



## Urban–Rural differences in teachers’ acceptance of artificial intelligence for teaching and learning: Evidence from indonesia using the technology acceptance model

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### Abstract

**Background:** Artificial Intelligence (AI) offers significant opportunities to enhance teaching and learning through instructional support, automated assessment, and learning analytics. However, teachers’ acceptance of AI may vary according to perceived usefulness, ease of use, and differences in technological access across geographical settings.

**Aim:** This study aimed to compare teachers’ acceptance of AI for teaching and learning between urban and rural schools in Melawi Regency, Indonesia.

**Method:** A quantitative comparative design was employed using the Technology Acceptance Model (TAM), encompassing Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using (ATU), and Behavioral Intention (BI). Data were collected from 100 teachers through an online Likert-scale questionnaire. Content validity was established through expert review, and the data were analyzed using descriptive statistics and an independent samples t-test.

**Results:** The findings indicated that teachers in both settings demonstrated high levels of AI acceptance. However, urban teachers reported higher acceptance ( $M = 4.22$ ) than rural teachers ( $M = 4.05$ ). The difference was statistically significant ( $t = 7.35, p < 0.001$ ) with a very large effect size (Cohen’s  $d = 2.32$ ), suggesting a substantial influence of geographical context on AI acceptance.

**Conclusion:** Urban teachers exhibit significantly greater acceptance of AI than rural teachers. Infrastructure availability, digital literacy, and institutional support appear to be key factors influencing this disparity. Strengthening digital capacity and improving technological infrastructure are essential to promote equitable AI integration in education.

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## INTRODUCTION

Artificial Intelligence (AI) has become one of the most influential digital technologies shaping contemporary educational practices. The integration of AI into educational environments has created new opportunities for improving teaching effectiveness, learning experiences, and administrative efficiency (Chen et al., 2020; Cheung et al., 2021). AI-powered applications can assist teachers in preparing instructional materials, generating assessments, evaluating student performance, and providing personalized learning support (Abrar et al., 2025; Almuhanha, 2025). The increasing availability of intelligent educational tools has enabled educators to streamline routine tasks and

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allocate more time to meaningful instructional activities. As educational institutions continue to embrace digital transformation, AI is increasingly viewed as a strategic resource for enhancing educational quality. The technology also supports the development of innovative learning environments that encourage critical thinking, creativity, and problem-solving skills. Furthermore, AI has the potential to facilitate data-driven decision-making by providing insights into students' learning progress and academic performance. Educational stakeholders therefore recognize AI as an important component of future-oriented teaching and learning systems. The growing adoption of AI technologies reflects broader efforts to modernize educational practices and improve learning outcomes. Consequently, understanding how educators perceive and respond to AI has become an important area of educational research.

The successful implementation of AI in education depends not only on technological availability but also on teachers' willingness to accept and utilize the technology in their professional practices. Teachers serve as key agents in determining whether educational innovations are effectively integrated into classroom activities (Karolčík & Marková, 2023; Moreno-Guerrero et al., 2020; Peng et al., 2023). Although AI offers numerous benefits, levels of acceptance may vary among educators due to differences in perceptions, experiences, and contextual conditions. Some teachers may view AI as a valuable tool that enhances productivity and instructional quality, while others may be hesitant because of limited familiarity or concerns regarding technological complexity (Al-Mughairi & Bhaskar, 2024; Alwaqdani, 2025). The Technology Acceptance Model suggests that users' perceptions of usefulness and ease of use play a central role in shaping technology adoption. In addition, social influences, institutional support, and access to technological resources can affect individuals' intentions to use emerging technologies (Almaiah et al., 2022; Caffaro et al., 2020; Schroeder et al., 2023; Trivedi et al., 2024). The diffusion of innovation perspective further emphasizes that adoption decisions are influenced by perceived advantages, compatibility with existing practices, and opportunities for experimentation. Therefore, teachers' acceptance of AI cannot be understood solely from a technological perspective but must also consider social and environmental factors. Variations in educational contexts may create different experiences that influence attitudes toward AI utilization. As a result, investigating factors associated with teachers' acceptance of AI remains essential for supporting successful educational transformation.

Geographical and socio-economic conditions represent important contextual factors that may influence teachers' access to and acceptance of educational technologies. Schools located in urban areas generally benefit from stronger technological infrastructure, more reliable internet connectivity, greater access to digital devices, and increased opportunities for professional development (Graves et al., 2021; Timotheou et al., 2023). In contrast, schools situated in rural regions often encounter challenges related to limited technological facilities, inadequate digital resources, and restricted access to training programs (Ahiaku et al., 2025; Olanrewaju et al., 2021). These differences may contribute to unequal opportunities for teachers to engage with innovative technologies such as AI. The situation is particularly relevant in regions characterized by substantial geographical diversity and unequal educational resource distribution. Melawi Regency represents an example of such a context, where schools are distributed across both central and remote areas with varying levels of technological accessibility. Urban schools located in administrative and economic centers tend to have better access to digital resources and professional support networks. Conversely, rural schools may face obstacles related to infrastructure limitations and lower exposure to technological innovations. Such disparities have the potential to influence teachers' confidence, readiness, and willingness to incorporate AI into their instructional practices. Understanding these differences is crucial for ensuring that digital transformation initiatives can be implemented equitably across educational settings.

