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A Study on Teachers' Acceptance of Digital Technology in Vietnamese Secondary Education: An Assessment Using the Technology Acceptance Model

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Abstract. This study investigates factors influencing digital technology adoption among lower secondary school teachers in Vietnam, a key element of the country's educational digital transformation. Despite investments in digital infrastructure, successful integration hinges on teachers' effective use of these tools. This research addresses the gap in understanding teacher technology acceptance, as existing literature, often relying on the Technology Acceptance Model (TAM), frequently overlooks the influence of psychological and social factors crucial in developing educational systems. Extending the TAM, this study explores these factors within the Vietnamese context. A stratified sample of 364 teachers across diverse regions (North, Central, and South Vietnam) and subject areas (Mathematics, Natural Sciences and Social Sciences) was surveyed online using Google Forms. The instrument, based on the extended TAM, measured perceived usefulness, perceived ease of use, attitude toward innovation, fear of job displacement, peer support and school policies. Data analysis, using SPSS software, employed descriptive

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statistics, correlation and regression analysis to determine the relative importance of each factor in predicting technology adoption. Findings reveal that beyond perceived usefulness and ease of use, psychological factors (e.g., concerns about competence, age, habits) and social factors (e.g., technological advancements, complexity, community support) significantly influence teacher decisions. These results offer valuable insights for policymakers and educational leaders promoting effective digital integration. The study concludes with recommendations for targeted teacher training, supportive policies and strategies to mitigate technology-related anxieties, contributing to successful digital transformation in Vietnamese education.

Keywords: digital technology; secondary education; technology acceptance model

1. Introduction

The Technology Acceptance Model (TAM), developed by Fred D. Davis in 1989, rooted in the Theory of Reasoned Action (Davis, 1989), is a cornerstone in understanding technology adoption (Davis, 1989). As one of the most widely used theories in this domain, TAM elucidates the factors driving user adoption and utilization of new technologies (Grover et al., 2019). Its enduring relevance is evidenced by numerous extensions and applications across diverse fields, solidifying its theoretical foundation for examining human behavior within technological environments (Grover et al., 2019). Specifically, TAM posits that two core perceptions influence an individual's intention to use technology: perceived usefulness (PU) and perceived ease of use (PEOU). PU refers to the belief that using a particular system will enhance job performance (Davis, 1989). Essentially, it addresses whether a user perceives the technology as valuable for their tasks. PEOU, on the other hand, concerns the degree to which a user anticipates that using a system will be effortless (Davis, 1989). A technology perceived as easy to use lowers adoption barriers, while a complex interface can hinder positive attitudes (Venkatesh et al., 2003). While TAM has demonstrated accuracy in predicting intention to use (Ibrahim & Shiring, 2022), researchers have expanded upon the model to incorporate additional factors like user knowledge, trust in technology stability and security, social influence and individual characteristics such as age, gender, and experience (Venkatesh et al., 2012).

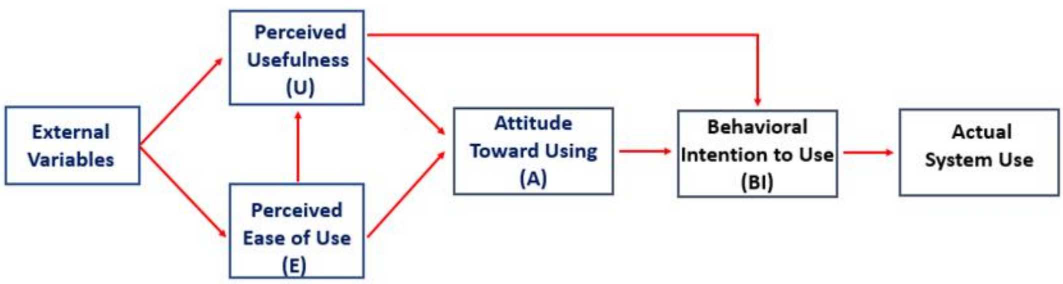

Figure 1: Technology Acceptance Model – TAM (Davis, 1989)

TAM's simplicity and practicality have made it a popular framework for studying technology acceptance across various applications, from software to complex information systems. Its widespread use is reflected in research spanning diverse areas: ERP software adoption (Shibly et al., 2022), online learning adoption (Ahmed, 2021), AI technology adoption (Baroni et al., 2022), internet banking (Nurhakimah & Widodo, 2023), and digital marketing programs (Sonia & Marsasi, 2023).

Digital technology has permeated numerous aspects of life (Agrawal & Saxena, 2024; Penney et al., 2012). In the context of the Fourth Industrial Revolution, integrating digital technology into education is no longer optional, but essential (Tikkanen, 2016). In Vietnam, while many schools have invested in modern facilities and encouraged technology integration, and even introduced advanced technologies like AI, AR and IoT (Agrawal & Saxena, 2024), the effective adoption and utilization of these tools by teachers presents a significant challenge (Moorhouse, 2023). Existing literature suggests a gap between the availability of technology and its actual integration into pedagogical practices. Studies highlight potential barriers such as inadequate training, lack of technical support, resistance to change, and concerns about the impact on teacher roles (Ertmer, 2005; Hew & Brush, 2006). Furthermore, a comprehensive understanding of Vietnamese teachers' specific perceptions of PU and PEOU concerning these technologies, within the context of their unique educational environment, is lacking. This research addresses this gap by examining teachers' acceptance of digital technology in Vietnamese secondary education through the lens of TAM.

This study aims to evaluate technology acceptance in teaching among secondary school teachers in Vietnam using TAM. Specifically, this research seeks to answer the following questions:

1. What are the key factors influencing teachers' perceptions of the usefulness and ease of use of digital technology in teaching?
2. How do PU and PEOU influence teachers' intention to adopt digital technology in their teaching practices?
3. What challenges and limitations do teachers face in accepting and effectively using digital technology in the classroom?
4. What is the relationship between TAM constructs (PU and PEOU) and teachers' cognitive, psychological and social factors related to technology integration?
5. What strategies can be implemented to enhance technology acceptance and effective integration among secondary school teachers in Vietnam?

