Teachers' Readiness to Use Artificial Intelligence for Learning in Elementary Schools Today

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Abstract
This study aims to examine elementary school teachers' readiness to use artificial intelligence for learning in the current digital era. It specifically explores teachers' knowledge of artificial intelligence, technical skills, perceived usefulness, confidence, attitudes, ethical awareness, and willingness to integrate artificial intelligence into classroom learning. This study employs a descriptive quantitative approach. Data are collected using a questionnaire administered to elementary school teachers. The questionnaire is designed to obtain information about teachers' preparedness, experiences, perceptions, and challenges related to the use of artificial intelligence for educational purposes. The collected data are analyzed descriptively to identify the level and characteristics of teachers' readiness and the areas that require further development. The study is expected to provide a comprehensive description of teachers' preparedness for artificial intelligence-supported learning. The findings are anticipated to indicate that readiness is influenced by technological competence as well as confidence, positive attitudes, perceived usefulness, ethical awareness, and willingness to use artificial intelligence responsibly. The study also expects to identify challenges related to teachers' knowledge, technical abilities, access to appropriate resources, and responsible classroom implementation. This study highlights teacher readiness as an important foundation for the meaningful integration of artificial intelligence in elementary education. Rather than positioning artificial intelligence as a replacement for teachers, the study emphasizes its role as a supportive learning technology that can assist teachers in preparing materials, designing activities, developing assessments, and providing relevant learning resources. The study may provide practical considerations for school policies, professional development programs, teacher training, and responsible artificial intelligence guidelines. Strengthening teacher readiness is expected to support smart education and future learning while preserving teachers' central role in guiding students, developing character, and ensuring meaningful, ethical, and human-centered learning. It also recognizes that responsible implementation requires continuous reflection, appropriate supervision, and attention to students' developmental needs.

Keywords: Artificial Intelligence; Teachers' Readiness; Elementary Education; Smart Education; Future Learning; Exchange Rate; Gini Coefficient; Bound Testing Analysis

1. Introduction

Artificial Intelligence (AI) has increasingly become part of educational development and is changing the way teachers prepare, deliver, and evaluate classroom learning. In elementary schools, the integration of AI offers unprecedented opportunities to support educators in developing learning materials, designing interactive activities, preparing personalized assessments, and providing learning resources tailored to diverse student needs. However, the successful implementation of AI-supported learning depends not only on the availability of

technology or infrastructure, but fundamentally on teachers' readiness to use it effectively, ethically, and responsibly.

Teacher readiness encompasses multiple interconnected dimensions: technical skills, pedagogical knowledge, perceived usefulness, self-confidence, ethical awareness, and a constructive attitude toward digital integration. While students in elementary schools particularly upper-grade students (Grades IV, V, and VI) are rapidly adopting digital platforms and AI tools, their cognitive capacity to filter information and recognize digital risks remains in development. This creates a critical demand for teachers to act as ethical navigators and facilitators.

Data were collected using a multi-method strategy involving questionnaires and readiness audits, in-depth semi-structured interviews, and observation and document analysis. Questionnaires and readiness audits were administered to assess teachers' self-perceived knowledge of AI, technical skills, confidence, perceived usefulness, and ethical awareness. In-depth semi-structured interviews were conducted to explore specific pedagogical strategies, ethical dilemmas, and the challenges encountered when integrating AI and digital tools into teaching practices. Additionally, observations and document analysis were carried out across nine classroom sessions and 17 teaching documents to verify whether teachers' reported readiness was consistent with their actual classroom practices.

2. Research Method

Research Design

This study employs a descriptive approach combining quantitative survey mechanisms with qualitative case inquiry to provide a comprehensive analysis of elementary school teachers' readiness and challenges. The descriptive design allows for mapping levels of preparedness across specific readiness indicators while capturing contextual nuances from classroom implementations.

Context and Participants

The study was conducted with elementary school teachers, featuring SDN Rahayu in West Java as a representative urban-fringe primary school setting. Participants included upper-grade elementary teachers (Grades IV, V, and VI) as key informants, school administration (principal), and upper-grade students as supporting informants to triangulate findings regarding digital interactions and AI usage.

