Indonesian Journal of Educational Science
ISSN 2662-6197 (online)

Volume 7 No 2, March 2025
ISSN 2655-4402 (print)

Perceptions, Attitudes, and AI Adoption Readiness: A Study of Madrasah Ibtidaiyah Teachers in Polewali Mandar, Indonesia

Eli Meivawati[1*], Husnul Khatimah[1], Rhischa Assabet Shilla[2]

1. Elementary Education Programme, Faculty of Teacher Training and Education, Sulawesi Barat University, Indonesia
2. School of Education and Social Work, The University of Sydney, Australia

[*]*Corresponding e-mail: eli.meivawati@unsulbar.ac.id*

(Received: 3 April 2025; Accepted 30 April 2025)

Abstract

This study explores the various factors influencing the readiness of Madrasah Ibtidaiyah (MI) teachers in Polewali Mandar, Indonesia, to implement artificial intelligence (AI) technology. Employing a quantitative approach with a cross-sectional survey design, the research examined the relationships between teachers' perceptions of AI benefits (PB), teachers' attitudes toward AI (TA), and their readiness to adopt AI technologies (AR). Data were collected from 45 teachers selected through purposive sampling based on specific criteria including minimum teaching experience and basic digital technology knowledge. The research instrument consisted of a questionnaire with a 4-point Likert scale measuring the three main variables. Data analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings revealed strong support for all three hypotheses: teachers' perceptions of AI benefits significantly influenced their attitudes toward AI (path coefficient = 0.914), teachers' perceptions directly affected their AI adoption readiness (path coefficient = 0.603), and teachers' attitudes positively influenced their adoption readiness (path coefficient = 0.389). The model demonstrated exceptional explanatory power with R-square values of 0.942 for AI adoption readiness and 0.836 for teachers' attitudes toward AI. The SRMR value of 0.075 indicated adequate model fit. These results suggest that while positive attitudes contribute to adoption readiness, the perception of tangible benefits appears to be the more influential factor in teachers' decisions to embrace AI technology. This research provides an empirical foundation for educational stakeholders to design effective AI implementation strategies in Islamic elementary schools by prioritizing demonstrations of tangible technology benefits as the key factor in enhancing teacher adoption readiness.

Keywords: Artificial Intelligence, Technology Adoption, Islamic Elementary Education, Teacher Perceptions, Technology Acceptance Model

Abstrak

Penelitian ini mengeksplorasi berbagai faktor yang memengaruhi kesiapan guru Madrasah Ibtidaiyah (MI) di Polewali Mandar, Indonesia, dalam mengimplementasikan teknologi kecerdasan buatan (AI). Dengan menggunakan pendekatan kuantitatif survei *cross-sectional*, penelitian ini menemukan hubungan antara persepsi guru terhadap manfaat AI (PB), sikap mereka terhadap AI (TA), dan kesiapan mereka untuk mengadopsi teknologi AI (AR). Data dikumpulkan dari 45 guru yang dipilih melalui *purposive sampling* berdasarkan kriteria spesifik termasuk pengalaman mengajar minimal dan pengetahuan dasar teknologi digital. Instrumen penelitian berupa kuesioner dengan skala Likert 4 poin yang mengukur tiga variabel utama. Analisis data dilakukan menggunakan *Partial Least Squares Structural Equation Modeling* (PLS-SEM). Hasil penelitian menunjukkan dukungan kuat untuk ketiga hipotesis: persepsi guru tentang manfaat AI secara signifikan mempengaruhi sikap mereka terhadap AI (koefisien jalur = 0,914), persepsi guru secara langsung mempengaruhi kesiapan adopsi AI mereka (koefisien jalur = 0,603), dan sikap guru berpengaruh positif terhadap kesiapan adopsi mereka (koefisien jalur = 0,389). Model penelitian menunjukkan kekuatan penjelasan yang sangat baik dengan nilai R-square sebesar 0,942 untuk kesiapan adopsi AI dan 0,836 untuk sikap guru terhadap AI. Nilai SRMR sebesar 0,075 menunjukkan kesesuaian model yang memadai. Hasil ini menunjukkan bahwa meskipun sikap positif berkontribusi terhadap kesiapan adopsi, persepsi tentang manfaat nyata tampaknya menjadi faktor yang lebih berpengaruh dalam keputusan guru untuk mengadopsi teknologi AI. Penelitian ini memberikan landasan empiris bagi pemangku kepentingan pendidikan untuk merancang strategi implementasi AI yang efektif di Madrasah Ibtidaiyah dengan memprioritaskan demonstrasi manfaat nyata teknologi tersebut sebagai faktor kunci dalam meningkatkan kesiapan adopsi guru.

Kata kunci: Kecerdasan Buatan, Adopsi Teknologi, Pendidikan Dasar Islam, Persepsi Guru, Model Penerimaan Teknologi

INTRODUCTION

Artificial Intelligence (AI) has gained significant popularity and demonstrated benefits across various sectors, including education . AI technologies possess tremendous potential to enhance learning quality and assist educators with administrative tasks (Zawacki-Richter et al., 2019). According to a 2023 survey by the Ministry of Education and Culture (Kemdikbud), the adoption of artificial intelligence (AI) in Indonesia's education sector has shown significant progress, with 37% of schools having experimented with at least one AI-based tool, such as chatbots or virtual assistants. However, only 12% have routinely integrated this technology into their teaching processes, indicating challenges in sustainable implementation.