The results of this study will provide valuable insights for three key areas. First, they will contribute to developing a deeper understanding of Vietnamese teachers' attitudes and behaviors toward technology integration in education. Second, and equally important, these findings will inform the development of targeted interventions and professional development programs designed to promote technology acceptance and effective use. Finally, the study will contribute to the theoretical understanding of TAM's applicability within the Vietnamese educational context.

2. Literature Review

The integration of technology into education was widely recognized as an inevitable trend (Gulavani & Kanthe, 2019), yet the actual adoption and effective utilization of these tools by teachers remained a challenge (Bostan & Şener, 2021; Fwa, 2021). Therefore, this study investigated technology acceptance in teaching among secondary school teachers in Vietnam, employing the TAM as its theoretical framework. Specifically, this research explored the factors influencing teachers' perceptions of the usefulness and ease of use of technology, considering both psychological and social influences. By understanding these factors, the study aimed to propose solutions that enhance teachers' technology acceptance, ultimately contributing to improved educational quality. Moreover, this study extended the traditional TAM by incorporating psychological and social factors, recognizing that teachers' technology acceptance was not solely driven by perceived utility but also by their individual beliefs, attitudes and social context. These factors included, but were not limited to, psychological factors such as teachers' self-efficacy in using technology, their attitudes toward technology in education, their perceived need for technology integration, and their personal innovativeness, as well as social factors such as peer influence, school leadership support for technology integration, professional development opportunities related to technology, and the availability of technical support. Furthermore, the importance of technology integration in education was underscored by its potential to address the learning and development needs of 21st-century students (Thinnukool, 2018).

As highlighted in the literature, the benefits of technology in education are multifaceted. For instance, technology facilitates personalized learning environments (Xie & Lin, 2018), creating learning experiences tailored to individual student needs. In addition, it enables the creation of engaging and interactive lessons through multimedia elements (Weinert et al., 2024), fostering student interest and motivation. Also, technology empowers students to develop creative thinking skills by providing tools for exploration, creation, and problem-solving (Edmondson, 2022). Beyond this, the internet provides access to a vast repository of global information, enabling both teachers and students to quickly and easily access a wealth of knowledge (Chevalier et al., 2024), and online learning platforms and applications facilitate anytime, anywhere learning, breaking down geographical barriers and time constraints (Du, 2019). Additionally, technology plays a crucial role in developing essential 21st-century skills. For example, it fosters critical thinking by enabling students to analyze and evaluate information objectively (Omariba, 2021), and online tools promote communication and collaboration among students (Debnath, 2020; Segbenya et al., 2022). Similarly, technology-based exercises and simulations help students develop problem-solving skills and logical thinking (Kasemsap, 2021). Furthermore, early exposure to technology prepares students for a digitally driven future (Böhm & Renz, 2022) and equips them with the necessary skills for the modern labor market, where technology proficiency is increasingly essential. Finally, technology can automate administrative tasks, freeing up teachers' time to focus on instruction and student interaction, and it also facilitates data collection and analysis, enabling educators to track student progress and evaluate the effectiveness of teaching methods (McKnight et al., 2016). In conclusion, by examining these benefits within the context of the TAM and the identified psychological and social factors, this study aims to provide valuable insights into how to effectively promote technology acceptance among secondary school teachers in Vietnam and leverage technology to enhance the quality of education.

The application of advanced technologies such as AI, AR and IoT in teaching is creating significant breakthroughs in general education (Liao et al., 2021). Below is an overview of the application of these technologies and their impact on the education sector.

Artificial Intelligence is a branch of computer science focused on creating computer systems capable of performing tasks that require human intelligence, such as learning, reasoning, problem-solving, and recognizing language and images (Roby, 2023). In education, artificial intelligence technology can: (1) *Personalize learning:* AI can analyze each student's learning data to create tailored learning programs, helping students acquire knowledge more effectively; (2) *Support teachers:* AI can automate tasks such as grading, creating assignments and providing immediate feedback to students, allowing teachers to focus on teaching and interacting with students; (3) *Create intelligent learning tools:* Chatbots, virtual assistants and automated learning software help students practice and reinforce their knowledge proactively.

Augmented Reality is a technology that combines the real world with virtual elements to create an interactive experience. AR allows users to see virtual objects overlaid on the real world through devices such as smartphones and smart glasses (Chandrasekar, 2022). The outstanding strengths of augmented reality technology bring to education such as: (1) *Creating vivid learning experiences:* AR allows students to interact with 3D models, conduct virtual experiments, and explore historical sites visually; (2) *Supporting visualization of knowledge:* AR helps students visualize abstract concepts more easily; (3) *Increasing interaction:* AR creates an engaging learning environment, encouraging students to actively participate in the learning process.

The Internet of Things is a network of physical devices connected to the internet, capable of collecting and exchanging data. IoT allows these devices to communicate with each other and with larger systems (Szoniecky & Toumia, 2019). In education, IoT allows: (1) *Creating smart learning environments:* by connecting devices and sensors in the classroom, creating an interactive and flexible learning space; (2) *Data collection:* by helping to collect data on student learning processes, helping teachers evaluate effectiveness and adjust teaching methods; (3) *Automating processes:* by helping to automate tasks such as controlling lighting, temperature, and sound in the classroom, creating the best learning conditions for students.

The application of AI, AR and IoT technologies in education has opened up numerous new opportunities, including enhancing education quality through personalized learning, increased interaction, and engaging learning experiences (Omar et al., 2023). Familiarizing students with these technologies will equip them with the necessary skills to succeed in the digital age.