Although research on Artificial Intelligence (AI) in education has grown substantially over the past decade, most studies have primarily focused on the potential of AI to enhance teaching, learning, assessment, and educational management (Chen et al., 2020; Hwang et al., 2020; Nguyen et al., 2023; Ouyang et al., 2020). Similarly, a considerable body of literature has examined teachers' acceptance of AI using the Technology Acceptance Model (TAM), emphasizing factors such as perceived usefulness, perceived ease of use, trust, digital competence, and behavioral intention to adopt AI technologies in educational settings (An et al., 2023; Choi et al., 2023; Kong et al., 2024; D. Zhao, 2025). Previous studies have also explored AI adoption among pre-service teachers, science teachers, and higher education instructors, demonstrating that individual perceptions and technological readiness significantly influence AI acceptance (Al Darayseh, 2023; Zhang et al., 2023). Meanwhile, research on the urban–rural digital divide has largely concentrated on disparities in digital infrastructure, internet accessibility, and technology utilization across communities and regions rather than on teachers' acceptance of AI in educational contexts (Feurich et al., 2024; Lin et al., 2023; J. Wang et al., 2025). Consequently, existing studies have generally treated AI acceptance and geographical digital inequality as separate research domains, leaving limited understanding of how geographical context may influence teachers' acceptance of AI for teaching and learning. Furthermore, empirical evidence comparing AI acceptance between urban and rural teachers remains scarce, particularly in developing countries such as Indonesia, where disparities in technological infrastructure and digital resources continue to exist. Therefore, this study addresses this gap by investigating urban–rural differences in teachers' acceptance of Artificial Intelligence for teaching and learning through the Technology Acceptance Model framework, thereby extending the current literature on AI adoption in education and providing empirical evidence from the Indonesian context.

This study aims to compare teachers' acceptance of Artificial Intelligence for teaching and learning between urban and rural schools in Melawi Regency, Indonesia. Specifically, the study seeks to measure the level of AI acceptance among teachers working in urban schools and compare it with the level of acceptance among teachers working in rural schools. The study further examines whether significant differences exist between the two groups regarding their perceptions and intentions toward AI utilization. By focusing on geographical context, this research attempts to provide a deeper understanding of how environmental conditions influence technology acceptance in education. The findings are expected to contribute to the growing body of knowledge concerning AI adoption among educators. In addition, the study aims to provide empirical evidence regarding the relationship between educational context and technological acceptance. The results may assist educational policymakers in identifying barriers that hinder equitable technology adoption across regions. Furthermore, the study may inform the design of targeted professional development programs aimed at strengthening teachers' digital competencies. The findings can also support efforts to improve technological infrastructure in underserved educational areas. Ultimately, this research seeks to promote more inclusive and balanced implementation of AI technologies within educational systems.

## LITERATURE REVIEW

Artificial Intelligence (AI) has become an increasingly important technology in contemporary educational systems due to its ability to support teaching, learning, assessment, and educational management. AI technologies enable the automation of repetitive tasks, allowing teachers to devote more time to instructional and pedagogical activities (Chen et al., 2020). Recent developments in generative AI have expanded educational applications by providing intelligent content generation, adaptive learning support, automated feedback, and personalized learning experiences. These

capabilities have attracted considerable attention from educators, policymakers, and researchers seeking to improve educational effectiveness and efficiency. AI has also been recognized as a catalyst for educational innovation by facilitating data-driven decision-making and supporting individualized learning pathways. Furthermore, AI can assist teachers in identifying students' learning needs and monitoring academic progress more accurately (Babu J et al., 2024; Khan et al., 2021; Y. Wang, 2025). The integration of AI into education is aligned with broader digital transformation initiatives occurring across educational institutions worldwide. As a result, many countries have begun incorporating AI-related competencies into teacher professional development programs. Despite these advantages, successful AI implementation depends heavily on users' willingness to adopt and utilize the technology. Therefore, understanding the factors that influence teachers' acceptance of AI has become an increasingly important area of educational technology research.

Teachers' acceptance of AI plays a critical role in determining the success of AI integration within educational environments. Acceptance refers to an individual's willingness to adopt, utilize, and continue using a technological innovation for specific purposes. In educational settings, teachers function as primary users who directly influence how technological innovations are implemented in classroom practices (Aleksieva et al., 2025; Christopoulos & Sprangers, 2021; Jöhler et al., 2022; Stumbrienė et al., 2024; Timotheou et al., 2023). Positive acceptance is generally associated with greater willingness to experiment with new technologies and integrate them into instructional activities. Conversely, low levels of acceptance may limit the effectiveness of technological investments and reduce the likelihood of successful implementation. Previous studies have shown that teachers' acceptance of AI is influenced by multiple factors, including perceived benefits, technological competence, trust in AI systems, and institutional support (Choi et al., 2023; Primartadi et al., 2026; C. Zhang et al., 2025). Educators who perceive AI as useful and relevant to their professional responsibilities are more likely to develop positive attitudes toward its use. Similarly, teachers with higher levels of digital literacy tend to exhibit stronger intentions to adopt emerging technologies. Organizational support, access to professional training, and positive technological experiences further contribute to higher acceptance levels. Consequently, understanding teachers' acceptance is essential for promoting sustainable and effective AI adoption in education.