Table 1. Recaps of Informants and Data Sources

Source	Type of Informant/Activity	Volume
Upper-Grade Teachers	Key Informants (Grade IV, V, VI teachers)	3 teachers
School Principal	Supporting Informant (Policy & Infrastructure)	1 principal
Upper-Grade Students	Supporting Informants (Focus Group Discussion)	12 students
Observation Sessions	Classroom & Digital Activity Observation	9 sessions
Teaching Documents	Lesson plans, AI prompts, digital modules	17 documents

Source: processed data

Instruments and Data Collection

Data were collected using a multi-method strategy involving questionnaires and readiness audits, in-depth semi-structured interviews, and observation and document analysis. Questionnaires and readiness audits were administered to assess teachers' self-perceived knowledge of AI, technical skills, confidence, perceived usefulness, and ethical awareness. In-depth semi-structured interviews were conducted to explore specific pedagogical strategies, ethical dilemmas, and the challenges encountered when integrating AI and digital tools into teaching practices. Additionally, observations and document analysis were carried out across nine classroom sessions and 17 teaching documents to verify whether teachers' reported readiness was consistent with their actual classroom practices.

Data Analysis

Data were analyzed descriptively following the interactive data analysis framework (data reduction, data display, and conclusion drawing/verification). Methodological credibility was secured through source triangulation, technique triangulation across instruments, and member-checking procedures.

3. Results and Discussions

Overview of Teacher Readiness Dimensions

Data analysis revealed that elementary school teachers demonstrate varying levels of readiness across seven core dimensions. In terms of perceived usefulness and attitude, teachers show strong appreciation for AI's ability to streamline administrative tasks, generate visual media, and assist in lesson planning. Regarding confidence and willingness, teachers express a strong interest in integrating AI into their teaching practices, provided that clear guidelines and age-appropriate safeguards are established. Furthermore, teachers demonstrate strong ethical awareness, particularly concerning data privacy, the prevention of academic dishonesty, and

protecting students from unverified digital content. However, technical and pedagogical skills remain the areas requiring the most systematic improvement, as teachers frequently rely on informal learning to acquire proficiency in using AI tools.

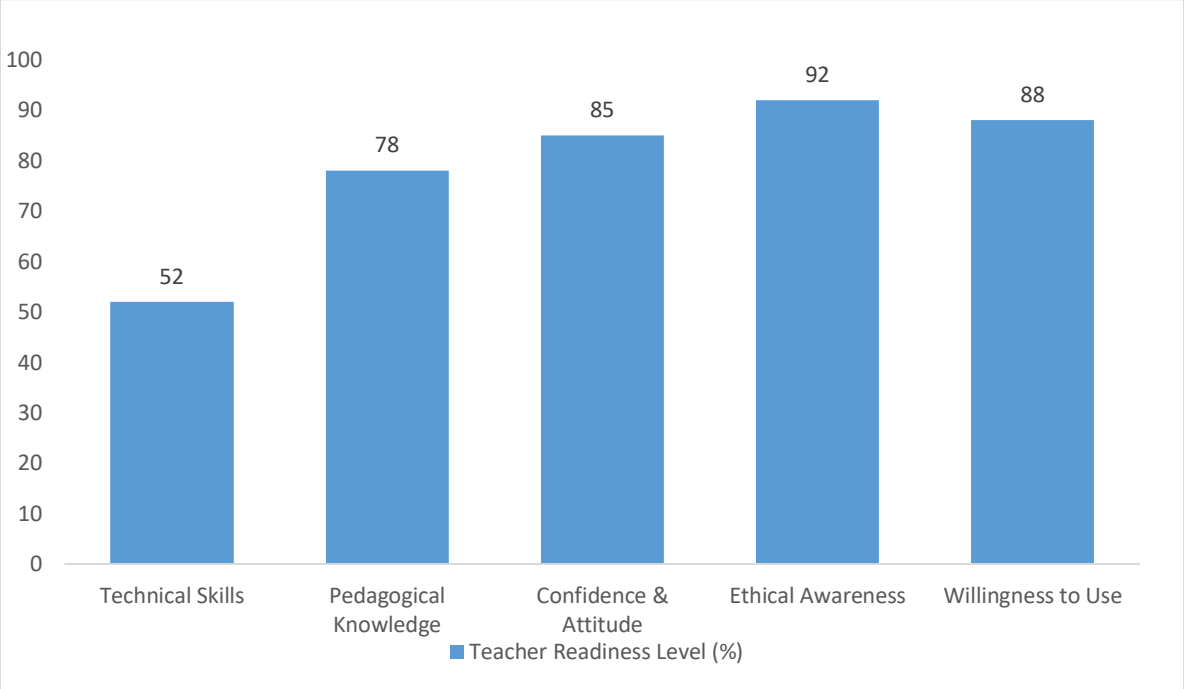

Figure 1. Profile of Elementary School Teachers' Readiness Dimensions across Technical, Pedagogical, and Ethical Aspects