Despite the significant advantages of digital technologies, there are still challenges for low-income countries, including: high costs of investing in digital technologies; uneven teacher skills in effectively using these technologies; and internet connectivity quality directly affecting the effectiveness of using these technologies.

The application of AI, AR and IoT technologies in education is becoming increasingly prevalent (Singh & Hussain, 2022). These technologies have great potential to improve education quality and create positive changes in teaching and learning. However, to fully exploit the potential of these technologies, there needs to be investment and effort from schools, teachers, students, and policymakers (Jehad Ali & Ahmad, 2022).

Vietnam is striving to digitalize its education system, but this process still faces many challenges (Vuong & Pham, 2023). Some of the main difficulties that Vietnamese education is facing include: (1) *Technology infrastructure:* Not all schools, especially those in remote and rural areas, have stable and high-speed internet connections. There is a shortage of technological equipment such as computers, projectors and interactive whiteboards in many schools. The selection and deployment of suitable educational software is limited; (2) *Resources:* Investing in educational technology requires significant financial resources, while the education budgets of the country and localities are still limited; (3) *Human resources:* There is a shortage of teachers with the skills to use technology and the ability to design online lessons; (4) *Awareness:* Many teachers are still hesitant and unfamiliar with using technology in teaching. Students in different regions have unequal levels of access to and use of technology. Many parents are concerned about their children's overuse of technology; (5) *Policies:* Policies on digital transformation in education lack synchronization and specificity. Mechanisms for managing and evaluating the effectiveness of digital transformation activities are still incomplete; (6) *Digital content:* The quality of existing digital content does not fully meet the diverse learning needs of students. Finding and accessing high-quality digital content is still difficult and lacks availability; (7) *Information security:* Cybersecurity risks are present, leading to issues with the security of students' and teachers' personal information that cannot be controlled. Children can easily access harmful and inappropriate content online.

To overcome these challenges, there needs to be a synchronized solution such as investing in upgrading technology infrastructure to increase internet connectivity and equip schools with modern equipment; focussing on teacher training by organizing training courses to improve teachers' technological skills; paying attention to building quality digital content such as developing online learning platforms and creating diverse and engaging learning materials; improving policies by issuing clear and specific policies on digital transformation in education and strengthening cooperation to connect schools, businesses and social organizations to jointly build a digital education ecosystem.

3. Methodology

This study investigates technology acceptance in teaching among secondary school teachers in Vietnam using the TAM. Specifically, this research seeks to answer the five research questions posed in Part 1 (Introduction).

3.1 Research Approach

This study employs a cross-sectional design. This design was chosen because it provides a snapshot of teachers' technology acceptance attitudes and perceptions at a specific point in time, coinciding with the national digital transformation program in education at the beginning of the 2024-2025 academic year. This approach allows for an efficient assessment of the current state of technology acceptance and identification of contributing factors relevant to the research questions. While longitudinal studies could offer insights into changes over time, the cross-sectional design is more appropriate for this initial exploratory study.

3.2. Participants and Sampling

The study population for this research consisted of secondary school teachers in Vietnam. Secondary school teachers were chosen as the focus of this study because they represent a crucial group in the implementation of digital technologies within the Vietnamese education system. Their acceptance and use of technology are essential for the success of nationwide digital transformation efforts. A sample of 364 teachers of mathematics, natural sciences and social sciences from various regions across Vietnam was selected using stratified random sampling based on region (North, Central, South) and subject taught.

These are subject groups according to the secondary school education program in Vietnam. This stratified approach ensured representation from diverse geographical areas and subject specializations, enhancing the generalizability of the findings to the broader population of secondary school teachers in Vietnam. The sample size of 364 was determined using a power analysis conducted with G*Power software. Assuming a medium effect size ($f^2 = .15$), an alpha level of .05, and a desired power of .80, the analysis indicated a required sample size of 350. We oversampled slightly to 364 to account for potential attrition or incomplete responses. This sample size was deemed sufficient to provide statistically significant results and represent the nearly 300 000 secondary school teachers in Vietnam. All 364 questionnaires were submitted and included in the final analysis. Data was collected over a four-week period in October 2024. Teachers were contacted via email through their school administrators and invited to participate in the online survey. Reminder emails were sent after two weeks to those who had not yet responded.

3.3. Data Collection Instrument and Validation

Data was collected through an online survey using Google Forms. The questionnaire included items measuring perceptions of usefulness, ease of use and intention to use technology in teaching, based on the TAM. It also included items assessing cognitive, psychological and social factors related to technology integration, as well as questions about challenges and limitations faced by teachers in using digital technology. A five-point Likert scale (ranging from strongly disagree to strongly agree) was used for all items related to perceptions and attitudes. The survey questionnaire was designed by the authors for this study.

The questionnaire underwent rigorous validation to ensure its reliability and validity. Face validity was established through expert review by two educational technology specialists and two experienced secondary school teachers. These experts assessed the clarity, relevance and comprehensiveness of the items in relation to the research objectives and the TAM model. Their feedback was incorporated into the final questionnaire. Content validity was ensured by aligning the questionnaire items with the research objectives, the TAM model and the specific research questions. Due to the established nature of the TAM constructs, an exploratory factor analysis was not conducted. Confirmatory factor analysis may be conducted in future research to further validate the factor structure. Inter-rater reliability was assessed by having the two experts independently evaluate the clarity and relevance of the items. Cronbach's alpha was calculated to assess the internal consistency of the scales, resulting in a value of 0.85, indicating strong reliability. A pilot test of the questionnaire was conducted with 20 teachers prior to the main data collection. Feedback from the pilot test was used to refine the wording of several items, improving clarity and reducing ambiguity.

