

**A MODEL FOR AI-BASED TEACHING AND
LEARNING ADOPTION FOR ELEMENTARY
SCHOOL TEACHERS IN WEST JAVA,
INDONESIA**

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A MODEL FOR AI-BASED TEACHING AND LEARNING ADOPTION
FOR ELEMENTARY SCHOOL TEACHERS IN WEST JAVA, INDONESIA

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ABSTRACT

Artificial Intelligence (AI) is a computer system that mimics the human brain's ability to process information and make decisions. AI technology is used to learn patterns in data and make predictions or decisions based on that learning. Based on the current situation, elementary school teachers need help in adopting AI technology due to limited training, lack of resources, and resistance to change. In order to address this problem, this research aims to identify the factors influencing the adoption of AI technology among primary school teachers in West Java, Indonesia. The research involved 384 participants and used a quantitative approach. Specific factors influencing AI adoption were identified by developing a model for AI-based teaching and learning and assessing readiness factors. The results from the study identified optimism, innovativeness, insecurity, discomfort, perceived value, perceived trust, perceived usefulness, and perceived ease of use as factors in the successful adoption of AI among primary school teachers in West Java. The customized adoption model provides a practical roadmap for integrating AI into teaching and learning processes, highlighting regional specificities while remaining relevant to similar educational challenges worldwide. The assessment of readiness factors provides actionable insights for fostering a supportive environment for technology integration. The study concluded with recommendations for future research and implications for educators, administrators, and policymakers.

Keywords: AI adoption, elementary school teachers, readiness factors, quantitative methods, West Java, Indonesia.

APPROVAL

This is to certify that this thesis conforms to acceptable standards of scholarly presentation and is fully adequate, in quality and scope, for the fulfilment of the requirements for the degree of Doctor of Philosophy

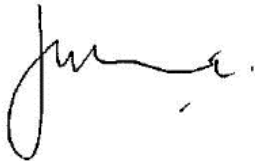
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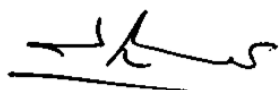


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DECLARATION

I hereby declare that the thesis submitted in fulfilment of the PhD degree is my own work and that all contributions from any other persons or sources are properly and duly cited. I further declare that the material has not been submitted either in whole or in part, for a degree at this or any other university. In making this declaration, I understand and acknowledge any breaches in this declaration constitute academic misconduct, which may result in my expulsion from the programme and/or exclusion from the award of the degree.

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Signature of Candidate:

Date: 23 April 2024

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LIST OF ABBREVIATION

AeU	Asia e University
AI	Artificial Intellegence
AU	Actual Use
DIS	Discomfort
INN	Innovativeness
INS	Insecurity
IU	Intention to Use
OPT	Optimism
PE	Perceived Easy to Use
PV	Perceived Validity
PT	Perceived Trust
PU	Perceived Usefulness
TAM	Technology Acceptance Model
TRI	Technology Readiness Index
TRM	Technology Readiness Model
UB	Usage Behaviour

CHAPTER 1

INTRODUCTION

1.0 Introduction

Artificial Intelligence (AI) is a computer system designed to mimic the human brain's abilities in processing information and making decisions. AI technology is a technology that is adopted to learn patterns in data and make predictions or decisions based on that learning (Niikura et al., 2022). The development of AI technology provided great potential for enhancing learning and teaching experiences. However, the successful adoption of AI technology in the educational context heavily relied on the readiness and acceptance of teachers as the primary users. AI technology is crucial in primary education in West Java, Indonesia. West Java is one of the most populous provinces in Indonesia, with a diverse and heterogeneous population. Introducing AI into this region's elementary school education can significantly impact students' learning outcomes and experiences. Teachers play a critical role in implementing AI technology in the classroom, guiding students in using AI tools, and effectively integrating them into the curriculum. The importance of AI technology implementation in elementary school learning lies in its ability to personalize education, adapt to individual student needs, and provide real-time feedback to enhance the learning process. Teachers in West Java need to be equipped with the knowledge and skills to effectively use AI technology to meet the diverse learning needs of their students. In addition, factors such as information literacy, access to technology, and available facilities and infrastructure play a critical role in determining teachers' readiness to adopt AI in their teaching practices. This research aims to identify the factors influencing the readiness and acceptance of AI technology among primary school teachers in West Java. The results of this study are expected to provide

valuable insights and recommendations for developing effective and sustainable AI implementation strategies in the educational context of West Java, ultimately improving the quality of education for students in the region.