One of the most widely applied theoretical frameworks for explaining technology adoption is the Technology Acceptance Model (TAM). The model proposes that individuals' decisions to adopt a technology are primarily influenced by their perceptions of usefulness and ease of use. Perceived Usefulness refers to the extent to which users believe that a technology can enhance their performance and productivity. Perceived Ease of Use reflects users' perceptions regarding the effort required to learn and operate the technology. According to TAM, these perceptions influence users' attitudes toward technology, which subsequently affect their behavioral intentions to use it (Cioc et al., 2023; Mailizar et al., 2021; Unal & Uzun, 2021; K. Wang et al., 2022; Yang et al., 2021). Behavioral intention is considered a strong predictor of actual technology usage. The model has been extensively validated across various technological contexts, including educational technologies, online learning platforms, and artificial intelligence applications. Researchers frequently employ TAM because of its simplicity, explanatory power, and ability to predict technology adoption behaviors. In educational research, TAM provides a useful framework for understanding how teachers evaluate and respond to technological innovations. Therefore, TAM serves as an appropriate theoretical foundation for examining teachers' acceptance of AI in educational contexts.

The urban–rural digital divide represents another important factor that may influence technology acceptance among educators. Digital divide refers to inequalities in access to digital technologies, internet connectivity, technological infrastructure, and digital competencies across different populations and geographical regions (Inegbedion, 2021; Lythreatis et al., 2022; Raihan et al., 2024; Rydzewski, 2025). Urban schools generally benefit from more advanced infrastructure,

greater technological availability, and broader access to professional development opportunities (Kormos, 2022; Li, 2025; Timotheou et al., 2023). In contrast, rural schools often face limitations related to connectivity, technological resources, and institutional support (Ahiaku et al., 2025; Olanrewaju et al., 2021). These disparities may affect teachers' opportunities to interact with emerging technologies and develop confidence in their use. Differences in technological exposure can subsequently influence perceptions of usefulness, ease of use, and overall acceptance of educational innovations. Furthermore, variations in socio-economic conditions may shape organizational priorities and investment in educational technologies. Teachers working in rural areas may encounter additional challenges associated with technological implementation, including limited technical assistance and insufficient training opportunities. As a result, geographical context can become an important determinant of technology adoption and utilization. Examining urban–rural differences therefore provides valuable insights into factors that contribute to unequal technology acceptance within educational systems.

Based on the Technology Acceptance Model and the urban–rural digital divide perspective, teachers' acceptance of AI is expected to vary according to geographical context and technological accessibility. Teachers who have greater access to digital infrastructure, technological resources, and professional development opportunities are more likely to perceive AI as useful and easy to use (Castro et al., 2025; Chounta et al., 2022; Nazaretsky et al., 2022; Yao & Wang, 2024; J. Zhang & Zhang, 2024). These positive perceptions may contribute to more favorable attitudes toward AI and stronger behavioral intentions to utilize the technology in teaching and learning activities. Conversely, limited access to technological resources may reduce opportunities for experimentation and weaken confidence in using AI applications. Such conditions can ultimately influence overall acceptance levels among educators. The interaction between technological factors and geographical conditions highlights the importance of examining contextual influences on technology adoption. Understanding these relationships is particularly important in developing countries where educational inequalities remain a significant challenge. Empirical evidence regarding urban–rural differences in AI acceptance can support the development of targeted interventions aimed at reducing digital disparities. The findings may also contribute to the refinement of policies designed to promote equitable AI integration across educational settings. Therefore, investigating teachers' acceptance of AI through the lens of TAM and geographical context provides a comprehensive framework for understanding educational technology adoption.

## METHOD

### Research Design

This study employed a quantitative approach with a comparative research design to investigate differences in teachers' acceptance of Artificial Intelligence (AI) for teaching and learning between urban and rural schools in Melawi Regency, Indonesia. A comparative design was considered appropriate because the primary objective of the study was to examine whether significant differences existed between two independent groups of teachers based on their geographical location. The study was guided by the Technology Acceptance Model (TAM), which explains technology acceptance through four key constructs: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using (ATU), and Behavioral Intention (BI). These constructs were used to assess teachers' perceptions and intentions regarding the utilization of AI in educational practices. The study adopted a cross-sectional survey design in which data were collected from participants at a single point in time. This design enabled the researchers to compare the acceptance levels of AI among teachers working in different educational environments. The quantitative

approach also facilitated objective measurement and statistical comparison of the variables under investigation.

### Participants

The population of this study consisted of primary, junior secondary, and senior secondary school teachers employed in Melawi Regency, West Kalimantan, Indonesia. To obtain a representative sample, a combination of cluster sampling and proportionate stratified sampling techniques was employed. Initially, the study area was divided into two geographical clusters, namely urban and rural areas. Urban schools were represented by schools located in Nanga Pinoh, the administrative and economic center of Melawi Regency. Rural schools were represented by schools located in the districts of Ella Hilir, Menukung, Belimbing Hulu, Tanah Pinoh, and Sayan. Subsequently, the population was stratified according to school location, and respondents were randomly selected within each stratum to ensure balanced representation. A total of 100 teachers participated in the study, comprising 50 teachers from urban schools and 50 teachers from rural schools. This sample size was considered adequate for conducting comparative statistical analyses and examining differences in AI acceptance between the two groups.