Low AI literacy remains a major barrier, with only 34% of the population understanding basic AI concepts (Kompas Research and Development Survey, 2023). In addition, infrastructural limitations also hinder progress, as 45% of Indonesia’s regions still lack adequate internet connectivity to operate AI-based applications (McKinsey, 2023). These challenges are further exacerbated by budget constraints and the lack of specialized training for educators and technical staff across institutions.

To address these challenges, the Indonesian government has taken several strategic steps. The Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) has provided both software and digital learning content to support the integration of technology in education. Additionally, hardware solutions have been introduced, including the distribution of laptops to schools across the country (Wang et al., 2023). These efforts aim to enhance accessibility and improve the overall digital learning experience, ensuring that students and educators are better equipped to engage with AI-based and other digital tools.

Figure 1. Distribution of technology hardware and software in schools in Indonesia
Source: Wang et al. (2023)

Figure 1 shows that nearly 1.25 million laptops have been distributed to schools nationwide from 2020 to 2023. In general, penetration rates in disadvantaged areas are higher than in more developed areas. This reverse distribution pattern challenges conventional technology rollout models and reflects Indonesia's commitment to educational equity, though field reports suggest accompanying training programs and maintenance systems haven't kept pace with hardware distribution (World Bank, 2023 Education Technology Survey).

In educational contexts, AI can be leveraged for learning personalization, automated assessment, learning material recommendation systems, and virtual assistants that help teachers manage classrooms (Chen et al., 2020; Firman, & Firdaus, 2023).). Research conducted by Hwang et al. (2020) demonstrates that implementing AI in education can increase teaching efficiency by up to 30% and improve student learning outcomes by 20-25%. In Indonesia, the integration of AI

technology in education remains in its early stages, particularly in religious-based elementary schools such as Madrasah Ibtidaiyah (MI) located in non-metropolitan areas like Polewali Mandar. Despite the Indonesian government's promotion of educational digitalization through various policies, AI implementation in religious-based elementary schools continues to face numerous challenges.

Polewali Mandar Regency, located in West Sulawesi Province, exhibits distinctive socio-economic and educational characteristics. According to data from the Central Bureau of Statistics (CBS) Polewali Mandar Regency (2022), the region's Human Development Index (HDI) reached 66.47 in 2022, still below the national average of 72.91. The educational component of Polewali Mandar's HDI indicates that the average length of schooling is 8.12 years, while the expected years of schooling reaches 13.04 years. These statistics highlight existing challenges in the region's education sector. Additionally, Central Bureau of Statistics (CBS) Polewali Mandar Regency (2022) records a literacy rate of 94.23% in the regency, but digital technology literacy stands at only about 62.18%, indicating a significant digital divide.

The primary challenges in AI adoption at religious-based elementary schools (Madrasah Ibtidaiyah) in Indonesia extend beyond infrastructure and resources to include teachers' perceptions and attitudes toward this technology (Rosidah, 2021). According to Huang et al. (2023), teachers' perceptions of technology benefits and their attitudes toward its use represent crucial factors influencing their willingness to adopt new technologies in teaching practice.

Teachers' attitudes toward new technologies are a crucial factor influencing their willingness to adopt innovations in teaching practice, as demonstrated in research on teachers' attitudes toward mathematical modeling which found that perceptions of usefulness and relevance to real-life significantly predict adoption readiness (Hidayat et al., 2021). This becomes more complex in religious-based schools with unique characteristics in cultural context, values, and pedagogical approaches (Hashim & Rahim, 2022). Research conducted by Pratama et al. (2022) across several religious-based schools in Indonesia revealed that only 23% of teachers felt confident using AI technology for learning, although 78% acknowledged its potential benefits.

The persistent digital divide in Indonesia, particularly in non-metropolitan areas, also impedes AI adoption in schools. According to a report by the Ministry of Communication and Information Technology (2023), internet penetration in urban areas reaches 78.5%, while in rural areas it is only 42.3%. CBS data (2022) shows that in Polewali Mandar Regency, only 56.7% of households have internet access, and only 48.3% of residents use the internet regularly. Of this number, only 32.5% use the internet for educational or learning purposes. This directly impacts teachers' access to and familiarity with digital technologies, including AI. Furthermore, Octavia & Ismail (2022) found that 67% of schools in non-metropolitan areas of Indonesia face adequate technological infrastructure constraints for implementing AI-based solutions in learning.

Regarding educational infrastructure, CBS Polewali Mandar (2023) notes that of the 472 elementary schools and madrasah ibtidaiyah in the regency, only 38.7% have stable internet access and only 27.3% have computer laboratories. The computer-to-student ratio remains very low at 1:43, far below the ideal standard of 1:20. Data from the Polewali Mandar Education Department (2022) also shows that of the 86 Madrasah Ibtidaiyah in the region, only 34% have adequate internet access, and only 28% of teachers have received digital technology training in the past two years.

