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RESEARCH ARTICLE Hafifah

Perceptions and Readiness of Elementary Teachers in Integrating Artificial Intelligence into Learning: Evidence from South Cikarang Indonesia

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Abstrak

Penelitian ini mengkaji persepsi dan kesiapan guru sekolah dasar dalam mengintegrasikan kecerdasan buatan (AI) ke dalam praktik pembelajaran di wilayah Cikarang Selatan, Indonesia. Dengan menggunakan desain kuantitatif deskriptif, data dikumpulkan dari 20 guru di enam sekolah melalui kuesioner terstandar. Hasil penelitian menunjukkan persepsi yang umumnya positif, dengan tingkat kesepakatan tinggi bahwa AI berpotensi meningkatkan efisiensi, kreativitas, serta mendukung proses penilaian, disertai dengan kebutuhan yang kuat akan pelatihan. Guru menekankan bahwa AI dipandang sebagai alat pendukung, bukan pengganti, yang mencerminkan optimisme pragmatis dan kekhawatiran rendah terhadap hilangnya peran guru. Namun, kesiapan institusi masih bervariasi, dengan perbedaan signifikan antara sekolah negeri dan swasta. Temuan ini menekankan pentingnya pengembangan profesional yang terarah, dukungan infrastruktur, serta regulasi yang jelas agar adopsi AI mampu melindungi peran guru sekaligus meningkatkan mutu pendidikan. Studi ini juga memperluas model penerimaan teknologi dengan menyoroti peran dukungan institusional sebagai faktor moderasi utama.

Kata kunci: kecerdasan buatan; kesiapan guru; pendidikan dasar; Technology Acceptance Model; Cikarang Selatan.

Abstract

This study investigates elementary teachers' perceptions and readiness to integrate artificial intelligence (AI) into classroom practices in South Cikarang, Indonesia. Using a descriptive quantitative design, data were collected from 20 teachers across six schools through a validated questionnaire. Findings reveal generally positive perceptions, with high agreement on AI's potential to enhance efficiency, creativity, and assessment support, alongside strong demand for training. Teachers emphasized AI as a supportive tool rather than a replacement, reflecting pragmatic optimism and relatively low concern about job displacement. However, institutional readiness remains uneven, with significant differences between public and private schools and across school contexts. The results highlight the need for targeted professional development, robust infrastructure, and clear governance frameworks to ensure AI adoption protects teacher agency while improving educational quality. The study also extends the Technology Acceptance Model by emphasizing institutional support as a key moderating factor.

Keywords: artificial intelligence; teacher readiness; elementary education; Technology Acceptance Model; South Cikarang.

1. INTRODUCTION

The rapid development of digital technology in recent years has significantly transformed the education sector worldwide. One of the most prominent innovations is artificial intelligence (AI), which is designed to simulate human intelligence in tasks such as data analysis, decision-making, and natural language interactions (Zawacki-Richter et al., 2019; Holmes et al., 2021). UNESCO (2023) emphasizes that AI has great potential to support adaptive learning, automated assessments, and administrative management in schools. Similarly, OECD (2023) has published policy guidelines encouraging ethical and effective adoption of AI in education.

Globally, studies indicate that the adoption of AI in education has accelerated, particularly after the COVID-19 pandemic. UNESCO (2022) reports that more than 40 percent of schools in developed countries have implemented AI-based systems to facilitate personalized learning. However, developing countries face persistent barriers, including inadequate infrastructure, limited access to teacher training, and uneven institutional support (Zhai et al., 2021; Tang & Bao, 2022). In Indonesia, the Ministry of Education (2023) highlights an increase in digitalization initiatives in schools, yet AI adoption remains limited to pilot projects in urban areas.