### Instruments

Data were collected using a structured questionnaire developed based on the Technology Acceptance Model (TAM). The instrument was designed to measure teachers' acceptance of Artificial Intelligence in educational settings through four constructs: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using (ATU), and Behavioral Intention (BI). Perceived Usefulness measured teachers' perceptions of the extent to which AI could enhance the effectiveness and efficiency of teaching and learning activities. Perceived Ease of Use assessed teachers' perceptions regarding the ease of learning and operating AI technologies. Attitude Toward Using evaluated teachers' overall attitudes toward the implementation of AI in education, whereas Behavioral Intention measured their willingness to use AI in future teaching practices. The questionnaire employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). To ensure content validity, the instrument underwent expert validation conducted by a doctoral-level Educational Technology specialist from Universitas Tanjungpura. The validation process focused on item relevance, construct alignment, language clarity, and contextual suitability. Feedback from the expert reviewer was incorporated into the final version of the questionnaire prior to data collection. Data collection was conducted through an online survey using Google Forms. The questionnaire link was distributed to potential respondents through WhatsApp groups, school communication networks, and teacher professional communities. Prior to participation, respondents received information regarding the objectives of the study and instructions for completing the survey. Participation was voluntary, and respondents were encouraged to provide honest responses based on their experiences and perceptions regarding AI utilization in teaching and learning. Completed questionnaires were collected electronically and subsequently screened to ensure completeness and consistency before analysis.

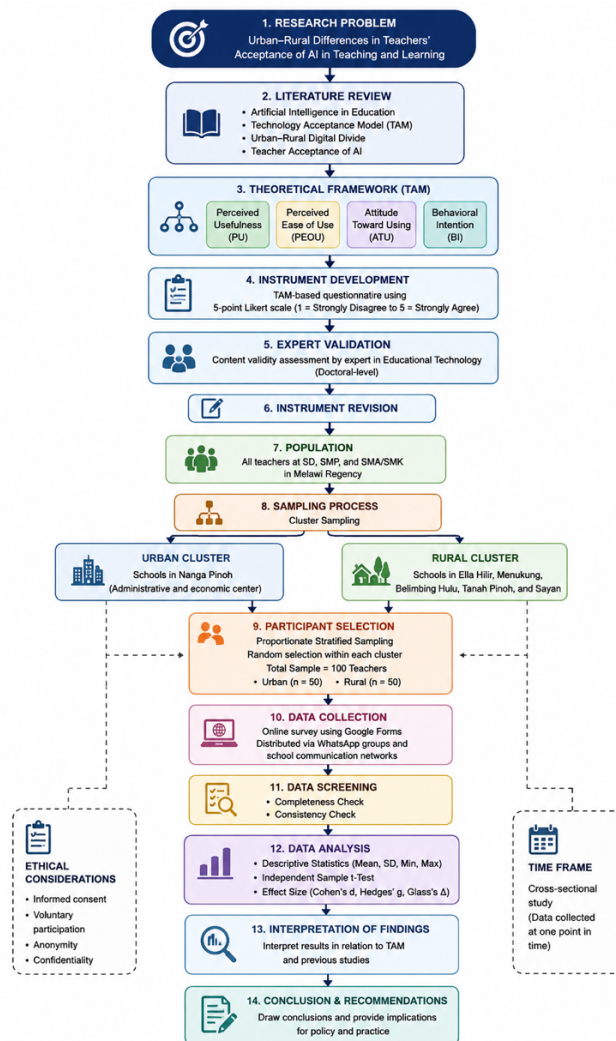
### Data Analysis

The collected data were analyzed using Statistical Package for the Social Sciences (SPSS) version 30. Descriptive statistical analyses, including frequencies, means, standard deviations, minimum values, and maximum values, were employed to describe teachers' acceptance of AI across the four TAM constructs. Descriptive statistics were used to identify general patterns of AI acceptance among urban and rural teachers. To determine whether significant differences existed between the two groups, an independent samples t-test was performed. Prior to conducting the t-test, Levene's test for equality of variances was used to assess the homogeneity assumption.

Statistical significance was evaluated at the 0.05 significance level. In addition to significance testing, effect size analyses were conducted using Cohen's *d*, Hedges' *g*, and Glass's delta to assess the magnitude and practical significance of observed differences. The combination of descriptive and inferential statistical procedures enabled a comprehensive examination of urban–rural differences in teachers' acceptance of AI.

## Procedure

The study was conducted through several systematic stages. The first stage involved identifying the research problem and reviewing relevant literature concerning Artificial Intelligence in Education and technology acceptance theories. The second stage consisted of developing the questionnaire based on the constructs of the Technology Acceptance Model and conducting expert validation to establish content validity. Following the validation process, revisions were made to improve the quality and clarity of the instrument. The third stage involved distributing the online questionnaire to teachers working in urban and rural schools throughout Melawi Regency. During the data collection period, responses were monitored and recorded electronically through Google Forms. The fourth stage included data screening, coding, and verification to ensure data quality and completeness. Subsequently, descriptive and inferential statistical analyses were conducted using SPSS version 30. The final stage involved interpreting the findings, discussing the results in relation to previous studies and theoretical frameworks, and preparing the manuscript for publication. This systematic procedure ensured the reliability and validity of the research process and findings.