3.4. Data Analysis

Data analysis was performed using SPSS version 20. Descriptive statistics (means and standard deviations) were calculated for teachers' ratings on the acceptance of digital technology and the related factors. Correlation coefficients were used to examine the relationships between variables, addressing research questions 1, 2 and 4. Linear regression analysis was employed to test the hypotheses regarding the influence of PU and PEOU on intention to use, further addressing research question 2. Qualitative analysis of open-ended responses regarding challenges and limitations (research question 3) was conducted to identify recurring themes and patterns. The findings from both quantitative and qualitative analyses were used to inform recommendations for promoting technology acceptance and effective integration (research question 5). The results of these analyses were used to inform recommendations for promoting the adoption of digital technologies in teaching nationwide.

3.5. Data and Code Availability

The dataset used in this study is available upon request from the corresponding author. Researchers interested in accessing the data should contact [Corresponding Author's Name and Email Address] with a brief description of their research purpose. Requests will be reviewed to ensure they align with ethical data-sharing practices and protect participant confidentiality.

4. Results

This section presents the findings of the survey on secondary school teachers' acceptance of digital technology in teaching, based on the TAM. Data was collected from 364 teachers of mathematics, natural sciences and social sciences. Teacher demographics are illustrated in Figures 2-5.

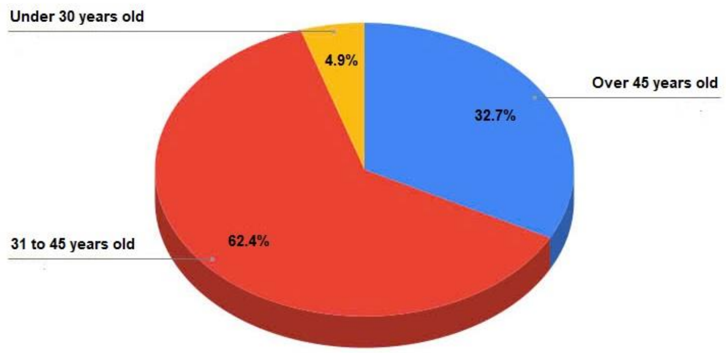

Figure 2: Age of surveyed teachers

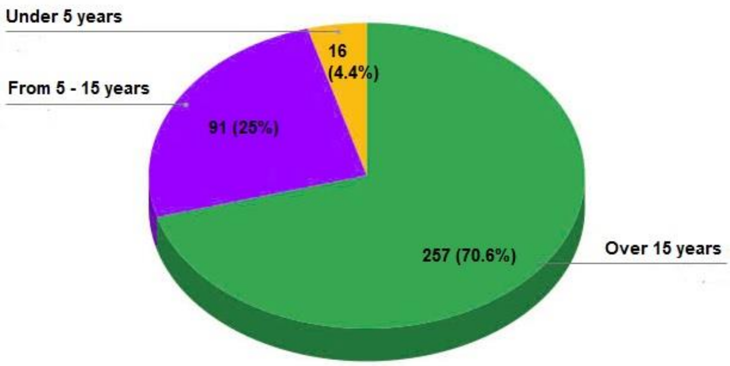

Figure 3: Teaching experience of surveyed teachers

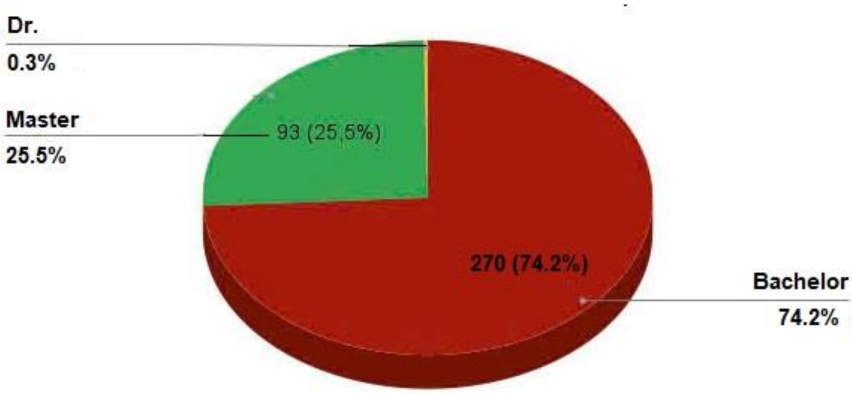

Figure 4: Educational level of surveyed teachers

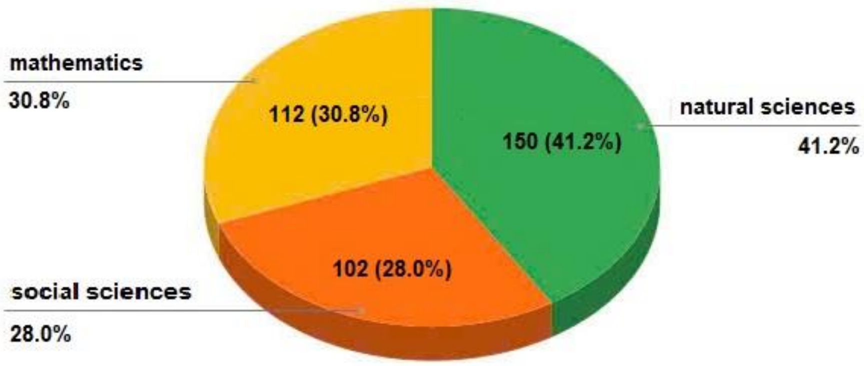

Figure 5: Subjects taught by surveyed teachers

The survey instrument, based on the TAM model, comprised three factors (A, B, and C) assessed using a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree; see Appendix). Factor analysis results for each factor are presented in Figures 6-8.