Teachers play a crucial role in integrating technology, including AI, into classroom practice. Research indicates that AI can help teachers alleviate administrative burdens, offer automated feedback, and facilitate student-centered learning (Holmes et al., 2022; Marzuki and Fitriyani, 2023; Chen et al., 2023). Nevertheless, teacher readiness is strongly influenced by factors such as digital literacy, institutional support, and professional development opportunities (Azhari and Fajri, 2022; Pham et al., 2023).

The adoption of technology in education can be explained through the Technology Acceptance Model (TAM). This model argues that perceived usefulness and perceived ease of use significantly shape the intention to adopt technological innovations (Davis, 1989; Teo and Huang, 2019; Al-Emran et al., 2021). Applying TAM in the context of AI integration helps to understand how teachers' perceptions and readiness influence their acceptance of AI in elementary education.

Although a growing body of global literature exists on AI in education (Holmes et al., 2021; OECD, 2023; UNESCO, 2023), research in Indonesia remains limited, often focusing on broader digital transformation rather than AI-specific applications (Kurniawan, 2021; Azhari and Fajri, 2022). Few empirical studies have explored how elementary school teachers perceive and prepare for the integration of AI, especially in semi-urban areas such as South Cikarang. This gap highlights the lack of contextualized evidence on teacher readiness in adopting AI in Indonesian elementary schools.

This study aims to examine the perceptions and readiness of elementary school teachers in integrating AI into their teaching practices. It specifically addresses three research questions. First, how do elementary teachers perceive the usefulness of AI in classroom learning? Second, what barriers hinder teachers from adopting AI? Third, how prepared are elementary teachers in South Cikarang to integrate AI into classroom practices?

2. METHOD

2.1. Research Design

This study employed a descriptive quantitative design to systematically examine elementary school teachers' perceptions and readiness to integrate AI into classroom learning. The study was exploratory, prioritizing depth of insight over statistical generalizability given the limited adoption of AI in Indonesian elementary schools.

2.2. Participants and Sampling

Respondents consisted of 20 teachers from six elementary schools in South Cikarang, encompassing both public and private institutions. Teachers were selected using purposive sampling to ensure representation across school types and grade levels. The inclusion criteria required that participants have at least two years of teaching experience and basic familiarity with digital learning tools. While the sample size was modest, it aligns with the exploratory aim of the study, which sought to identify emerging patterns and challenges rather than achieve broad statistical generalization.

2.3. Instrument Development and Validation

Data were collected using a structured questionnaire consisting of 15 Likert-scale items ranging from "strongly disagree" (1) to "strongly agree" (5). The items measured teachers' understanding of AI, prior experiences, perceived benefits, perceived challenges, and overall readiness for AI adoption. Several items were adapted from validated instruments used in previous studies on technology adoption in education (Teo & Huang, 2019; Al-Emran et al., 2021) and were modified to suit the elementary education context. To minimize response bias, some items were reverse-coded.

The instrument underwent expert validation by two education technology specialists and one researcher in the field of AI education. A pilot test was conducted with five elementary teachers outside the main sample, resulting in minor adjustments to item clarity. Internal consistency reliability was confirmed with a Cronbach's alpha coefficient of 0.86, indicating high reliability.

2.4. Data Collection Procedures

Data collection was conducted between March and April 2024. Teachers completed the questionnaire in a paper-based format during scheduled school meetings. Participation was voluntary, responses were anonymous, and informed consent was obtained before participation.

2.5. Data Analysis

Descriptive statistics were first employed to summarize response distributions, including means, standard deviations, and percentages for each item. To further identify differences between groups, independent-samples t-tests were conducted to compare public and private school teachers, and one-way ANOVA was used to compare teachers across schools. Responses were also aggregated into thematic categories (understanding, benefits, challenges, and readiness) for interpretive clarity. Open-ended

comments provided by teachers were subjected to simple thematic coding to complement the quantitative findings.