**Figure 1.** Research Procedure for Comparing Urban and Rural Teachers' Acceptance of Artificial Intelligence Using the Technology Acceptance Model (TAM).

## RESULTS AND DISCUSSION

This study examined differences in teachers' acceptance of Artificial Intelligence (AI) for teaching and learning between urban and rural schools in Melawi Regency, Indonesia. Teachers' acceptance was evaluated using four constructs derived from the Technology Acceptance Model (TAM): Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using (ATU), and Behavioral Intention (BI). Descriptive statistical analyses were first conducted to examine patterns of AI acceptance across the two groups, followed by inferential statistical analyses to determine whether the observed differences were statistically significant.

### Descriptive Analysis of AI Acceptance

The descriptive analysis revealed that teachers from both urban and rural schools generally demonstrated positive perceptions toward the use of AI in educational activities. Across all TAM constructs, mean scores exceeded 3.90 on a five-point Likert scale, indicating a high level of acceptance among respondents. However, urban teachers consistently reported higher scores than rural teachers for all dimensions of AI acceptance.

**Table 1.** Comparison of Mean Scores Across TAM Constructs

Construct	Urban Teachers	Rural Teachers	Mean Difference
Perceived Usefulness (PU)	4.22	4.10	0.12
Perceived Ease of Use (PEOU)	4.20	4.04	0.16
Attitude Toward Using (ATU)	4.16	3.99	0.17
Behavioral Intention (BI)	4.30	4.02	0.28
<b>Overall Mean</b>	<b>4.22</b>	<b>4.04</b>	<b>0.18</b>

The overall mean score of urban teachers was 4.22, while rural teachers obtained an overall mean score of 4.04. Although both values indicate a high level of acceptance, the difference suggests that urban teachers tend to exhibit more favorable perceptions and intentions regarding AI integration in educational settings.

### Perceived Usefulness (PU)

The Perceived Usefulness construct measured teachers' perceptions regarding the benefits of AI in improving instructional effectiveness and efficiency. Urban teachers obtained an average score of 4.22, whereas rural teachers reported a slightly lower average score of 4.10. Among urban respondents, the highest-rated item was PU6 ( $M = 4.34$ ,  $SD = 0.593$ ), indicating strong agreement that AI can enhance teaching performance and productivity. The lowest score within this construct was observed for PU3 ( $M = 4.16$ ,  $SD = 0.618$ ), although it remained within the high acceptance category. Among rural teachers, scores ranged from 4.04 to 4.18. The highest mean score was observed for PU6 ( $M = 4.18$ ,  $SD = 0.661$ ), while the lowest scores were recorded for PU1 and PU3 ( $M = 4.04$ ). The consistently high scores across both groups indicate that teachers generally recognize the value of AI for supporting educational activities. Nevertheless, the higher scores among urban teachers suggest greater confidence regarding the practical benefits of AI implementation.

### Perceived Ease of Use (PEOU)

The Perceived Ease of Use construct evaluated teachers' perceptions concerning the simplicity of learning and utilizing AI technologies. Urban teachers achieved an average score of 4.20, while rural teachers reported an average score of 4.04. Within the urban group, PEOU6 recorded the highest score ( $M = 4.28$ ,  $SD = 0.573$ ), indicating that respondents generally perceived AI tools as easy to operate. The lowest score was observed for PEOU3 ( $M = 4.10$ ,  $SD = 0.678$ ). In contrast, rural teachers exhibited slightly lower scores, ranging from 3.92 to 4.16. The lowest score was observed for PEOU1 ( $M = 3.92$ ,  $SD = 0.695$ ), suggesting that some respondents still experienced difficulties in

understanding or utilizing AI applications. Despite these differences, both groups generally perceived AI as relatively easy to use. However, the lower scores among rural teachers may indicate reduced exposure to digital technologies and fewer opportunities for technology-related training.

### ***Attitude Toward Using (ATU)***

The Attitude Toward Using construct assessed teachers' overall attitudes toward integrating AI into teaching and learning activities. Urban teachers reported an average score of 4.16, whereas rural teachers reported a lower average score of 3.99. The highest score among urban teachers was observed for ATU3 ( $M = 4.22$ ,  $SD = 0.679$ ), reflecting a positive attitude toward AI-supported learning environments. Among rural teachers, scores ranged from 3.96 to 4.04, with ATU1 receiving the highest mean score ( $M = 4.04$ ,  $SD = 0.638$ ). The relatively lower scores in this construct compared with PU and PEOU suggest that although teachers acknowledge the usefulness and usability of AI, some reservations regarding its implementation may still exist. The difference between urban and rural teachers indicates that geographical context may influence teachers' attitudes toward educational technology adoption.

### ***Behavioral Intention (BI)***

Behavioral Intention represented teachers' willingness to continue using AI in future instructional activities. This construct exhibited the highest scores among all TAM dimensions. Urban teachers achieved an average score of 4.30, while rural teachers reported an average score of 4.02. The highest item score in the entire dataset was BI3 among urban teachers ( $M = 4.40$ ,  $SD = 0.639$ ), indicating a strong intention to adopt AI in future teaching practices.

