that recognizing AI's benefits does not necessarily lead to intention to adopt. This behavioral gap appears mediated by sociotechnical concerns, such as ethical apprehensions, trust in algorithmic processes, and fear of overdependence. Constructs such as DEP and BIAS extend the explanatory scope of existing adoption models by foregrounding the ethical and cultural dimensions of technological change in education.

Complementing these findings, the LDA analysis reveals grounded concerns across three principal domains: technical limitations in infrastructure and professional readiness; pedagogical anxieties over the erosion of teacher agency and relational dynamics; and ethical and privacy considerations related to data governance, fairness, and institutional trust. These themes highlight that resistance to AI adoption is not rooted in unfamiliarity or technological pessimism, but rather in critical reflection shaped by pedagogical values and systemic limitations.

The findings of this research advance the literature through three principal contributions:

1. *Model Extension* – It broadens the UTAUT framework by incorporating AI-specific inhibitors such as DEP, BIAS, and EC, dimensions frequently absent in traditional technology adoption research.
2. *Methodological Integration* – It demonstrates the analytical power of integrating SEM and LDA to triangulate quantitative patterns with contextualized, topic-level discourse.
3. *Contextual Contribution* – It provides rare empirical insight into the Vietnamese educational context, bridging a gap in global discussions on AI adoption in developing education systems.

The implications of these findings are substantial. Professional development programs must be redesigned to include not only operational competencies but also critical ethical literacy and reflective inquiry into AI's role in pedagogy. National education strategies should prioritize equitable infrastructure investment and enforceable data protection frameworks. Moreover, AI developers and ed-tech platforms must engage teachers as co-creators of pedagogically aligned, ethically sound technologies that support rather than supplant human teaching.

In conclusion, AI integration in education must be approached as a systemic endeavor that balances innovation with ethical responsibility. The success of Vietnam's national AI ambitions in education will depend not only on technological readiness but also on how well AI solutions resonate with the lived realities, values, and professional identities of its educators.

Ethics Statements

This study was conducted in adherence to ethical research standards, ensuring voluntary participation, confidentiality, and informed consent. Participants were teachers across Vietnam, who voluntarily responded to the survey regarding AI adoption in education. Prior to participation, all respondents were informed about the purpose, scope, and intended use of the research data. They were assured that their responses would remain anonymous and confidential, with no personally identifiable information collected or disclosed.

As this study was based on survey distribution with volunteer participation, no intervention or experimental manipulation was involved. Participation was entirely optional, and respondents retained the right to withdraw at any

stage without any consequences. The study complied with ethical research guidelines as outlined by the Hanoi National University of Education.

By submitting their responses, participants explicitly consented to the use of their anonymized data for academic research purposes. The findings derived from this study aim to contribute to the understanding of AI integration in education and inform policy and pedagogical strategies.

Acknowledgment

This research would not have been possible without the generous participation and insights provided by teachers across Vietnam. We extend our deepest gratitude to the educators who took the time to share their perspectives, experiences, and concerns regarding the integration of artificial intelligence in education. Your willingness to engage in this study has provided invaluable contributions to understanding the evolving role of AI in teaching and learning.

We also wish to express our appreciation to the schools and educational institutions that facilitated this research by encouraging teacher participation. Your support enabled us to gather diverse viewpoints that reflect the realities of AI adoption across different teaching contexts, from urban centers to rural communities.

A special thank you is extended to the policymakers and educational technology experts who provided critical insights into the broader landscape of AI implementation in Vietnam. Your guidance has helped us contextualize the findings within national educational policies and global technological trends.

Finally, we acknowledge the support of our academic institutions and research collaborators for their continuous encouragement and resources that made this study possible. This research is dedicated to the hardworking educators who strive every day to shape the future of education, navigating the challenges and opportunities that AI presents. Your dedication to teaching, innovation, and student success remains the foundation of educational progress in Vietnam.