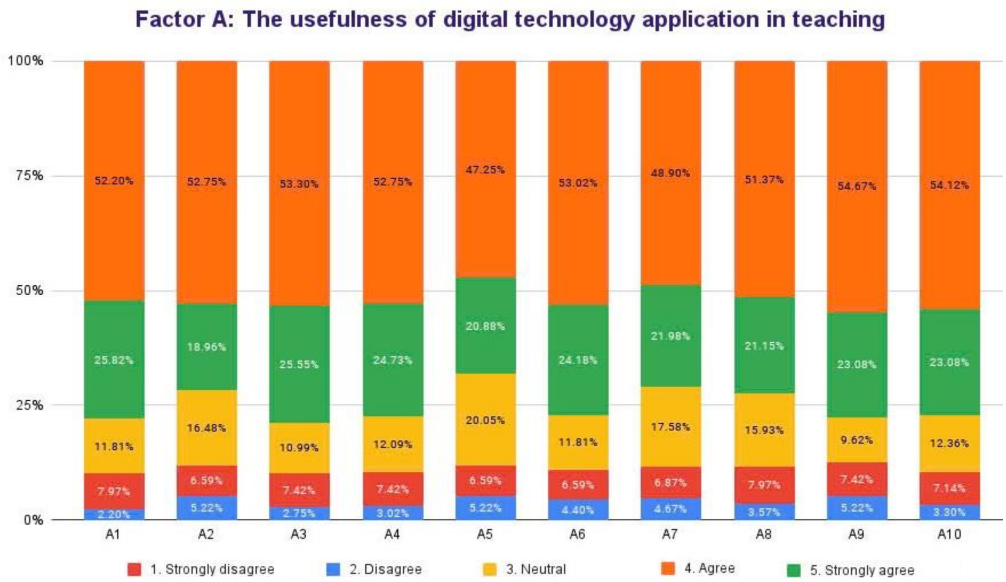

Figure 6: Level of acceptance of factor A by surveyed teachers

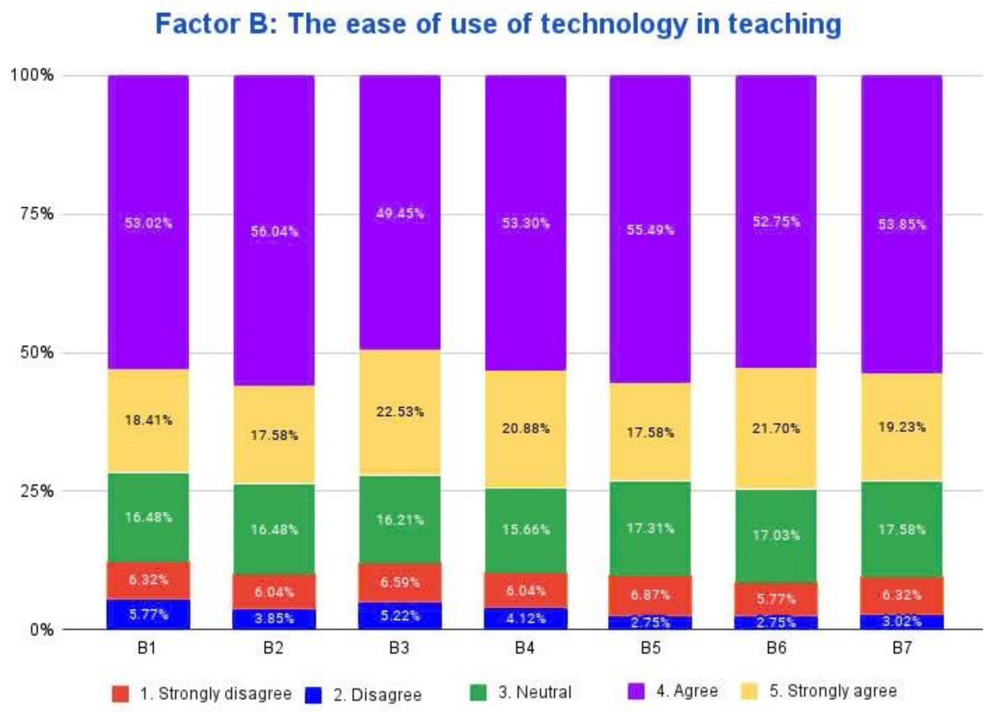

Figure 7: Level of acceptance of factor B by surveyed teachers

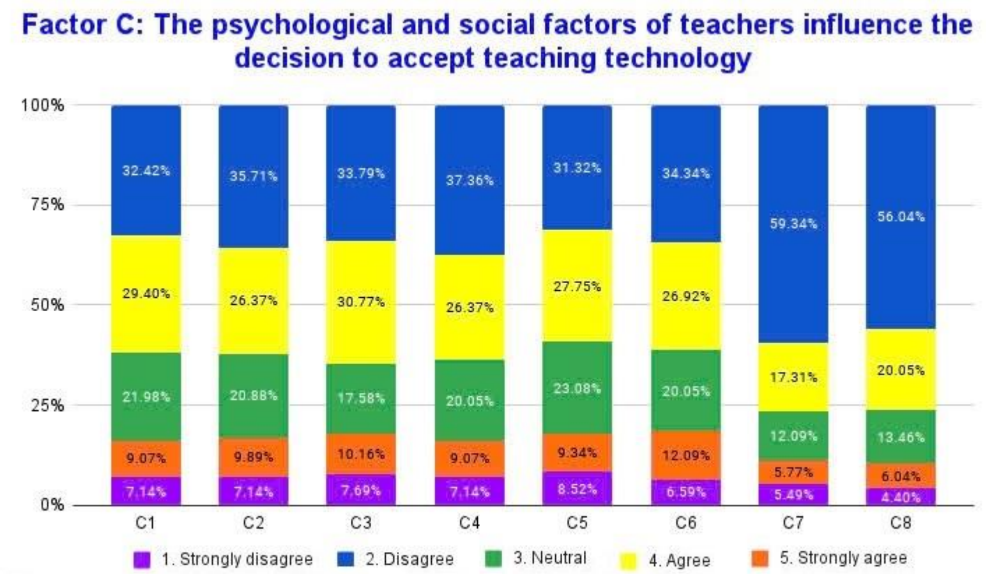

Figure 8: Level of acceptance of factor C by surveyed teachers

Overall Scale Reliability and Descriptive Statistics

The overall Cronbach's alpha coefficient for the scale was greater than 0.8, indicating excellent internal consistency. All "Cronbach's alpha if item deleted" coefficients were lower than the overall alpha, confirming each item's positive contribution to scale reliability. While two variables in Factor C (C7 and C8) showed a slight increase in alpha if deleted, the "Corrected Item-Total

Correlation" remained above 0.3, and the overall alpha change was minimal, thus maintaining scale reliability.