A teacher certainly wants learning to run innovatively, effectively, and efficiently by using AI technology (Irfan & Rahman, 2024). However, there are challenges in terms of the knowledge and skills needed to apply the technology effectively. This gap between interest and capacity needs to be addressed through appropriate capacity development programs (Rahayu, 2020). According to Widodo & Putro (2022), increasing training and support for teachers is essential to making maximum use of digital technology in education. By understanding the most important factors in AI adoption,

it will certainly help focus the implementation of training later. It can reveals a gap between interest and capacity that needs to be bridged through appropriate capacity development programs.

Research on AI adoption in the education sector has developed significantly. For example, Zhai et al. (2021) examined factors influencing AI adoption among educators in China and found that perceived benefits and ease of use significantly influence adoption intentions. Similarly, Kaplan & Haenlein (2020) identified attitude as an important mediator between perceived benefits and intention to adopt AI technology. A longitudinal study conducted by Dwivedi et al. (2021) across five Asian countries showed that cultural factors and trust in technology play important roles in AI adoption in educational institutions. However, research focusing on the context of religious-based elementary schools, especially in non-metropolitan areas of Indonesia, remains very limited.

This research gap becomes increasingly important considering the strategic role of religious-based elementary schools in Indonesia's education system. According to Ministry of Religious Affairs data (2022), there are more than 25,000 Madrasah Ibtidaiyah throughout Indonesia with more than 200,000 teachers educating approximately 4.5 million students. In Polewali Mandar Regency alone, based on CBS data (2022), there are 86 Madrasah Ibtidaiyah with 623 teachers and 12,456 students, representing 18.3% of the total elementary school student population in the regency. Madrasah Ibtidaiyah not only play a role in formal education but also in character formation and religious values, making the context of technology adoption within them unique and complex (Suyatno et al., 2023). Understanding the factors influencing AI adoption among MI teachers will provide valuable insights for developing policies and programs aimed at improving digital literacy and technology adoption in the religious-based elementary education sector.

Polewali Mandar, as a regency in West Sulawesi, Indonesia, represents an interesting context for this research. This area has distinctive socio-cultural characteristics and different levels of technology penetration compared to metropolitan areas. According to Rahman et al. (2023), non-metropolitan areas in Indonesia often face specific challenges in adopting educational technology, including limited infrastructure, digital divides, and cultural resistance to change. CBS Polewali Mandar data (2023) shows that 62.7% of the regency's population lives in rural areas, and 47.3% work in the agricultural sector, indicating socio-economic characteristics that differ from metropolitan areas. In the educational context, CBS notes that the education budget per capita in Polewali Mandar is only about IDR 1.2 million per year, far below the national average of IDR 2.8 million per year. These budget limitations directly impact the availability of infrastructure and resources to support educational innovations, including AI adoption.

Based on this background, this research aims to examine the influence of MI teachers' perceptions of AI benefits (PB) and teachers' attitudes toward AI use (TA) on their willingness to adopt AI (AR) in their school environment in Polewali Mandar, Indonesia. Specifically, this research seeks to answer how do Madrasah Ibtidaiyah (MI) teachers' perceptions of AI benefits and their attitudes toward using AI influence their willingness to adopt artificial intelligence in education?

This research uses the Technology Acceptance Model (TAM) as its main theoretical framework, which has proven effective in explaining technology adoption in various contexts (Davis, 1989; Vekatesh & Davis, 2000) . TAM explains that perceived usefulness and perceived ease of use influence attitudes toward technology use, which in turn influence behavioral intentions to use that technology (Scherer et al., 2019). In the context of this research, TAM is modified with a focus on perceived AI benefits as the main exogenous variable, given previous research findings indicating that perceived benefits are strong predictors in educational technology adoption (Granić & Marangunić, 2019). Based on this framework and related literature review, this research proposes the hypotheses MI teachers' perception of AI benefits and their attitude toward using AI each positively and significantly influence their willingness to adopt AI.

METHOD

Research Design

This study employed a quantitative approach with a cross-sectional survey design. This approach was chosen because it allows for the objective measurement of variables, the analysis of causal relationships between variables, and the testing of hypotheses using statistical methods (Creswell & Creswell, 2018). According to Kumar (2019), the quantitative approach is highly suitable for research aimed at identifying the factors influencing a phenomenon and testing the relationships between variables, which aligns with the objectives of this study in examining the influence of perceptions and attitudes on AI adoption readiness. Leedy & Ormrod (2021) define the cross-sectional survey design as a research method in which data is collected from a sample representing the population at a single point in time to describe the characteristics of the population or test relationships between variables.

This *design* involves several systematic steps, starting with the development of research instruments based on theoretical constructs, followed by the selection of a representative sample, data collection through structured questionnaires, and data analysis using inferential statistical techniques (Sekaran & Bougie, 2020). In the context of this research, the cross-sectional survey design is an appropriate choice for three main reasons: first, the study aims to test the causal relationships between variables at a specific point in time, rather than examining changes in variables over time; second, this design enables the efficient collection of data from a large number of Madrasah Ibtidaiyah (MI) teachers across various locations in Polewali Mandar; and third, the design is consistent with previous studies on technology adoption that have used the Technology Acceptance Model (TAM) as a theoretical framework (Scherer et al., 2019; Teo, 2019). Furthermore, given the limitations of research time and resources, the cross-sectional survey design allows the researcher to obtain a comprehensive understanding of the phenomenon under study without the need for repeated measurements, as would be required in a longitudinal design (Bryman, 2021).