In contrast, rural teachers demonstrated more moderate intentions, with scores ranging from 3.96 to 4.06. The largest mean difference between groups was observed within this construct ( $\Delta = 0.28$ ), suggesting that geographical location may exert the strongest influence on teachers' future intentions to utilize AI. These findings indicate that urban teachers appear more prepared and motivated to integrate AI technologies into their professional practices.

### **Independent Samples t-Test**

To determine whether the differences observed between urban and rural teachers were statistically significant, an independent samples t-test was conducted.

**Table 2.** Group Statistics

Group	N	Mean	SD	SE
Urban Teachers	20	4.22	0.072	0.016
Rural Teachers	20	4.04	0.077	0.017

The descriptive comparison indicates that urban teachers demonstrated a higher level of AI acceptance than rural teachers. The mean difference between groups was 0.175 points on a five-point scale.

**Table 3.** Independent Samples t-Test Results

Variable	F	p	t	df	p-value
AI Acceptance	0.311	0.581	7.35	38	<0.001

Levene's test indicated that the assumption of equal variances was satisfied ( $F = 0.311$ ,  $p = 0.581$ ). Therefore, the equal variances assumed model was used for interpretation. The t-test results demonstrated a statistically significant difference in AI acceptance between urban and rural teachers ( $t = 7.35$ ,  $df = 38$ ,  $p < 0.001$ ). Furthermore, the 95% confidence interval ranged from 0.126 to 0.223 and did not include zero, confirming the reliability of the observed difference.

### Effect Size Analysis

Although statistical significance indicates the presence of group differences, effect size analysis provides information regarding the practical magnitude of those differences.

**Table 4.** Effect Size Estimates

Effect Size	Value	Interpretation
Cohen's <i>d</i>	2.32	Very Large
Hedges' <i>g</i>	2.27	Very Large
Glass's $\Delta$	2.24	Very Large

The effect size analysis revealed exceptionally large differences between urban and rural teachers. Cohen's *d* value of 2.32 greatly exceeded the conventional threshold for a large effect ( $d \geq 0.80$ ), indicating that geographical location had a substantial influence on teachers' acceptance of AI. Similar conclusions were obtained from Hedges' *g* (2.27) and Glass's delta (2.24), which confirmed the robustness of the findings. These results suggest that the observed differences are not only statistically significant but also highly meaningful in practical educational contexts. Overall, teachers in urban schools exhibited consistently higher levels of perceived usefulness, perceived ease of use, positive attitudes, and behavioral intentions toward AI adoption than teachers in rural schools.

### Discussion

The findings of this study indicate that teachers in both urban and rural schools demonstrated a generally high level of acceptance toward the use of Artificial Intelligence (AI) in teaching and learning activities. Nevertheless, teachers working in urban schools consistently reported significantly higher scores across all Technology Acceptance Model (TAM) constructs, including Perceived Usefulness, Perceived Ease of Use, Attitude Toward Using, and Behavioral Intention. These findings suggest that although AI has gained positive recognition among educators regardless of location, geographical context continues to influence the degree of technology acceptance. This pattern is consistent with the Diffusion of Innovation theory, which posits that innovations tend to be adopted more rapidly in environments characterized by greater access to resources, communication channels, and technological infrastructure. Educational settings with stronger technological ecosystems provide more opportunities for individuals to observe, experiment with, and benefit from emerging technologies. Consequently, teachers in urban schools may have developed stronger confidence in AI applications due to more frequent exposure to digital tools and innovation-oriented educational environments. Similar findings have been reported in studies examining educational technology adoption, where contextual factors significantly influenced users' perceptions and willingness to embrace new technologies (Al-kfairy, 2024; Dubey & Sahu, 2021; Feng et al., 2025; Granić, 2022). Research on AI integration in schools has repeatedly shown that technology acceptance is shaped not only by individual beliefs but also by environmental conditions that facilitate or constrain technology use. Therefore, the higher acceptance observed among urban teachers in this study reflects broader structural advantages associated with urban educational environments.

The differences observed in Perceived Usefulness provide important insights into how teachers evaluate the practical value of AI for instructional purposes. Urban teachers reported higher usefulness scores than rural teachers, indicating stronger beliefs that AI can improve teaching effectiveness, support lesson preparation, enhance assessment processes, and reduce administrative burdens. According to the Technology Acceptance Model, perceived usefulness is one of the strongest determinants of technology adoption because users are more likely to embrace technologies that contribute positively to their professional performance. The findings align with previous studies that identified perceived usefulness as a critical predictor of AI acceptance among educators (Aldraiweesh & Alturki, 2025; Ali et al., 2025; Almogren et al., 2024). Research conducted by Zhao et

al. demonstrated that teachers who recognized the instructional benefits of AI exhibited stronger intentions to incorporate AI tools into classroom activities. Likewise, studies by Kong et al. found that perceived educational value significantly influenced teachers' willingness to use generative AI technologies for lesson planning and instructional support. The higher usefulness perceptions among urban teachers may be associated with greater opportunities to observe successful AI applications in educational contexts and to participate in technology-enhanced teaching initiatives. In contrast, teachers in rural areas may have fewer opportunities to witness the direct benefits of AI due to limited technological exposure and fewer examples of successful implementation. Nevertheless, the relatively high usefulness scores among rural teachers indicate growing awareness regarding the potential contributions of AI to educational improvement. This finding suggests that awareness of AI benefits is expanding across geographical boundaries, although disparities in practical experience continue to influence acceptance levels.