The mean values for all factors were above 3.0, suggesting a general agreement with the items. Specifically, the means for Factor A (Usefulness) and Factor B (Ease of Use) were 4.027 and 3.915, respectively, indicating strong positive perceptions of the technology's utility and usability. Standard deviation values for all factors were below 1, indicating moderate response dispersion and a reasonable level of consensus.

Factor A: PU of Digital Technology in Teaching

Table 1: Item-total statistics of the level of agreement the usefulness of digital technology application in teaching

Items	The Items and Descriptions	N	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Mean	Std. Deviation
A1	The application of AI, AR and IoT technologies in teaching is suitable for the ongoing 4.0 revolution.	364	0.735	0.922	4.07	0.658
A2	Contents with AI, AR and IoT applications suitable for students and the general education curriculum.	364	0.714	0.923	3.95	0.701
A3	AI, AR and IoT can present complex scientific concepts in a more accurate and understandable way.	364	0.723	0.923	4.11	0.671
A4	AI, AR and IoT technologies enhance the learning experience and provide more practical skills compared to traditional teaching methods.	364	0.746	0.922	4.09	0.698
A5	The application of AI, AR and IoT technologies in teaching provides deeper knowledge compared to traditional methods.	364	0.665	0.926	3.92	0.753

Items	The Items and Descriptions	N	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Mean	Std. Deviation
A6	The diversity and richness of learning content are increased thanks to AI, AR and IoT technologies.	364	0.766	0.921	4.05	0.710
A7	Students perceive and understand more clearly when learning with AI, AR and IoT applications.	364	0.754	0.921	3.99	0.714
A8	AI, AR and IoT technologies help to demonstrate the different learning styles of students.	364	0.755	0.921	4.00	0.748
A9	Integrating technology effectively into traditional teaching methods improves their overall usefulness and better prepares students for the future.	364	0.671	0.926	4.03	0.771
A10	Classroom management, the teaching process of teachers, and student learning in the classroom will undergo appropriate changes when educational technology is applied.	364	0.743	0.922	4.04	0.675
Mean: 4.027						
Std. Deviation: 0.556						
Cronbach's Alpha: 0.930						

Factor A (Table 1) examined the PU of digital technology applications in teaching (A1-A10). High corrected item-total correlations (0.665 to 0.766) demonstrate a strong relationship between individual items and the overall usefulness perception. High mean scores (3.92 to 4.11) reflect a positive view of technology's utility in engaging students. Teachers particularly agreed that AI, AR and IoT applications can present complex concepts more scientifically and understandably (A3, Mean = 4.11), highlighting their perceived value in enhancing comprehension. This aligns with studies suggesting the potential of AI, AR and IoT to improve learning outcomes by providing personalized and interactive learning experiences (Holmes et al., 2023).

Factor B: Perceived Ease of Use of Digital Technology in Teaching

Table 2: Item-total statistics of the level of agreement the ease of use of digital technology in teaching

Items	The Items and Descriptions	N	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Mean	Std. Deviation
B1	Providing readily available support and training makes it easier for teachers to effectively integrate AI, AR and IoT technologies into their teaching.	364	0.654	0.902	3.89	0.776
B2	Teachers using AI, AR and IoT technologies help to enhance students' problem-solving and critical thinking skills.	364	0.736	0.892	3.93	0.656
B3	Teachers can easily guide students in applying the knowledge learned from AI, AR and IoT to real-world situations.	364	0.730	0.893	3.87	0.767
B4	Clear guidance from teachers on using AI, AR and IoT technologies improves students' understanding and makes these technologies easier for them to learn with.	364	0.733	0.892	3.91	0.672
B5	Experiential learning through AI, AR and IoT applications, facilitated by teachers, makes practicing new skills more intuitive and less intimidating for students.	364	0.748	0.891	3.96	0.673

B6	When teachers effectively utilize AI, AR and IoT technologies, students find it easier to retain knowledge and develop practical skills.	364	0.742	0.892	3.92	0.668
B7	The interactive nature of AI, AR and IoT technologies, as implemented by teachers, promotes greater student engagement and simplifies collaborative learning experiences.	364	0.734	0.892	3.92	0.676
Mean: 3.915						
Std. Deviation: 0.561						
Cronbach's Alpha: 0.907						

Factor B (Table 2) explored the PEOU of digital technology in teaching (B1-B7). High agreement on ease of use (mean scores ranging from 3.87 to 3.96) suggests that this is a significant driver of technology adoption. Teachers believed that students gain confidence through digital experiments (B5, Mean = 3.96) and that these technologies enhance problem-solving and critical thinking skills (B2, Mean = 3.93), as well as knowledge retention, skill development, and collaboration (B6 and B7, Mean = 3.92). However, a slightly lower mean score for teacher ease in guiding students to apply knowledge learned from AI, AR and IoT (B3, Mean = 3.87) suggests a need for professional development in this area. This finding is consistent with studies discussing challenges in applying technology-based learning (Tian et al., 2020).