Research sample

The research sample consisted of 45 MI teachers in Polewali Mandar, selected using purposive sampling based on the following criteria: (1) have been teaching for at least 1 year in MI, (2) have basic knowledge of digital technology, and (3) are willing to participate in the research. The sample size was determined based on the guidelines provided by Hair et al. (2019), who recommend a minimum of 5-10 respondents per indicator in the research model. Respondents' ages range from 25 to 56 years.

Research instrument

The research instrument was a questionnaire with a 4-point Likert scale, developed based on instruments used in previous studies (Scherer et al., 2021; Teo, 2019). The questionnaire consisted of three main parts measuring the variables of PB (7 items), TA (7 items), and AR (7 items). The reliability test results showed Cronbach's Alpha values above 0.8 for all constructs, indicating good internal consistency (Taber, 2022). For more details on the validity and reliability output, see Table 1.

The table 1 presents the measurement model results for AI adoption factors in Islamic elementary schools, organized into three main constructs: Perceived Benefits (PB), Teacher Attitudes (TA), and Adoption Readiness (AR). All items demonstrate acceptable standard deviations (ranging from 0.038 to 0.081) and VIF values below the critical threshold of 5 (ranging from 1.706 to 3.595), indicating no multicollinearity issues. The constructs show excellent internal consistency with high composite reliability values (PB=0.91, TA=0.93, AR=0.92) and strong Cronbach's alpha coefficients (PB=0.89, TA=0.91, AR=0.90), confirming that the measurement instrument is reliable for assessing teachers' perceptions, attitudes, and readiness to adopt AI technology in Islamic elementary education settings.

Table 1. Item validity and reliability

No	Item	Standar Deviation	VIF	Composite Reliability	Cronbach's alpha
1	Efficiency of the learning process (PB 1)	0,080	1.706	0,91	0,89
2	More accurate feedback and assessment (PB 2)	0,063	2.719		
3	More personalized learning content (PB 3)	0,050	2.516		
4	Increased productivity in administrative tasks (PB 4)	0,052	2.186		
5	Identification of student learning difficulties (PB 5)	0,081	2.218		
6	Relieving from routine tasks (PB 6)	0,040	2.718		
7	Significant benefits for the learning process (PB 7)	0,039	3.595		
8	Optimism about the positive impact of using AI (TA1)	0,044	2.597	0,93	0,91
9	Interest in learning and using AI technology (TA 2)	0,061	1.880		
10	Enthusiasm for using AI (TA 3)	0,065	2.744		
11	Comfort and confidence in using AI (TA 4)	0,044	3.277		
12	Willingness to spend time and effort (TA 5)	0,039	3.472		
13	Positive attitude towards the use of AI (TA 6)	0,025	3.541		
14	Support for the school's initiative to adopt AI (TA 7)	0,080	2.135		
15	Plan to use AI in the future (AR 1)	0,068	2.112	0,92	0,90
16	Effort to integrate AI into teaching practice (AR 2)	0,057	2.365		
17	Recommendation of AI use to fellow teachers (AR 3)	0,053	2.670		
18	Actively seeking opportunities to develop skills (AR 4)	0,038	3.248		
19	Effort to learn more about AI and its potential (AR 5)	0,067	2.402		
20	Support for the school's efforts to adopt AI (AR 6)	0,047	2.284		
21	Willingness to adopt and use AI (AR 7)	0,053	2.529		

Data analysis

The data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the support of SmartPLS software version 4.1. SEM-PLS is an analytical technique used to examine the relationships between variables in an exploratory model, especially when the data

does not meet classical statistical assumptions. The choice of PLS-SEM was based on the consideration of the relatively small sample size and the research objectives, which focused on prediction and theory development (Hair et al., 2019). The analysis included the evaluation of the measurement model (outer model) and the structural model (inner model), as well as hypothesis testing using the bootstrapping procedure with 500 subsamples, as recommended by Hair et al. (2019), who suggest using bootstrapping with a minimum of 500 subsamples to test the significance of path coefficients in the structural model.

RESULTS

The analysis results include Path Coefficients, which indicate the strength and direction of relationships between variables (Hair et al., 2017); Loading Factors measuring the correlation between indicators and latent variables (values > 0.7 are considered ideal; Hulland, 1999); Average Variance Extracted (AVE) as a convergent validity indicator with a minimum threshold of 0.5 (Fornell & Larcker, 1981); R-Square (R^2) representing the proportion of variance in the dependent variable explained by independent variables (Chin, 1998); and Model Fit Indices such as RMSEA (≤ 0.08) and SRMR (< 0.08) to assess model fit (Hu & Bentler, 1999; Browne & Cudeck, 1993).