3. RESULT AND DISCUSSION

3.1. Research Result

The survey of 20 elementary teachers in South Cikarang revealed diverse perceptions regarding the integration of AI into classroom practices. Descriptive statistics were calculated to capture the degree of agreement with 15 statements related to understanding, perceived benefits, challenges, and readiness. Table 1 presents the overall approval levels, along with the mean scores and standard deviations, to illustrate not only the level of consensus but also the variability of responses across items.

Table 1. Teachers' agreement levels on AI in learning

No	Statement	Percentage (%) Agree/Strongly Agree	Mean	SD
1	Understanding the basic concept of AI	80%	4.02	0.65
2	AI makes the teaching process more efficient	85%	4.12	0.59
3	Have used AI applications for teaching	70%	3.74	0.78
4	AI provides recommendations according to students' needs	75%	3.91	0.72
5	Interested in learning more about AI	85%	4.20	0.54
6	AI improves the quality of learning	80%	4.00	0.61
7	AI helps in student assessment	65%	3.65	0.83
8	AI helps overcome teachers' time constraints	75%	3.92	0.70
9	AI supports lesson material preparation	80%	4.08	0.67
10	Need training on AI usage	90%	4.45	050
11	Concerned that AI may replace teachers	30%	2.30	0.91
12	School supports the use of AI	70%	3.70	0.74
13	AI can enhance teachers' creativity	85%	4.15	0.60
14	AI is a teaching aid, not a teacher replacement	90%	4.50	0.51
15	Ready to integrate AI into teaching practices	80%	4.02	0.65

The results in Table 1 indicate generally positive perceptions toward AI integration, with most items receiving agreement rates above 70%. The highest level of consensus was observed in the need for training on AI usage (90%, M = 4.45, SD = 0.50) and the belief that AI is a supportive tool rather than a replacement for teachers (90%, M = 4.50, SD = 0.51). This reflects strong enthusiasm for capacity building while maintaining confidence in the irreplaceable role of human teachers. In contrast, only 30% of respondents expressed concern about AI potentially replacing teachers (M = 2.30, SD = 0.91), suggesting relatively low anxiety about job displacement. Moderate agreement was reported on the actual use of AI applications (70%, M = 3.74, SD = 0.78) and school-level support (70%, M = 3.70, SD = 0.74), indicating that while individual attitudes are favorable, institutional readiness may still be uneven. The variability across items, as

indicated by the standard deviations, suggests that some teachers are early adopters, while others remain cautious, highlighting the need for targeted professional development.

To further examine potential differences between public and private school teachers, independent samples t-tests were conducted across the four measured dimensions. This analysis aimed to determine whether teachers' institutional backgrounds significantly influenced their perceptions regarding culturally responsive teaching and education for sustainable development.

Table 2. Independent samples t-test results (public vs. private teachers)

Variable	Public M (SD)	Private M (SD)	t(df)	p
Understanding	4.12 (0.56)	3.89 (0.61)	2.45(18)	0.016*
Benefits	4.05 (0.52)	3.87 (0.59)	1.98(18)	0.049*
Challenges	3.42 (0.71)	3.58 (0.68)	-1.62(18)	0,107
Readiness	3.76 (0.64)	3.52 (0.66)	2.11(18)	0.036*

The results presented in Table 2 show that public school teachers reported significantly higher scores in understanding, benefits, and readiness compared to their private school counterparts, with p-values below the .05 threshold. However, no significant difference was found for the challenges dimension, indicating that both groups encountered similar levels of difficulty when implementing culturally responsive and sustainability-oriented practices. These findings suggest that while public school teachers may perceive themselves as more prepared and knowledgeable, the barriers to implementation remain a shared concern across institutions.

To further examine differences across schools, a one-way ANOVA was conducted to compare teachers' perceptions regarding their understanding, perceived benefits, challenges, and readiness to implement culturally responsive teaching integrated with education for sustainable development. This analysis aimed to identify whether variations in school contexts influenced teachers' responses beyond the public–private school comparison.