The findings related to Perceived Ease of Use further highlight the role of digital competence and technological experience in shaping teachers' acceptance of AI. Urban teachers reported higher ease-of-use scores, suggesting that they felt more confident in learning, understanding, and operating AI technologies than rural teachers. This result is consistent with TAM, which proposes that technologies perceived as easier to use are more likely to be accepted and adopted. Teachers who possess stronger digital literacy skills often experience fewer barriers when interacting with technological innovations, leading to more favorable evaluations of technology. Similar findings have been reported by Galindo-Domínguez and colleagues, who identified digital competence as a significant predictor of positive attitudes toward AI integration in educational settings (Galindo-Domínguez et al., 2024). Studies involving pre-service and in-service teachers have likewise demonstrated that previous experiences with digital technologies contribute to stronger perceptions of ease of use and higher adoption intentions. The lower ease-of-use scores observed among rural teachers may reflect disparities in access to professional development opportunities, technological training, and digital learning environments. Such disparities are commonly associated with the broader phenomenon of the digital divide, which continues to affect educational institutions in many developing regions. In practical terms, teachers who have limited opportunities to interact with technology may require additional support before they can confidently utilize AI tools in classroom practice. Therefore, efforts to improve teachers' digital literacy and technological self-efficacy are likely to play an important role in narrowing the urban–rural gap in AI acceptance.

Another notable finding is the difference in Attitude Toward Using and Behavioral Intention, with the largest disparity observed in behavioral intention. Although teachers from both groups expressed generally positive attitudes toward AI, urban teachers demonstrated considerably stronger intentions to continue using AI in future teaching activities. Behavioral intention is widely recognized as the most immediate predictor of actual technology use, making this finding particularly important for understanding future adoption patterns. The result suggests that while teachers may acknowledge the usefulness and usability of AI, their willingness to actively integrate the technology into practice depends on additional contextual factors. This interpretation is supported by the Unified Theory of Acceptance and Use of Technology (UTAUT), which emphasizes the importance of facilitating conditions and social influence in determining technology adoption behavior. Teachers working in urban schools are more likely to benefit from supportive professional networks, institutional encouragement, and organizational cultures that promote technological innovation. Previous studies have similarly found that teachers' intentions to adopt AI are strengthened when schools provide adequate technical support, professional development opportunities, and access to relevant technological resources (Ayanwale et al., 2022; Liu, 2025; Ma & Lei, 2024; J. Zhao et al., 2025). Conversely, educators operating in resource-constrained environments may hesitate to invest effort in adopting technologies that appear difficult to sustain over time. The stronger behavioral

intentions observed among urban teachers therefore likely reflect a combination of technological readiness, organizational support, and positive prior experiences with educational technologies. These findings underscore the importance of creating supportive conditions that encourage sustained AI adoption among teachers in diverse educational settings.

Perhaps the most significant contribution of this study lies in the exceptionally large effect size identified between urban and rural teachers. The Cohen's  $d$  value of 2.32 indicates that geographical location exerts a substantial influence on AI acceptance, extending beyond what might be expected from random variation alone. This finding contributes to the growing literature on the urban–rural digital divide by demonstrating that geographical disparities affect not only access to technology but also perceptions, attitudes, and intentions related to emerging educational innovations. Previous studies investigating digital inequality have primarily emphasized infrastructure availability, internet accessibility, and technological resources as key indicators of disparity. However, the present findings suggest that the consequences of these inequalities extend into the psychological and behavioral dimensions of technology adoption. In other words, unequal technological environments may influence how teachers perceive the usefulness of AI, how comfortable they feel using it, and whether they intend to adopt it in future practice. These results are particularly relevant for developing countries where uneven distribution of technological resources continues to pose challenges for educational modernization. The findings imply that investments in hardware and connectivity alone may be insufficient to achieve equitable AI integration. Comprehensive strategies that combine infrastructure development, digital literacy enhancement, continuous professional training, and institutional support are required to reduce geographical disparities in AI acceptance. Ultimately, the study extends the application of the Technology Acceptance Model within the context of Artificial Intelligence in Education and provides empirical evidence that geographical and socio-economic conditions remain critical determinants of educational technology adoption.