Obstacles Faced by Teachers (Answering the Research Question)

Addressing the selected research question regarding the obstacles teachers face in integrating AI and digital citizenship, the study identified six major challenges, categorized into Internal (School Level) and External (Outside School).

Table 2. Matrix of Obstacles in AI and Digital Citizenship Integration

Obstacle Category	Description of Challenge	Factor Type
Generational Gap	Teachers feel less acquainted with rapid AI/digital platforms popular among students	Internal
Rapid Trends	Pre-packaged learning examples become outdated quickly for digital-native students	Internal
Lack of Guidelines	Absence of explicit curriculum frameworks regarding ethical AI use and digital ethics	Internal
Time Constraints	Packed subject schedules limit dedicated AI ethics discussions to short segments	Internal

Obstacle Category	Description of Challenge	Factor Type
Home Supervision	Unsupervised student access to smart devices and AI tools at home in the evening	External
Divergent Rules	Inconsistency between school digital agreements and home device habits	External

Source: processed data

A crucial finding is that the most consequential barriers are structural rather than technical. Technical knowledge gaps (such as generational difference) were successfully turned into pedagogical opportunities by teachers who adopted participatory approaches—asking students to explain new apps before guiding them on moral and ethical grounds. Conversely, limited instructional time and the absence of official curricular guidelines remain severe structural constraints beyond individual teacher control.

Layered Pedagogical Strategies and Effectiveness

To overcome readiness gaps and operational challenges, teachers employed a layered strategy structure.

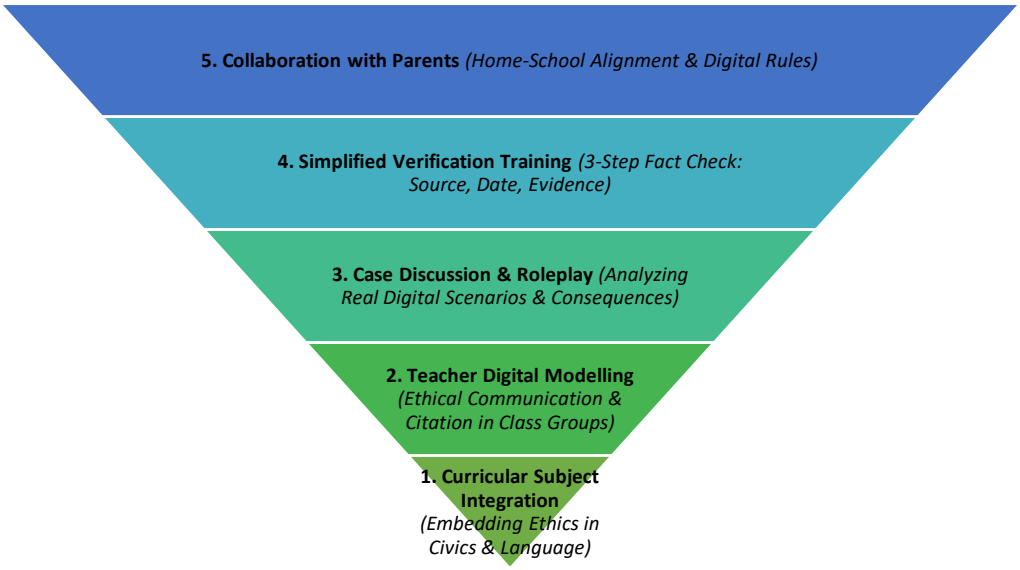

Figure 2. Layered Strategy Framework for AI and Digital Ethics Integration

Observations of student behavior indicators showed that passive ethical caution (refraining from forwarding unverified information) forms faster than active technical verification skills (checking timestamps and reverse image matching). This gap occurs because ethical attitudes grow through daily teacher modeling and habituation, whereas technical verification requires repeated practice the exact element constrained by limited class time.