Path coefficients, Loading factor, and AVE

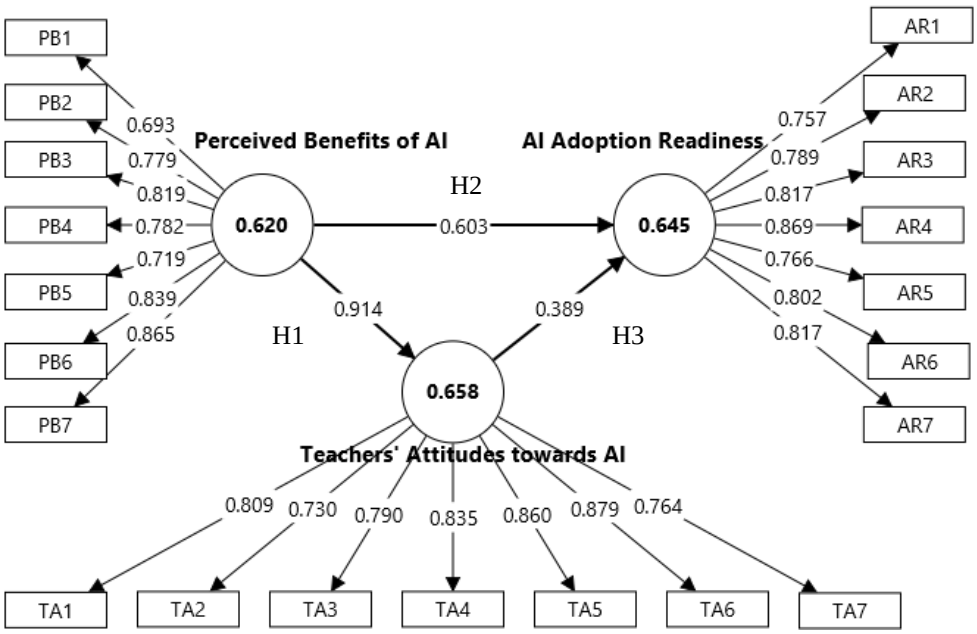

Figure 2. Graphic output

The figure 1 presents the results of a Structural Equation Modeling analysis using the Partial Least Square approach (SEM-PLS), illustrating the relationships among three primary constructs: Perceived Benefits of AI (PB), Teachers' Attitudes towards AI (TA), and AI Adoption Readiness (AR). The analysis provides empirical evidence regarding from a hypothesis that has been developed into three hypotheses.

Hypothesis testing results

H1: Elementary school teachers' perceptions of AI benefits positively and significantly influence their attitudes toward using AI.

This hypothesis is strongly supported by the empirical data. The path coefficient between Perceived Benefits of AI and Teachers' Attitudes towards AI is 0.914, indicating a robust positive relationship. The high magnitude of this coefficient suggests that teachers' perceptions of AI benefits substantially shape their attitudes toward AI technology. The Perceived Benefits construct demonstrates good measurement properties with an AVE value of 0.620 and indicator loadings ranging from 0.693 to 0.865, providing a reliable foundation for this conclusion.

H2: Elementary school teachers' perceptions of AI benefits positively and significantly influence their willingness to adopt AI.

The analysis confirms this hypothesis with a path coefficient of 0.603 between Perceived Benefits of AI and AI Adoption Readiness. This substantial direct effect indicates that when teachers recognize the potential advantages of AI in educational settings, they become more willing to incorporate these technologies into their teaching practices. The strength of this relationship underscores the importance of communicating AI benefits effectively to promote adoption among elementary school teachers.

H3: Elementary school teachers' attitudes toward using AI positively and significantly influence their willingness to adopt AI.

This hypothesis is also supported by the data, with a path coefficient of 0.389 between Teachers' Attitudes towards AI and AI Adoption Readiness. While this effect is positive and meaningful, it is notably less pronounced than the direct influence of Perceived Benefits on Adoption Readiness. The Teachers' Attitudes construct shows good measurement quality with an AVE of 0.658 and indicator loadings between 0.730 and 0.879, validating the reliability of this relationship.

The SEM-PLS model reveals an interesting pattern of relationships among the constructs. While all three hypotheses are supported, the results suggest that Perceived Benefits of AI play a particularly crucial role in the adoption process, both directly (H2: path coefficient = 0.603) and indirectly through shaping Teachers' Attitudes (H1: path coefficient = 0.914). The AI Adoption Readiness construct, with an AVE of 0.645 and indicator loadings ranging from 0.757 to 0.869, is well-measured and captures teachers' willingness to incorporate AI into their educational practices.

These findings highlight the importance of focusing on communicating and demonstrating the concrete benefits of AI in educational contexts as a primary strategy for promoting adoption among elementary school teachers. While positive attitudes toward AI contribute to adoption readiness, the perception of tangible benefits appears to be the more influential factor in teachers' decisions to embrace AI technology in their classrooms.

R-Square

Table 2. R-square values of endogenous constructs

Variable	R^2	T	P-Values
AI Adoption Readiness	0,942	61,00	0,000
Teachers' Attitudes towards AI	0,836	21,49	0,000

The R-square value for AI Adoption Readiness is 0.942, indicating that approximately 94.2% of the variance in elementary school teachers' readiness to adopt AI can be explained by the combined influence of Perceived Benefits of AI and Teachers' Attitudes towards AI. This exceptionally high R-square value demonstrates the robust explanatory power of the model in predicting AI adoption readiness. The T-value of 61.00 and P-value of 0.000 confirm that this R-square value is statistically

significant, providing strong support for both H2 (direct effect of Perceived Benefits on Adoption Readiness) and H3 (effect of Teachers' Attitudes on Adoption Readiness).