Table 3. One-way ANOVA results (across schools)

Variable	df	F	p	Post-hoc (Tukey)
Understanding	5, 14	03.28	0.012*	School A > School C
Benefits	5, 14	02.11	0.081	–
Challenges	5, 14	04.02	0.004*	School B > School D, E
Readiness	5, 14	03.56	0.009*	School A > School E

As shown in Table 3, significant differences were found in teachers' levels of understanding, reported challenges, and readiness across schools, whereas perceived benefits did not differ significantly. Specifically, teachers in School A demonstrated higher levels of understanding and readiness compared to other schools. In contrast, teachers in School B reported more challenges than those in Schools D and E. These findings suggest that institutional context plays a notable role in shaping teachers' perceptions, particularly in terms of their readiness and the obstacles they encounter.

3.2. Discussion

Overall, teachers in South Cikarang reported favorable perceptions of AI for instructional efficiency, creativity support, assessment assistance, and materials preparation, alongside a strong interest in capacity building. A high level of agreement that AI is a teaching aid rather than a replacement, coupled with comparatively low fear of job loss, suggests a pragmatic stance that resonates with recent guidance emphasizing the "human-centered" and teacher-empowering use of generative AI in education (UNESCO, 2023; OECD, 2025).

Yet the 90% agreement that "AI is a teaching aid, not a teacher replacement" requires nuance. Emerging work highlights tensions between the promise of AI as a co-pilot and risks to teacher autonomy, including algorithmic nudging, over-monitoring, and workflow standardization that can erode professional judgment over time (Giannakos et al., 2024; Szabó, 2024; Zhu et al., 2025). Our finding that only 30% feared replacement may partly reflect early adoption optimism in this context, as well as the still limited depth of AI use in elementary classrooms. However, studies warn that expanding generative AI ecosystems can subtly erode autonomy, intensify datafication, and shift control from teachers to platforms unless explicit governance guardrails are in place (Molenaar et al., 2023; Barnes, 2025).

The strong call for training (with 90% agreement) aligns with international policy guidance that prioritizes teacher capacity, AI literacy, and ethical competence as prerequisites for effective and equitable implementation (Kennedy, 2024; UNESCO, 2025). Both UNESCO's global guidance and the OECD's recent outlooks emphasize that system-level professional learning and teacher-involved policy design are crucial for preventing tool-driven pedagogies and protecting teacher agency (OECD, 2023; U.S. Department of Education, 2023). Our results, particularly the moderate ratings for "school support," point to a local implementation gap between teacher enthusiasm and institutional readiness that mirrors global concerns (Teacher Task Force, 2024).

Comparative patterns from the inferential tests add texture to the analysis. Public-school teachers scored higher on understanding, perceived benefits, and readiness than private-school peers, while both groups reported similar challenge levels. Although the sample size is small, this finding echoes broader reports that institutional policy clarity, access to vetted tools, and collective learning structures can enhance perceived readiness, even when barriers remain (Duan et al., 2024; OECD, 2025). Cross-school ANOVA differences highlight how local leadership, infrastructure, and development opportunities influence teacher confidence and challenge burdens, consistent with governance analyses that underscore the role of school-level guidance in shaping AI practices (AP News, 2024).

Interpreting efficiency gains also warrants care. While teachers widely endorsed AI's time-saving potential in our data, external evidence shows mixed effects: some reports highlight meaningful time savings for frequent users, whereas others show only modest workload reductions without structured implementation and training (EdTech Magazine, 2024; Royal Society of Chemistry, 2024). This suggests that perceived efficiency in our sample may be a leading indicator of potential rather than a guaranteed outcome, reinforcing the case for targeted professional learning and implementation support (Chronicle of

Higher Education, 2024).