1.1 Background of the Study

Education is one of the crucial aspects of the development of a nation. In the era of rapid information and communication technology advancement, implementing technology in learning has become a priority in enhancing the quality of education. One technology that is gaining attention is artificial intelligence (AI). AI has the potential to transform traditional learning paradigms into adaptive, interactive, and personalized learning experiences. Supriadi et al. (2022) explain that the development of AI technology provides significant opportunities to improve the education system in Indonesia. Nemorin et al. (2023) show that although artificial intelligence attracts attention in education and development, its usage still needs to be improved. According to Nazaretsky et al. (2022), AI-based Teaching and Learning is the utilization of Artificial Intelligence in education to enhance the teaching and learning process. This technology involves using algorithms and computer systems that can automatically collect, analyze, and process data to provide students with personalized and compelling learning experiences. By adopting AI-based Teaching and Learning, educators are expected to leverage this technology to improve the quality of instruction, provide timely feedback, and facilitate interaction and collaboration between students and teachers. According to Holmes Tuomi (2022), AI-based teaching and learning uses Artificial Intelligence in the context of education to enhance teaching and learning. This approach involves the application of AI technology in collecting, analyzing, and interpreting data to provide adaptive and personalized learning experiences for students.

In Indonesia, particularly in the region of West Java, educational development is a primary focus in efforts to enhance the quality of education at all levels. However, adopting AI technology in learning still needs to be improved, especially among elementary school teachers. Despite the promising benefits of AI technology in learning, the acceptance and readiness of teachers to adopt it still need to be improved. Bali et al. (2022) highlight the importance of enhancing digital literacy among educators and students to optimize the utilization of AI in the learning process. Alhumaid et al. (2023) show that the adoption of AI applications in educational institutions in Saudi Arabia is still limited and lacks structure. Factors such as lack of understanding about artificial intelligence, limited resources, and challenges in regulation and privacy influence the adoption of this technology. These studies provide essential information for educational institutions and policymakers regarding the challenges and factors that must be considered in adopting artificial intelligence in education.

To realize the potential of AI technology in learning in West Java, it is necessary to understand the factors influencing the readiness and acceptance of teachers to adopt this technology. Independent variables, information literacy, and the availability of facilities and infrastructure are crucial factors in achieving teachers' acceptance and adoption of AI technology. Starks Reich (2023) highlights that educators often need help integrating technology into learning, mainly due to inadequate technological support, insufficient training and skills, and lack of recognition and support from school leaders. This needs to be supported by curriculum implementation. Currently, the curriculum in Indonesia adopts a self-directed learning curriculum called "Merdeka Belajar" (Freedom to Learn) campus. Astini (2022) explains that one of the challenges

in implementing the concept of Merdeka Belajar in the New Normal era is the limited accessibility of students to the technology required for online learning.

Additionally, the role of teachers in supporting Merdeka Belajar needs to be enhanced through training and competency development. Hartanto et al. (2022) found that educational human resources' readiness to adopt information technology innovations still needs to improve. This is due to several factors, such as limited accessibility to technology, lack of training and competency development, and low motivation to learn new technology. Antonietti et al. (2023) discuss developing and validating the ICAP Technology Scale to measure how teachers integrate technology into learning activities by collecting data from 354 high school teachers in Switzerland and Italy using the developed scale. The study highlights the importance of technology use in learning and provides direction for developing better educational programs in the future.

Dharani et al. (2022) highlight the importance of teachers' role in integrating AI technology in learning to enhance the quality of learning and achieve better outcomes. Aggarwal et al. (2022) state that AI implementation also faces challenges, such as a lack of digital literacy, privacy concerns, and the increasing digital divide. Dai et al. (2023) integrate AI into the curriculum. However, they need help implementing curriculum, such as a lack of resources and training for teachers and difficulties in evaluating students' abilities in using AI technology. Batubara (2020) explains several challenges in implementing AI technology in teaching and learning, such as high implementation costs and lack of training and competency development for educators in using AI technology.