Conflict of Interest

The authors have no relevant financial or non-financial interests to disclose. All authors certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript. On behalf of all authors, the corresponding author states that there is no conflict of interest.

Funding

The authors did not receive support from any organization for the submitted work. No funding was received to assist with the preparation of this manuscript. No funding was received for conducting this study.

Generative AI Statement

As the author(s) of this work, we used the AI tool [Grok by xAI and ChatGPT] for the purpose of assisting with language editing, coding assisting, and initial drafting of sections. After using this AI tool, we reviewed and verified the final version of our work. We, as the author(s), take full responsibility for the content of our published work.

Authorship Contribution Statement

Van: conceptualized the study, formulated the research objectives, and developed the overall research design. He was responsible for creating the survey questionnaire, establishing the research protocol, and conducting the theoretical analysis. Additionally, Van played a crucial role in interpreting the study's findings, particularly in the context of AI adoption among teachers, and provided policy recommendations based on the results. Thanh: designed the mixed-methods framework for the study, ensuring the integration of quantitative and qualitative approaches. He was responsible for collecting both qualitative and quantitative data, conducting the thematic analysis of qualitative responses, and performing statistical analysis using R. Moreover, Duy Tran Thanh synthesized findings from multiple data sources, providing a comprehensive interpretation of the results to strengthen the study's conclusions. Dinh: played a pivotal role in the design of the questionnaire, ensuring that the survey accurately captured the perceptions and challenges of AI adoption among educators. Additionally, he was actively involved in the distribution of the survey, facilitating broad participation across different educational contexts in Vietnam. Beyond data collection, Dinh contributed significantly to data analysis, assisting in the interpretation of quantitative (SEM) and qualitative (LDA) results. He was also engaged in the discussion of data collection processes, providing critical insights into the methodological framework and ensuring the reliability and validity of the gathered responses. The first draft of the manuscript was jointly written by Van, Thanh, and Dinh. All authors (Van, Thanh, and Dinh) contributed to revising and editing the manuscript and provided approval for the final version. All authors agree to be accountable for all aspects of the work.

References

Abadie, A., Chowdhury, S., & Mangla, S. K. (2024). A shared journey: Experiential perspective and empirical evidence of virtual social robot ChatGPT's priori acceptance. *Technological Forecasting and Social Change*, *201*, Article 123202. https://doi.org/10.1016/j.techfore.2023.123202

Ballenas, E. B., & Lasco, M. T. (2024). Exploring mathematics teachers' behavioral intentions to use artificial intelligence through structural equation modeling. *2024 International Conference on TVET Excellence and Development (ICTeD)* (pp. 195-200). https://doi.org/10.1109/ICTeD62334.2024.10844599

Bergdahl, N., & Sjöberg, J. (2025). Attitudes, perceptions and AI self-efficacy in K-12 education. *Computers and Education: Artificial Intelligence*, *8*, Article 100358. https://doi.org/10.1016/j.caeai.2024.100358

Blei, D. M., Ng, A. Y., & Jordan, M. I. (2001). Latent Dirichlet Allocation. In T. Dietterich, S. Becker, & Z. Ghahramani (Eds.), *Advances in Neural Information Processing Systems* (Vol. 14). MIT Press. http://bit.ly/4l1WVN5

Bouchet-Valat, M. (2020). *SnowballC (version 0.7.0).* [Computer software]. http://bit.ly/3GeIKW3

Delello, J. A., Sung, W., Mokhtari, K., Hebert, J., Bronson, A., & De Giuseppe, T. (2025). AI in the classroom: Insights from educators on usage, challenges, and mental health. *Education Sciences*, *15*(2), Article 113. https://doi.org/10.3390/educsci15020113

Delgado-Rodríguez, S., Domínguez, S. C., & Garcia-Fandino, R. (2023). Design, development and validation of an educational methodology using immersive augmented reality for STEAM education. *Journal of New Approaches in Educational Research*, *12*, 19-39. https://doi.org/10.7821/naer.2023.1.1250