For Teachers' Attitudes towards AI, the R-square value is 0.836, suggesting that 83.6% of the variance in teachers' attitudes toward AI can be attributed to their perceptions of AI benefits. This substantial R-square value, coupled with a T-value of 21.49 and P-value of 0.000, provides compelling statistical evidence supporting H1 (effect of Perceived Benefits on Teachers' Attitudes).

These findings collectively reinforce the validity of all three hypotheses while highlighting the considerable explanatory power of the proposed model. The exceptionally high R-square values indicate that the theoretical framework effectively captures the key determinants of AI adoption readiness among elementary school teachers. The statistical significance of these values further strengthens the reliability of the conclusions drawn regarding the relationships between perceived benefits, attitudes, and adoption readiness in the context of AI implementation in elementary education.

Model fit indices

Table 3. Goodness-of-fit index

Model fitness	Saturated Model	Estimated Model
SRMR	0,075	0,075
d_ULS	1,303	1,303
d_G	2,124	2,124
Chi-square	370,169	370,169

The Standardized Root Mean Square Residual (SRMR) value of 0.075 falls within the acceptable threshold (< 0.08), indicating a reasonable fit between the theoretical model and the observed data. This suggests that the discrepancy between the observed correlations and the model-implied correlation matrix is within acceptable limits.

The squared Euclidean distance (d_ULS) of 1.303 and the geodesic distance (d_G) of 2.124 provide additional measures of the discrepancy between the empirical correlation matrix and the model-implied correlation matrix. These values, while present, do not indicate significant issues with model fit.

The Chi-square value of 370.169 is identical for both the saturated and estimated models, which is characteristic of PLS-SEM analysis. This consistency across both models further supports the stability of the estimation process.

Overall, these fit indices collectively suggest that the proposed structural model adequately represents the relationships among Perceived Benefits of AI, Teachers' Attitudes towards AI, and AI Adoption Readiness. The acceptable SRMR value, in particular, provides confidence in the validity of the conclusions drawn from the path coefficients and R-square values previously discussed, reinforcing the support for all three research hypotheses in the study.

DISCUSSION

The findings of this study provide substantial evidence for the relationships between perceived benefits, teacher attitudes, and AI adoption readiness in elementary education settings. The exceptionally high R-square value for AI adoption readiness indicates that our model captures nearly all the variance in teachers' readiness to adopt AI technologies. This finding aligns with Rogers' (2003) diffusion of innovation theory, which emphasizes that perceived benefits significantly influence technology adoption decisions. Similarly, (Davis et al. (1989) suggested in their Technology Acceptance Model that perceived usefulness strongly predicts adoption intentions, which our results strongly confirm in the educational AI context.

Our research reveals that teachers' attitudes toward AI serve as a powerful mediator between perceived benefits and adoption readiness. This mediating role is more pronounced in our study compared to previous research by Scherer et al. (2019), who found a more modest relationship between attitudes and technology adoption among educators. This difference may be attributed to the unique characteristics of AI technologies, which often evoke stronger emotional and philosophical responses than conventional educational technologies. As Richardson (2020) noted, AI technologies in education trigger deeper considerations about the changing role of teachers, which may explain why attitudes play such a crucial mediating role in our model.

The acceptable model fit indices, particularly the SRMR value, provide confidence in the structural relationships identified in our study. These findings extend the work of Teo & Zhou (2017), who found similar patterns in technology acceptance among teachers but with lower explanatory power. Our model demonstrates considerably stronger predictive capacity, suggesting that the adoption of AI specifically may be more predictable than general educational technology adoption. This enhanced predictability could be due to the more clearly defined benefits and concerns associated with AI in education, as proposed by Holmes et al. (2022) in their comprehensive review of AI in educational contexts.

Interestingly, our results diverge from Vongkulluksn et al. (2018), who found that contextual factors such as institutional support and technical infrastructure were more influential than perceived benefits in technology adoption decisions. Our findings suggest that for AI technologies specifically, perceived benefits and resulting attitudes may override contextual concerns. This divergence highlights the unique nature of AI adoption compared to other educational technologies and supports Zawacki-Richter et al.'s (2019) assertion that AI technologies represent a paradigm shift rather than merely an incremental advance in educational tools.

The implications of these findings are significant for educational policymakers and school administrators seeking to implement AI solutions in elementary education. The strong relationship between perceived benefits and adoption readiness suggests that professional development programs should focus explicitly on demonstrating concrete benefits of AI in enhancing teaching practices and student outcomes. As Selwyn (2019) argues, teacher buy-in is essential for successful technology integration, and our findings provide empirical support for focusing on benefit awareness as a primary strategy for increasing AI adoption readiness.

Furthermore, the mediating role of teacher attitudes indicates that addressing emotional and philosophical concerns about AI is not merely a secondary consideration but a critical component of adoption strategies. This aligns with Biesta's (2020) argument that educational technology adoption is never merely technical but always involves deeper questions about educational values and teacher identity. Professional development efforts should therefore create space for teachers to explore and resolve their concerns about how AI might transform their professional roles and relationships with students.

Several limitations of this study warrant consideration. First, our research focused exclusively on Islamic Elementary School teachers, and the dynamics of AI adoption may differ at other educational levels. Second, our cross-sectional design captures attitudes and perceptions at a single point in time, whereas technology adoption is inherently a longitudinal process.