### Implications

The findings of this study have important theoretical, practical, and policy implications for the integration of Artificial Intelligence (AI) in educational settings. From a theoretical perspective, the study extends the application of the Technology Acceptance Model (TAM) by demonstrating that geographical context significantly influences teachers' perceptions, attitudes, and behavioral intentions toward AI adoption. The results suggest that technology acceptance is not solely determined by individual cognitive factors but is also shaped by environmental and contextual conditions associated with urban and rural educational settings. From a practical standpoint, the consistently higher acceptance levels observed among urban teachers indicate the importance of providing adequate technological infrastructure, professional development opportunities, and institutional support to facilitate successful AI implementation. The substantial difference between urban and rural teachers highlights the need for targeted interventions that address location-specific challenges rather than applying uniform technology adoption strategies across all schools. Educational institutions should therefore design differentiated training programs that enhance teachers' digital literacy, technological confidence, and practical competence in utilizing AI-based tools for teaching and learning. Furthermore, the findings emphasize the importance of creating supportive school environments that encourage experimentation, innovation, and sustained engagement with emerging technologies. At the policy level, the study provides empirical evidence that can support the development of equitable digital transformation strategies, particularly in regions characterized by disparities in technological access and educational resources. Policymakers should prioritize investments in internet connectivity, digital infrastructure, and AI-related professional development programs for teachers working in rural schools. In addition, collaborative

partnerships among governments, schools, universities, and technology providers may help accelerate the diffusion of AI innovations across diverse educational contexts. Ultimately, reducing geographical disparities in AI acceptance will contribute to more inclusive educational modernization and ensure that the benefits of AI-enhanced learning can be accessed equitably by teachers and students regardless of their location.

### Limitations and Suggestions for Future Research

This study has several limitations that should be considered when interpreting the findings and planning future investigations. First, the study was conducted within a single regency, namely Melawi Regency, which may limit the generalizability of the findings to other regions with different socio-economic, cultural, and technological characteristics. Second, the sample size was relatively limited and may not fully represent the diversity of teachers across Indonesia. Third, the study employed a cross-sectional design that captured teachers' perceptions at a single point in time, making it difficult to examine changes in AI acceptance as teachers gain more experience with the technology. Fourth, the data relied exclusively on self-reported questionnaire responses, which may be influenced by social desirability bias or subjective perceptions. Fifth, the study focused primarily on the four constructs of the Technology Acceptance Model and did not incorporate additional variables that may influence AI acceptance, such as digital literacy, AI competency, technological self-efficacy, trust in AI, facilitating conditions, or organizational support. Sixth, differences in school resources and technological readiness were not directly measured, although these factors may contribute substantially to the observed urban–rural disparities. Future studies are therefore encouraged to involve larger and more geographically diverse samples from multiple provinces or countries to enhance external validity. Longitudinal research designs could also be employed to examine how teachers' acceptance of AI evolves over time as technological exposure and institutional support increase. Furthermore, future research should integrate complementary theoretical frameworks, such as the Unified Theory of Acceptance and Use of Technology (UTAUT), Diffusion of Innovation (DOI), or AI literacy models, to provide a more comprehensive understanding of technology adoption behavior. Researchers may also consider utilizing mixed-methods approaches that combine quantitative surveys with qualitative interviews or focus group discussions to gain deeper insights into teachers' experiences and challenges. Finally, future investigations should explore the impact of specific interventions, such as AI training programs, digital mentoring initiatives, and infrastructure improvement strategies, on reducing urban–rural disparities in AI acceptance and promoting more equitable technology integration in education.

### CONCLUSION

This study concludes that teachers in both urban and rural schools generally demonstrate a high level of acceptance toward the use of Artificial Intelligence (AI) in teaching and learning activities. However, significant differences were identified between the two groups across all dimensions of the Technology Acceptance Model (TAM), namely Perceived Usefulness, Perceived Ease of Use, Attitude Toward Using, and Behavioral Intention. Teachers in urban schools consistently reported higher acceptance levels than their counterparts in rural schools, indicating that geographical context plays an important role in shaping perceptions and intentions regarding AI adoption. The findings suggest that greater access to technological infrastructure, stronger digital literacy, and more extensive institutional support contribute to higher levels of AI acceptance among urban teachers. The independent samples t-test confirmed that the observed differences were statistically significant, while the exceptionally large effect size demonstrated that these differences were also practically meaningful. These results provide empirical evidence that disparities in educational technology acceptance extend beyond individual factors and are strongly influenced by

contextual and environmental conditions. The study further supports the applicability of the Technology Acceptance Model in explaining teachers' acceptance of AI within diverse educational settings. In addition, the findings contribute to the growing body of literature on Artificial Intelligence in Education by highlighting the importance of geographical and socio-economic factors in technology adoption. The results indicate that successful AI integration requires not only technological availability but also supportive learning environments and continuous professional development opportunities. Therefore, efforts to promote equitable AI adoption should prioritize improvements in digital infrastructure, teacher training, and institutional support, particularly in rural schools. Addressing these disparities is essential for ensuring that all educators can benefit from emerging AI technologies regardless of their geographical location. Ultimately, reducing the urban–rural gap in AI acceptance will support more inclusive, effective, and sustainable digital transformation in education.

### AUTHOR CONTRIBUTIONS STATEMENT

Lusiawati Iriani Butar-Butar conceived and designed the study, developed the research framework, coordinated data collection, performed the statistical analysis, interpreted the results, and prepared the original manuscript draft. Afandi contributed to the research design, instrument development, data validation, and critical revision of the manuscript. Reni Marlina participated in data collection, data management, and preliminary data analysis. Env Enawaty contributed to methodology development, interpretation of findings, and manuscript review and editing. Eva Faja Ripanti assisted in literature review, data verification, manuscript refinement, and final proofreading. All authors contributed substantially to the study, reviewed the manuscript critically for important intellectual content, approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

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