Duong, N. T., Pham, T. D. T., & Pham, V. K. (2024). A Comparative Study on AI-Based Learning Behaviors: Evidence from Vietnam. *International Journal of Human–Computer Interaction.* Advance online publication. https://doi.org/10.1080/10447318.2024.2430433

Epskamp, S. (2015). semPlot: Unified visualizations of structural equation models. *Structural Equation Modeling: A Multidisciplinary Journal*, *22*(3), 474–483. https://doi.org/10.1080/10705511.2014.937847

Feinerer, I., Hornik, K., & Meyer, D. (2008). Text mining infrastructure in R. *Journal of Statistical Software*, *25*(5), 1–54. https://doi.org/10.18637/jss.v025.i05

Government of Vietnam. (2021). *Quyết định số 2222/QĐ-TTg: Phê duyệt chương trình chuyển đổi số giáo dục nghề nghiệp đến năm 2025, định hướng đến năm 2030* [Decision No. 2222/QĐ-TTg: Approving digital transformation program in vocational education until 2025 and orientation until 203*0*]. Prime Minister's Office. https://chinhphu.vn/?pageid=27160&docid=204888&type=1&tagid=7

Haviz, M., Maris, I. M., Azis, D., & Helmita, R. (2024). An investigation into science motivation, technology acceptance, and satisfaction intention during the transition to E-learning of prospective biology teachers. *Cogent Education*, *11*(1), Article 2393065. https://doi.org/10.1080/2331186X.2024.2393065

Hunkenschroer, A. L., & Luetge, C. (2022). Ethics of AI-Enabled recruiting and selection: A review and research agenda. *Journal of Business Ethics*, *178*, 977-1007. https://doi.org/10.1007/s10551-022-05049-6

Khlaif, Z. N., Ayyoub, A., Hamamra, B., Bensalem, E., Mitwally, M. A. A., Ayyoub, A., Hattab, M. K., & Shadid, F. (2024). university teachers' views on the adoption and integration of generative AI tools for student assessment in higher Education. *Education Sciences*, *14*(10), Article 1090. https://doi.org/10.3390/educsci14101090

Kim, J., Merrill, K., Xu, K., & Sellnow, D. D. (2020). My teacher is a machine: Understanding students' perceptions of AI teaching assistants in online education. *International Journal of Human–Computer Interaction*, *36*(20), 1902-1911. https://doi.org/10.1080/10447318.2020.1801227

Le, K. C., Tran, T. B. K., Nguyen, M. H., & Luu, H. D. (2024). Digital transformation in the education sector in Vietnam. In T. L. Nguyen, A. T. Nguyen, E. Ślęzak-Belowska, & M. Salamaga (Eds.), *Economic and Political Aspects of EU-Asian Relations* (pp. 359-366). Springer. https://doi.org/10.1007/978-981-99-8945-4_22

Li, Q., Liu, Q., & Chen, Y. (2023). Prospective teachers' acceptance of virtual reality technology: A mixed study in rural China. *Education and Information Technologies*, *28*, 3217-3248. https://doi.org/10.1007/s10639-022-11219-w

Ma, T. (2025). Systematically visualizing ChatGPT used in higher education: Publication trend, disciplinary domains, research themes, adoption and acceptance. *Computers and Education: Artificial Intelligence*, *8*, Article 100336. https://doi.org/10.1016/j.caeai.2024.100336

Maheshwari, G. (2024). Factors influencing students' intention to adopt and use ChatGPT in higher education: A study in the Vietnamese context. *Education and Information Technologies*, *29*, 12167-12195. https://doi.org/10.1007/s10639-023-12333-z

Mimno, D., Wallach, H. M., Talley, E., Leenders, M., & McCallum, A. (2011). Optimizing semantic coherence in topic models. *Proceedings of the Conference on Empirical Methods in Natural Language Processing*, 262-272. https://aclanthology.org/D11-1024/