Factor C: Psychological and Social Factors Influencing Technology Acceptance

Table 3: Item-total statistics of the level of agreement the psychological and social factors of teachers influence the decision to accept teaching technology

Items	The Items and Descriptions	N	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Mean	Std. Deviation
C1	Teachers who are used to traditional teaching methods generally have less interest in using technology in their classes.	364	0.689	0.863	2.77	1.080

C2	Teachers do not want to use technology in teaching because they believe they do not have access to technology (due to their level, age, environment, ...).	364	0.799	0.851	2.63	1.071
C3	Teachers do not want to use technology in teaching because they are afraid of learning, afraid of wasting time, afraid of wasting money.	364	0.746	0.856	2.69	1.143
C4	Teachers want to use technology in teaching but are afraid to learn and study by themselves.	364	0.783	0.852	2.85	1.108
C5	The process of applying technology in teaching is too complicated for general teachers.	364	0.708	0.861	2.84	1.091
C6	Teachers worry that developing AI technology will completely replace the role of teachers in the future.	364	0.639	0.868	2.67	1.073
C7	Teachers are willing to apply technology in teaching when supported to access it.	364	0.412	0.889	3.77	0.991
C8	Teachers feel it is necessary to use technology in teaching because it improves teaching effectiveness and helps students learn in a modern educational technology environment.	364	0.402	0.890	3.80	1.008
Mean: 3.003						
Std. Deviation: 0.793						
Cronbach's Alpha: 0.882						

Factor C (Table 3) examined the psychological and social factors influencing teachers' decisions to adopt digital technology (C1-C8). Mean scores ranged from 2.63 to 3.80. Scores below 3 (C1-C6) indicate disagreement with statements related to blaming habits, age, reluctance to learn and fear of technology replacing teachers. This may be attributed to the predominantly younger age of the respondents (Figure 1) and their background in mathematics and natural sciences (Figure 4), which may foster a more positive attitude toward technology. Strong agreement with the need for access to support for technology integration (C7, Mean = 3.77) and the recognition of technology's role in improving teaching effectiveness and creating a modern learning environment (C8, Mean = 3.80) highlight the importance of addressing these factors to facilitate technology adoption. This finding is supported by studies on the importance of support and training for technology integration (Yelbay Yilmaz & Balbay, 2021).

5. Discussion

This study provides valuable insights into the factors influencing teachers' acceptance of digital technology in Vietnamese secondary education, directly addressing the research objectives of identifying key drivers and barriers to technology adoption. Results indicate that both PU and PEOU have a significant positive impact on teachers' intention to use digital technology, which aligns with the core principles of the TAM (Davis, 1989; Davis et al., 1989). This confirms TAM's suitability as a theoretical framework for understanding technology acceptance within this specific context, echoing findings from research of Venkatesh and associates (Venkatesh et al., 2003). However, while our findings support the general tenets of TAM, the specific factors influencing PU and ease of use may differ from those identified in previous research (Holden & Karsh, 2010). For instance, while some studies have found that peer influence is a strong predictor of PU (Venkatesh & Davis, 2000), our study found professional development opportunities and access to technical support to be more influential. This difference may be attributed to the specific context of Vietnamese secondary schools, where teachers may rely more on formal training and institutional support due to limited access to peer networks or a culture of seeking guidance from experts.

The positive relationship between PU and intention to use highlights the critical importance of demonstrating the practical benefits of digital technology to teachers. This finding is consistent with numerous empirical studies showing the link between PU and intention to use in educational settings (Alturas, 2021). By showcasing how technology can enhance teaching and learning, such as through improved student engagement with interactive simulations (as observed in our study), personalized learning experiences using adaptive platforms, and streamlined administrative tasks like grade management and communication with parents, policymakers and educators can effectively encourage teachers to adopt and utilize digital tools. Our findings suggest that focusing on tools that save teachers time, facilitate collaborative learning among students (a key theme emerging from our data), and provide access to rich educational resources aligned with the Vietnamese curriculum would be particularly effective in this context. For example, platforms offering pre-designed lesson plans, interactive exercises, and assessment tools could significantly reduce teachers' workload and enhance their instructional practices.

Similarly, the significant influence of PEOU underscores the need for user-friendly and intuitive digital technologies. This aligns with recent studies emphasizing the importance of ease of use in technology adoption among teachers (Akram et al., 2022). Our results indicate that clear instructions for using digital tools, readily available technical support from IT staff, and intuitive interfaces that require minimal technical expertise are crucial for teachers in Vietnamese secondary schools. For instance, many teachers in our study expressed frustration with complex software installations and frequent technical glitches. By providing adequate training programs tailored to teachers' specific needs and ongoing technical support, educational institutions can facilitate the smooth integration of technology into the classroom and address potential anxieties related to technology use (Christensen, 2002). This finding is particularly relevant given the rapid advancements in digital technologies and the need for teachers to continuously update their skills. Professional development workshops focused on specific digital tools and pedagogical strategies for integrating technology would be highly beneficial.

While the results of this study offer valuable insights, it is important to acknowledge its limitations. The sample size, while substantial (n= 364), may not be fully representative of all secondary school teachers in Vietnam, especially given the diverse geographical and socio-economic contexts within the country. Future research could explore variations in technology acceptance across different regions (e.g., urban vs. rural schools) and school types (e.g., public vs. private schools). Additionally, the self-reported nature of the data, collected through surveys, may introduce potential biases, such as social desirability bias, where teachers might overreport their positive attitudes toward technology. Future studies could incorporate observational data of classroom technology use or qualitative interviews with teachers to gain a more nuanced understanding of their actual experiences with digital technology. Furthermore, this study focused primarily on individual factors influencing technology acceptance. Future research should explore the impact of external factors, such as school culture that promotes or hinders technology use, leadership support for technology integration, and access to resources like reliable internet connectivity and updated devices, on teachers' technology acceptance (Jiménez Sierra et al., 2023). Investigating these contextual factors would provide a more holistic view of the complex challenges and opportunities associated with technology integration in education.