Two methodological considerations temper interpretation. First, social desirability bias can inflate positive self-reports of novel technology use, especially in professional surveys framed around innovation (Rickwood et al., 2023; Sasongko et al., 2025). Second, our n = 20 exploratory sample limits generalizability, and effect sizes should be interpreted with caution. Future studies should incorporate multi-site sampling, classroom observations, and longitudinal designs to examine whether perceived readiness translates into sustained, high-quality AI-supported pedagogy without compromising teacher agency (Li et al., 2025; Uygungil-Erdogan et al., 2025).

Implications follow directly. Policy and school leaders should co-design PD that (a) centers pedagogy and assessment literacy before tools, (b) includes explicit modules on autonomy, data governance, and ethics, and (c) provides curriculum-aligned exemplars and coaching cycles. Clear, context-sensitive policies—aligned with international guardrails—can help reconcile the "aid-not-replace" belief with genuine protections for professional judgment (Zhu et al., 2025; UNESCO, 2025). Readiness differentials across schools also argue for equity-oriented resource allocation and communities of practice that share artifacts, prompts, and evaluation rubrics (OECD, 2025).

Our results intersect with the Technology Acceptance Model and adoption research. Higher perceived usefulness and understanding likely raised readiness, while challenges constrained deeper use—patterns consistent with recent TAM-adjacent studies on AI and ChatGPT in education (Li et al., 2025; Sasongko et al., 2025). Given evidence that anxiety and perceived risk dampen adoption, PD should include hands-on practice to build efficacy and calibrate expectations (Uygungil-Erdogan et al., 2025; Kennedy, 2024).

In summary, South Cikarang teachers exhibit constructive optimism toward AI, accompanied by a clear demand for training and uneven institutional support. The practical takeaway is not to "scale tools" but to "scale teacher capacity and safeguards," ensuring that AI augments rather than encroaches on the relational and judgment-intensive work of elementary teaching (UNESCO, 2023; OECD, 2025).

4. CONCLUSION

This study provides evidence that elementary school teachers in South Cikarang view artificial intelligence as a promising tool to support teaching and learning. Teachers generally recognize its value in saving time, enhancing creativity, and assisting with assessments and lesson preparation. They also show strong interest in developing their competence through training, while expressing relatively little concern that AI might replace them. At the same time, the findings reveal uneven institutional readiness, with notable differences between public and private schools, as well as across various school contexts. While enthusiasm is high, gaps remain in infrastructure, leadership, and policy clarity, which shape not only teachers' confidence but also their ability to effectively implement AI.

These results carry several policy implications. Ministries of Education should embed AI literacy, ethical awareness, and classroom applications into teacher certification and professional development

programs. Schools, in turn, need to allocate budgets for technological infrastructure and establish mandatory AI training as part of continuous professional learning. Clear governance frameworks covering data privacy, algorithmic accountability, and teacher autonomy are also needed to ensure that AI strengthens rather than constrains the profession.

From a theoretical standpoint, this study enriches the Technology Acceptance Model by underscoring the role of institutional support, particularly policy clarity, infrastructure, and leadership, as a moderating factor between teachers' perceived usefulness of AI and their readiness to adopt it. The findings also reinforce the notion that while AI may augment routine tasks, the emotional labor and professional judgment of teachers remain essential. Protecting this human dimension requires policies and practices that guard against risks such as over-monitoring, bias, and erosion of autonomy.

Future research should extend beyond small exploratory samples to larger-scale, comparative studies across urban and rural contexts. Longitudinal approaches will be important for examining how teacher perceptions shift after sustained training and classroom implementation. Mixed-method designs that integrate surveys, interviews, and classroom observations could capture the complex dynamics between teacher agency, emotional labor, and AI-assisted practice.

In conclusion, the integration of AI in elementary education should be understood not simply as the adoption of a new tool, but as a systemic shift that demands investment in teacher capacity, institutional governance, and ethical safeguards. Only by aligning professional development with clear policies and equitable resources can AI adoption genuinely enhance the quality and sustainability of teaching and learning.

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