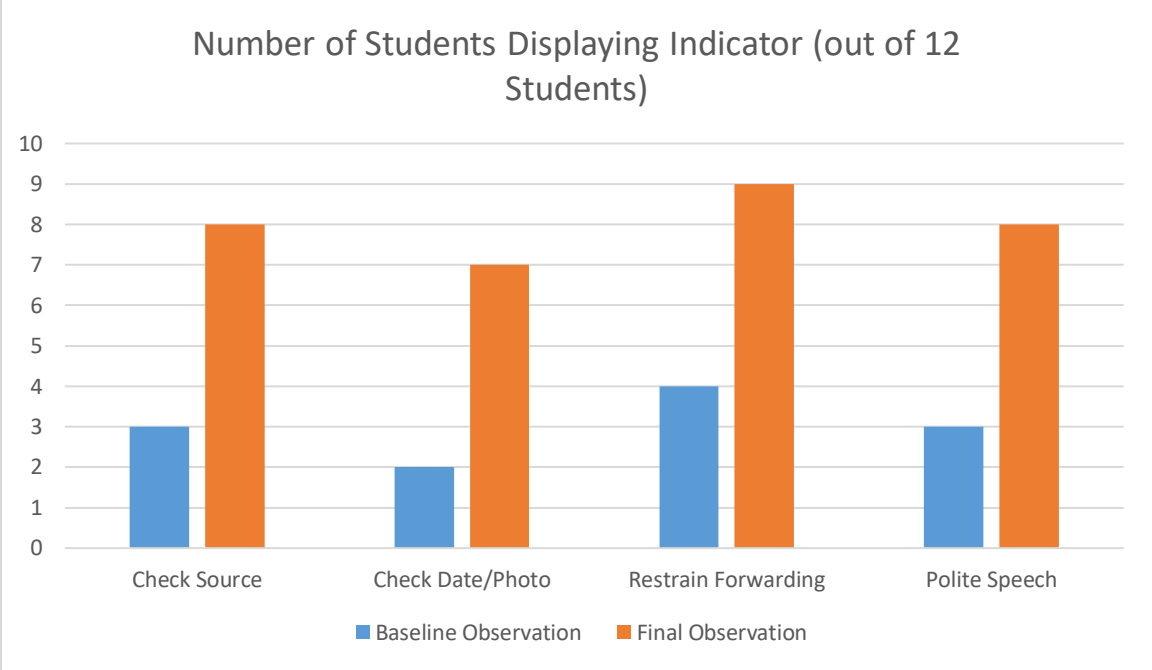

Figure 3. Comparison of Baseline and Final Student Digital Behavior Indicators (N = 12)

Discussion: AI Integration and Human-Centered Learning

The findings reinforce that AI should not be positioned as a replacement for teachers, but rather as an empowering supportive technology. While AI can automate lesson plan creation, quiz generation, and remedial material preparation, it cannot replace the teacher's role in character development, moral guidance, emotional empathy, and student mentorship. Strengthening teacher readiness ensures that smart education transitions remain human-centered, ethical, and developmentally appropriate for elementary school children.

4. Conclusion

This study evaluated elementary school teachers' readiness to utilize artificial intelligence (AI) in learning, with particular attention to the obstacles encountered during classroom implementation. The findings indicate that teacher readiness is driven by a combination of positive attitudes, perceived usefulness, and strong ethical awareness, although the development of technical skills requires continuous professional development. The primary obstacles to integrating AI and digital citizenship into elementary education are structural in nature, particularly severe time constraints and the lack of official curriculum guidelines, rather than teachers' inability to adapt to new technologies. Furthermore, teacher modeling and integrated classroom discussions have successfully fostered cautious digital attitudes among elementary students. However, students' technical verification skills remain underdeveloped due to limited opportunities for practical application.

Based on these findings, several policy and practical recommendations are proposed. Education authorities and policymakers should develop explicit and practical guidelines, along with modular curriculum units, to support the responsible integration of AI and digital citizenship into elementary education. School leaders should allocate dedicated time for digital literacy and AI ethics activities and establish formal parent-teacher communication frameworks to ensure consistency between home and school digital guidelines. Additionally, professional development programs should emphasize hands-on teacher training, particularly in practical AI prompt engineering for lesson design and ethical supervision techniques. These initiatives are expected to strengthen teachers' competencies and promote responsible and effective AI integration in elementary education.

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