Mindrila, D. (2010). Maximum likelihood (ML) and diagonally weighted least squares (DWLS) estimation procedures: A comparison of estimation bias with ordinal and multivariate non-normal data. *International Journal of Digital Society*, *1*(1), 60-66. https://doi.org/10.20533/ijds.2040.2570.2010.0010

Nguyen, A. H. D., Le, T. T., Dang, T.-Q., & Nguyen, L.-T. (2024). Understanding metaverse adoption in education: The extended UTAUMT model. *Heliyon*, *10*(19), Article e38741. https://doi.org/10.1016/j.heliyon.2024.e38741

Nguyen, A., Ngo, H. N., Hong, Y., Dang, B., & Nguyen, B.-P. T. (2023). Ethical principles for artificial intelligence in education. *Education and Information Technologies*, *28*, 4221-4241. https://doi.org/10.1007/s10639-022-11316-w

Niemi, H. (2024). AI in education and learning: Perspectives on the education ecosystem. In M. Streit-Bianchi, & V. Gorini (Eds.), *New Frontiers in Science in the Era of AI* (pp. 169-194). Springer. https://doi.org/10.1007/978-3-031-61187-2_11

Ogbo-Gebhardt, E., & Ogbo, O. (2024). Using a Large Language Model-Powered Assistant in Teaching: Stories of Acceptance, Use, and Impact among Ethnic Minority Students. *24th Biennial Conference of the International Telecommunications Society.* Econstor. https://hdl.handle.net/10419/302517

Rana, M. M., Siddiqee, M. S., Sakib, M. N., & Ahamed, M. R. (2024). Assessing AI adoption in developing country academia: A trust and privacy-augmented UTAUT framework. *Heliyon*, *10*(18), Article e37569. https://doi.org/10.1016/j.heliyon.2024.e37569

Roberts, C. B. (2024). *Examining high school teacher perspectives on the use of ChatGPT for teaching and learning* [Doctoral dissertation, Youngstown State University]. OhioLINK. https://bit.ly/4lvXrD6

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*(2), 1-36. http://www.jstatsoft.org/v48/i02/

Sharma, S., & Singh, G. (2024). Adoption of artificial intelligence in higher education: An empirical study of the UTAUT model in Indian universities. *International Journal of System Assurance Engineering and Management*. Advance online publication. https://doi.org/10.1007/s13198-024-02558-7

Silge, J., & Robinson, D. (2016). tidytext: Text mining and analysis using tidy data principles in R. *Journal of Open Source Software*, *1*(3), Article 37. https://doi.org/10.21105/joss.00037

Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education*, *5*(1), Article 1519143. https://doi.org/10.1080/2331186X.2018.1519143

Tram, N. H. M. (2024). Unveiling the drivers of AI integration among language teachers: Integrating UTAUT and AI-TPACK. *Computers in the Schools*, *42*(2), 100-120. https://doi.org/10.1080/07380569.2024.2441155

Velli, K., & Zafiropoulos, K. (2024). Factors that affect the acceptance of educational AI tools by Greek teachers-A structural equation modelling study. *European Journal of Investigation in Health, Psychology and Education*, *14*(9), 2560-2579. https://doi.org/10.3390/ejihpe14090169

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425-478. https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, *36*(1), 157-178. https://doi.org/10.2307/41410412

Zaim, M., Arsyad, S., Waluyo, B., Ardi, H., Al Hafizh, M., Zakiyah, M., Syafitri, W., Nusi, A., & Hardiah, M. (2024). AI-powered EFL pedagogy: Integrating generative AI into university teaching preparation through UTAUT and activity theory. *Computers and Education: Artificial Intelligence*, *7*, Article 100335. https://doi.org/10.1016/j.caeai.2024.100335

Zhang, C., Schießl, J., Plößl, L., Hofmann, F., & Gläser-Zikuda, M. (2023). Acceptance of artificial intelligence among pre-service teachers: A multigroup analysis. *International Journal of Educational Technology in Higher Education*, *20*(1), Article 49. https://doi.org/10.1186/s41239-023-00420-7