The findings of this research are expected to contribute to the development of education policies focused on the use of AI technology in learning. This research is

also expected to provide guidance for curriculum development and training programs to enhance the readiness and literacy of AI technology among elementary school teachers in West Java. Devi et al. (2022) explain the need for a child-centric approach to using AI in education, which means ensuring that this technology does not replace the role of teachers but remains a supportive tool that helps teachers facilitate better and personalized learning for each child. Kolog et al. (2022) explain that AI can significantly contribute to African education. Implementable solutions include developing integrated ICT systems, teacher and student training, flexible and inclusive curriculum development, and increased ICT resources and infrastructure access. The successful implementation of AI in education in Africa will require strong collaboration among all stakeholders and a sustainable and inclusive approach.

According to a study conducted by Ririh et al. (2020), several situations can be identified in implementing Artificial Intelligence (AI) in the education sector in Indonesia. These include:(1) Indonesia has a great potential for implementing AI in the education sector. This is due to rapid advancements in information and communication technology and the development of digital infrastructure in the country;(2) Despite the significant potential, the implementation of AI in the education sector in Indonesia faces resource limitations. There are constraints related to technology infrastructure, availability of adequate hardware and software, and limited internet access in specific areas;(3) The implementation of AI in the education sector also needs to improve understanding and sufficient skills in utilizing this technology. Teachers and educators need to receive adequate training and support to use AI in the learning process effectively;(4) In the context of AI implementation in the education sector, there is a need for mature regulations and policies to govern the use and protection of data, as well as address privacy and ethical issues. This is crucial to

ensure security and trust in the application of AI technology in the educational environment;(5) Despite the significant potential benefits, the adoption and acceptance of AI in the education sector still face challenges. There is resistance to change and concerns regarding replacing teachers' roles. Therefore, there is a need for appropriate approaches to socializing and engaging stakeholders in implementing AI in the education sector. By understanding these situations, strategic steps can be designed to address challenges and effectively leverage the potential of AI to improve the quality of education in Indonesia.

This research aims to identify the factors influencing the technological readiness and acceptance of AI-based learning among elementary school teachers in West Java, Indonesia. Through a deep understanding of these factors, it is expected that effective and sustainable implementation strategies of AI technology can be developed in the educational context of this region. Thus, this research has high relevance in the educational context of West Java, Indonesia, and can make a real contribution to enhancing the quality of learning by harnessing the potential of AI technology.

1.2 Problem Statement

The acceptance and readiness of elementary school teachers in West Java, Indonesia, towards using Artificial Intelligence (AI) technology in learning still need to be improved. One of the problems is the need for more technological readiness. A study by K. Kim Kwon (2023) investigated the AI competence of elementary school teachers in South Korea. The study aimed to understand the extent to which elementary school teachers have knowledge, skills, and attitudes related to AI. The research findings showed that many elementary school teachers face challenges and barriers in developing AI competencies. Some identified challenges include more specific AI-related training and professional development, school resources and infrastructure

limitations, and concerns about integrating AI technology into the existing curriculum. These factors can hinder the adoption of AI technology and reduce its effectiveness in enhancing the quality of learning. In addition to the need for more technological readiness, low information literacy is also a problem affecting the adoption of AI technology by elementary school teachers. Teachers need to have a sufficient understanding of AI technology, including knowledge of how to use it effectively and integrate it into the curriculum. However, the need for more information literacy about AI technology can constrain utilizing it optimally in learning. Furthermore, facility and infrastructure issues also influence the adoption of AI technology among elementary school teachers in West Java. Many schools still need help with access to the necessary hardware and software to support the use of AI technology. The lack of computers, unstable internet connections, or limited access to required AI devices can be barriers to effectively adopting AI technology in learning. Subowo et al. (2022) identified several challenges or barriers to using Artificial Intelligence (AI) among educators and teachers in Muhammadiyah elementary schools. Some of these challenges include the need for more knowledge and understanding of AI, limitations in technology resources and infrastructure, and concerns about job loss and the role of teachers in instruction. The paradigm shift in teaching and learning is also a challenge as it requires adjustments and additional training for teachers. Rahadiantino et al. (2022) explored constraints and challenges in implementing Artificial Intelligence (AI) learning for elementary school students in Batu City, Malang, East Java. Some identified constraints include the lack of knowledge and understanding of AI among students and teachers, limitations in infrastructure and technology devices in schools, as well as limited availability of resources. Other challenges include concerns about data security, resistance to change from stakeholders, and the need for adequate

training and mentoring for teachers to implement AI in learning. Based on the above explanations, several issues can be summarized as follows:

- i Lack of technological readiness: Elementary school teachers in West Java, Indonesia, face challenges in adopting artificial intelligence (AI) technology in learning. Many teachers still have limitations in using AI technology and need to understand its potential and benefits. This hinders the adoption of AI technology. (K. Kim & Kwon, 2023; Rahadiantino et al., 2022).
- ii Low information literacy: The need for more information literacy about AI technology is a barrier to effectively utilizing it in learning. Teachers need to have a sufficient understanding of AI technology and how to use it effectively and integrate it into the curriculum. This lack of understanding hinders elementary school teachers' adoption of AI technology in West Java. (Subowo et al., 2022; K. Kim & Kwon, 2023).
- iii Facility and infrastructure constraints: Facility and infrastructure issues also affect the adoption of AI technology among elementary school teachers. The lack of access to necessary hardware and software, such as computers, unstable internet connections, and limited access to AI devices, poses natural barriers to effectively adopting AI technology in learning. (Subowo et al., 2022; Rahadiantino et al., 2022; K. Kim & Kwon, 2023).

1.3 Research Objectives

The objectives of the research are:

- i To identify the factors influencing the adoption of AI technology in teaching and learning among elementary school teachers in West Java, Indonesia.

- ii To develop a model for AI-based teaching and learning adoption among elementary school teachers
- iii To evaluate the model for AI-based teaching and learning adoption among elementary school teachers in West Java, Indonesia.

Novelty in the objectives lies in the specific focus on AI technology adoption among elementary school teachers in West Java, Indonesia. The objectives encompass understanding the influencing factors, developing a tailored adoption model, evaluating readiness factors, and contributing to a comprehensive approach to AI integration in elementary education in this region

1.4 Research Question

The research question are:

- i What specific factors influence the adoption of AI technology in teaching and learning among elementary school teachers in West Java, Indonesia?
- ii What models can be used and adapted for AI-based teaching and learning process implementation?
- iii What factors in the model need to be assessed to determine the adoption of AI-based teaching and learning among elementary school teachers?

Table 1.1: Summarises the relationship between PS, RO, and RQ

PS	Problem Statements	RO	Research Objectives	RQ	Research Questions
PS1	Many teachers still have limitations in using AI technology and need to understand its potential and	RO1	To identify the factors influencing the adoption of AI technology in teaching and	RQ1	What are the specific factors that influence the adoption of AI technology in teaching and learning among

	benefits. This hinders the adoption of AI technology		learning among elementary school teachers in West Java, Indonesia		elementary school teachers in West Java, Indonesia?
PS2	Teachers need to have a sufficient understanding of AI technology and how to use it effectively and integrate it into the curriculum. This lack of understanding hinders elementary school teachers' adoption of AI technology in West Java.	RO2	To develop a model for AI-based teaching and learning adoption among elementary school teachers.	RQ2	What models can be used and adapted for AI-based teaching and learning process implementation?
PS3	The lack of access to necessary hardware and software, such as computers, unstable internet connections, and limited access to AI devices, poses natural barriers to effectively adopting AI technology in learning.	RO3	To evaluate the model for AI-based teaching and learning adoption among elementary school teachers in West Java, Indonesia	RQ3	What factors in the model need to be assessed to determine the adoption of AI-based teaching and learning among elementary school teachers?

1.5 Justification and Significance of Research

The justification of this study is to address the urgent need to understand the factors influencing technological readiness and acceptance of AI-based teaching and learning adoption model among elementary school teachers in West Java, Indonesia. In the era of rapid technological advancements, it is crucial to integrate AI into education to enhance the quality of learning and prepare students for an increasingly sophisticated future. By comprehending the factors affecting teachers' readiness and acceptance of AI, this research can better understand the challenges and opportunities in adopting AI technology in the elementary education setting. The findings of this study can be used to design appropriate educational policies, develop teacher training programs, and improve technology infrastructure in elementary schools. Thus, this research lays a solid foundation for accelerating the adoption of AI in elementary education in West Java, Indonesia, intending to enhance the quality of education and produce a generation prepared for the digital age.

The significance of the research include the following :

- i. Improved understanding of technology readiness factors, particularly in the context of AI adoption: This research aims to delve into a comprehensive analysis of the specific elements influencing technological readiness among elementary school teachers, focusing on adopting AI technology. The factors explored encompass critical aspects such as information literacy technology, accessibility to technological infrastructure, and pedagogical beliefs regarding AI integration. By shedding light on these factors, the study will elucidate why certain teachers exhibit a higher degree of preparedness to embrace AI technology, offering valuable insights into fostering effective AI adoption strategies in educational settings.