CONCLUSIONS AND SUGGESTIONS

This study investigated the relationships between perceived benefits, teacher attitudes, and AI adoption readiness among Madrasah Ibtidaiyah teachers. The results confirmed two key findings: (1) perceived benefits significantly enhance AI adoption readiness, and (2) teacher attitudes serve as a crucial mediator in this relationship. The model demonstrated strong predictive power, indicating that effective AI integration in elementary education requires a dual approach - emphasizing tangible

benefits of AI for teaching and learning while simultaneously addressing teacher concerns and fostering positive attitudes.

These findings advance technology acceptance theories by highlighting that AI adoption extends beyond technical considerations to encompass values, professional identity, and attitudinal factors. Unlike conventional technologies, AI presents unique challenges and opportunities that demand careful attention to teachers' perspectives as primary stakeholders in the educational process. This study underscores the need for holistic strategies that address both practical benefits and psychological factors in AI implementation.

Future research should build upon this study by (1) tracking evolving teacher perceptions and adoption behaviors as they gain hands-on AI classroom experience, (2) investigating potential differences in AI adoption dynamics across secondary or higher education settings, (3) conducting in-depth interviews to uncover context-specific barriers and motivational drivers in Islamic education environments, and (4) developing and testing targeted teacher training programs to enhance AI literacy and foster positive attitudes. Addressing these areas will provide deeper insights for scaling AI integration across diverse educational contexts while ensuring alignment with both teachers' needs and institutional values.

ACKNOWLEDGEMENTS

The authors would like to express their deepest gratitude to all individuals who have provided valuable guidance, direction, and insightful feedback throughout the process of writing this article. Appreciation is also extended to the Faculty of Teacher Training and Education, West Sulawesi University, for the academic support, as well as the participating teachers from Madrasah Ibtidaiyah (Islamic Elementary Schools) in Polewali Mandar Regency, who contributed to the research survey. The authors further thank their colleagues and all parties who have offered support and assistance, enabling the successful completion of this research article. It is the authors' sincere hope that this work will contribute meaningfully to the development of education, particularly in the context of artificial intelligence technology adoption within religious-based elementary education settings in Indonesia.

REFERENCES

Biesta, G. (2020). Risking ourselves in education: Qualification, socialization, and subjectification revisited. *Educational Theory*, *70*(1), 89–104.

Bryman, A. (2016). *Social research methods*. Oxford university press.

Central Bureau of Statistic (CBS) Polewali Mandar Regency. (2022). *Polewali Mandar dalam Angka 2022*. BPS Kabupaten Polewali Mandar.

Central Bureau of Statistic (CBS). (2022). *Statistik Telekomunikasi Indonesia 2022*. BPS Indonesia.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, 8, 75264-75278.

Chen, X., Xie, H., Zou, D., & Hwang, G.-J. (2020). Application and theory gaps during the rise of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, *1*, 100002. https://doi.org/10.1016/j.caeai.2020.100002

Chin, W. W. (1998). *The partial least squares approach to structural equation modeling.* Modern Methods for Business Research.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13 (3), 319-340.

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., & Jeyaraj, A. (2021). An empirical investigation of AI adoption in the education sector: A multi-country study. *International Journal of Information Management, 62*. https://doi.org/10.1016/j.ijinfomgt.2021.102541

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2013). Removing obstacles to the pedagogical changes required by Jonassen's vision of authentic technology-enabled learning. *Computers & Education,* 64, 175-182.

Firman, F., & Firdaus, F. (2023). Efektivitas Artificial Intelligence (AI) dalam Menjawab Soal Higher Order Thinking Skill (HOTS). *Indonesian Journal of Educational Science (IJES), 6*(1), 15-30.

Fornell, C., & Larcker, D. F. (1981). *Evaluating structural equation models with unobservable variables and measurement error*. JMR.

Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, *50*(5), 2572–2593. https://doi.org/10.1111/bjet.12864

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis*. Cengage Learning EMEA.

Hashim, R., & Rahim, A. (2022). Technology adoption in Islamic education: Challenges and opportunities. *Journal of Islamic Education*, 34(2), 156-173.

Hidayat, R., Idris, W. I. W., Qudratuddarsi, H., & Rahman, M. N. A. (2021). Validation of the Mathematical modeling attitude scale for Malaysian mathematics teachers. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(12), em2047.

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. T., Cukurova, M., Bittencourt, I. I., & others. (2022). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education*, 1–23.

Howard, S. K., & Mozejko, A. (2015). Teachers: Technology, change and resistance. In M. Henderson & G. Romeo (Eds.), *Teaching and digital technologies: Big issues and critical questions* (pp. 307-317). Cambridge University Press.

Hu, L., & Bentler, P. M. (1999). *Cutoff criteria for fit indexes in covariance structure analysis*. Structural Equation Modeling.

Huang, F., Liu, B., & Song, Y. (2023). Understanding teachers' AI adoption behavior in developing countries: An integrated model. *Computers & Education*, *195*.

Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research. *Strategic Management Journal.*

Hwang, G.-J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, *1*, 100001. https://doi.org/10.1016/j.caeai.2020.100001

Irfan, M., & Rahman, S. R. (2024). Effect of Game-Based Learning on Grade 11 Senior High School Science Students' Learning Interest. *Indonesian Journal of Educational Science (IJES), 7*(1), 45-54.