This research contributes to the growing body of knowledge on technology acceptance in education, specifically within the Vietnamese context. By understanding the factors influencing teachers' intentions to use digital technology, policymakers and educators can develop more effective and targeted strategies to promote the successful and sustainable integration of technology into teaching and learning practices. Our findings highlight the importance of not only providing access to technology but also focusing on demonstrating its practical benefits through real-world examples, ensuring ease of use through user-friendly design and robust technical support, and providing ongoing professional development and training tailored to teachers' needs. This study also lays the groundwork for future research to explore the complex interplay of individual, contextual, and technological factors that shape teachers' technology acceptance and actual use in the classroom.

6. Conclusion

This study investigated the factors influencing teachers' acceptance of AI, AR and IoT technologies in education, aiming to identify both the promoting factors and the challenges hindering adoption. Key findings reveal that several factors significantly impact teachers' willingness to embrace these technologies. Positive motivators include recognizing the pedagogical benefits of AI, AR and IoT, coupled with supportive infrastructure, training and a collaborative work environment. Conversely, challenges arise from limited access to technology, teachers' varying levels of technological proficiency (particularly among older educators), the time and effort required for learning, and anxieties surrounding technological change. Furthermore, the availability of clear guidance materials and technical support plays a crucial role in facilitating acceptance. Our findings also indicate that younger teachers, those with higher levels of expertise, prior technology experience, and a positive view of technology's role in education demonstrate greater receptiveness to these innovations.

These findings have significant implications for educational stakeholders. To effectively integrate AI, AR and IoT into teaching practices, schools and policymakers should prioritize investments in technology infrastructure and provide comprehensive training programs tailored to teachers' diverse needs and skill levels. Cultivating a culture of collaboration and mentorship, where teachers can share experiences and learn from one another, is also essential. Addressing anxieties through open communication and readily available technical support is crucial for successful implementation. Finally, recognizing and rewarding teachers' efforts in applying these technologies can further incentivize adoption.

While this study offers valuable insights, it is important to acknowledge its limitations. The sample of teachers, while substantial, may not fully represent the diverse population of educators, particularly across varying geographical locations and school types. Future research could explore these nuances by examining technology acceptance across different school settings (e.g., urban vs. rural, public vs. private) and demographic groups.

Additionally, this study primarily relied on self-reported data, which may be susceptible to social desirability bias. Future studies could incorporate observational data of actual classroom technology use and qualitative interviews to provide a richer understanding of teachers' experiences and challenges. Furthermore, this research focused primarily on individual teacher characteristics. Future research should investigate the influence of contextual factors, such as school leadership support, available resources (internet connectivity, devices), and school culture surrounding technology integration. Exploring these broader contextual influences would provide a more holistic understanding of technology adoption in education.

Finally, future research could investigate the long-term impact of AI, AR and IoT integration on student learning outcomes and teacher professional development.

By addressing these limitations and expanding the scope of inquiry, future studies can contribute to more effective strategies for promoting successful and sustainable technology integration in education.

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Appendix

Teacher survey questionnaire on the status of digital technology acceptance in teaching

Items	The factors and descriptions	1	2	3	4	5
Factor A: The usefulness of digital technology application in teaching						
A1	The application of AI, AR and IoT technologies in teaching is suitable for the ongoing 4.0 revolution.					
A2	Contents with AI, AR and IoT applications suitable for students and the general education curriculum.					
A3	AI, AR and IoT can present complex scientific concepts in a more accurate and understandable way.					
A4	AI, AR and IoT technologies enhance the learning experience and provide more practical skills compared to traditional teaching methods.					
A5	The application of AI, AR and IoT technologies in teaching provides deeper knowledge compared to traditional methods.					
A6	The diversity and richness of learning content are increased thanks to AI, AR and IoT technologies.					
A7	Students perceive and understand more clearly when learning with AI, AR and IoT applications.					
A8	AI, AR and IoT technologies help to demonstrate the different learning styles of students.					
A9	Integrating technology effectively into traditional teaching methods improves their overall usefulness and better prepares students for the future.					
A10	Classroom management, the teaching process of teachers, and student learning in the classroom will undergo appropriate changes when educational technology is applied.					
Factor B: The ease of use of digital technology in teaching						
B1	Providing readily available support and training makes it easier for teachers to effectively integrate AI, AR and IoT technologies into their teaching.					
B2	Teachers using AI, AR and IoT technologies help to enhance students' problem-solving and critical thinking skills.					
B3	Teachers can easily guide students in applying the knowledge learned from AI, AR and IoT to real-world situations.					
B4	Clear guidance from teachers on using AI, AR and IoT technologies improves students' understanding and makes these technologies easier for them to learn with.					
B5	Experiential learning through AI, AR and IoT applications, facilitated by teachers, makes practicing					

Items	The factors and descriptions	1	2	3	4	5
	new skills more intuitive and less intimidating for students.					
B6	When teachers effectively utilize AI, AR and IoT technologies, students find it easier to retain knowledge and develop practical skills.					
B7	The interactive nature of AI, AR and IoT technologies, as implemented by teachers, promotes greater student engagement and simplifies collaborative learning experiences.					
Factor C. The psychological and social factors of teachers influence the decision to accept teaching technology						
C1	Teachers who are used to traditional teaching methods generally have less interest in using technology in their classes.					
C2	Teachers do not want to use technology in teaching because they believe they do not have access to technology (due to their level, age, environment, ...).					
C3	Teachers do not want to use technology in teaching because they are afraid of learning, afraid of wasting time, afraid of wasting money.					
C4	Teachers want to use technology in teaching but are afraid to learn and study by themselves.					
C5	The process of applying technology in teaching is too complicated for general teachers.					
C6	Teachers worry that developing AI technology will completely replace the role of teachers in the future.					
C7	Teachers are willing to apply technology in teaching when supported to access it.					
C8	Teachers feel it is necessary to use technology in teaching because it improves teaching effectiveness and helps students learn in a modern educational technology environment.					