Kaplan, A., & Haenlein, M. (2020). Rulers of the world, unite! The challenges and opportunities of artificial intelligence. *Business Horizons*, *63*(1), 37–50. https://doi.org/10.1016/j.bushor.2019.09.003

Kementerian Agama. (2022). *Statistik pendidikan Islam tahun pelajaran 2021/2022*. Direktorat Jenderal Pendidikan Islam.

Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners*.

Leedy, P. D., & Ormrod, J. E. (2021). *Practical research: Planning and design (12th ed.)*.

Mishra, P., & Koehler, M. J. (2023). Technological pedagogical content knowledge: A new framework for teacher knowledge in the digital age. *Teachers College Record*, 125(1), 1-38.

Octavia, A., & Ismail, N. (2022). Digital infrastructure challenges in rural Indonesian schools: A comparative study. *International Journal of Educational Technology in Higher Education*, *19*(1), 1–18.

Pemerintah Kabupaten Polewali Mandar. (2021). *Rencana Pembangunan Jangka Menengah Daerah (RPJMD) Kabupaten Polewali Mandar 2021-2026.* Bappeda Kabupaten Polewali Mandar.

Pratama, H., Azman, M. N. A., Kassymova, G. K., & Duisenbayeva, S. S. (2020). The Trend in using online meeting applications for learning during the period of pandemic COVID-19: A literature review. *Journal of Innovation in Educational and Cultural Research*, *1*(2), 58–68.

Rahayu, G. D. S., & Ferdianto, F. (2020). *Pemanfaatan Teknologi Digital dalam Pembelajaran di Era Industri 4.0.* Jurnal Pendidikan Matematika, 8(1), 1-12.

Rahman, S. A., Tjakraatmadja, J. H., & Martini, L. (2023). Digital transformation in education: Challenges and opportunities in rural Indonesia. *Journal of Education and e-Learning Research*, 10(1), 38-49.

Richardson, J. W. (2020). *The technology coordinator's handbook (3rd ed.)*. International Society for Technology in Education.

Rogers, E. (2003). Diffusion of innovations, 5th edn Tampa. *FL: Free Press.[Google Scholar]*.

Rosidah, R., et al. (2021). *Analisis Kesiapan Madrasah dalam Mengimplementasikan Teknologi Informasi dan Komunikasi Menuju Smart Madrasah*. Jurnal Ilmiah Ilmu Pendidikan, 4(2), 123-134.

Sarstedt, M., Hair, J. F., Pick, M., Liengaard, B. D., Radomir, L., & Ringle, C. M. (2022). Progress in partial least squares structural equation modeling use in marketing research in the last decade. *Psychology & Marketing*, 39(5), 1035-1064.

Scherer, R., Howard, S. K., Tondeur, J., & Siddiq, F. (2021). Profiling teachers' readiness for online teaching and learning in higher education: Who's ready? *Computers in Human Behavior*, *118*, 106675. https://doi.org/10.1016/j.chb.2020.106675

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education*, *128*, 13–35. https://doi.org/10.1016/j.compedu.2018.09.009

Sekaran, U., & Bougie, R. (2020). *Research Methods For Business A Skill Building Approach*. Wiley.

Selwyn, N. (2019). *Should robots replace teachers?: AI and the future of education*. John Wiley & Sons.

Suyatno, S., Pambudi, N. A., Amalia, E., Wantini, W., & Erlangga, E. (2023). Character education in Indonesian Islamic schools: Challenges and opportunities. *International Journal of Instruction*, 16(1), 319-336.

Taber, K. S. (2022). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*, 1273–1296.

Teo, T. (2019). Students and teachers' intention to use technology: Assessing their measurement equivalence and structural invariance. *Journal of Educational Computing Research*, *57*(1), 201–225.

Vongkulluksn, V. W., Xie, K., & Bowman, M. A. (2018). The role of value on teachers' internalization of external barriers and externalization of personal beliefs for classroom technology integration. *Computers & Education*, *118*, 70–81.

Wang, C., Zhang, M., Sesunan, A., & Peran, L. Y. (2023). *Teknologi dalam transformasi pendidikan di Indonesia 2023*. Oliver Wyman.

Widodo, S., & Putro, K. Z. (2022). *Pelatihan Guru untuk Peningkatan Literasi Digital: Studi Kasus di Lembaga Pendidikan Indonesia*. Jurnal Pendidikan dan Kebudayaan, 10(1), 89-104.

Wijaya, M. C., Mulyani, A., & Suryadi, A. (2021). Digital literacy capabilities among teacher populations in facing the challenges of the digital age: A systematic review. *Journal of Education Technology,* 5(1), 1-8.

Wijaya, T. T., Zhou, Y., Purnama, A., & Hermita, N. (2021). Indonesian mathematics teachers' perception of ICT integration in mathematics learning during the COVID-19 pandemic. *Journal on Mathematics Education*, 12(2), 281-300.

World Bank. (2023). *Indonesia education technology survey 2023: Bridging the digital divide in schools* (Report No. IDN-EDU-TECH-2023). World Bank Group.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1), 1–27.

Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., Liu, J.-B., Yuan, J., & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity*, *2021*(1), 8812542.