



Implementation of Artificial Intelligence Learning in Elementary Schools (A Study of Elementary School Teachers' Understanding and Challenges in Southeast Pontianak)

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ABSTRACT: Southeast Pontianak on the concept of artificial intelligence, challenges in implementing artificial intelligence learning, and teachers' efforts in overcoming these challenges. This research used a qualitative method with a case study approach. Data collection techniques were carried out through interviews, observation, and documentation. The results of the study indicate that teachers have a basic understanding of artificial intelligence as a technology that helps the learning process, such as creating teaching materials, questions, and learning media. However, the implementation of artificial intelligence still faces various challenges, such as limited understanding of the technology, lack of training, limited school facilities, and concerns about the impact of artificial intelligence use on students. Efforts made by teachers include independent study, attending training, discussing with fellow teachers, and implementing blended learning between artificial intelligence and conventional methods.

KEY WORDS: Artificial Intelligence, Learning, Elementary School Teachers, Educational Technology

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1. INTRODUCTION

The development of digital technology has brought about significant changes in various areas of life, including education. Digital transformation in education is driving a paradigm shift in learning from conventional approaches to more adaptive, interactive, and student-centered learning. One technology that is increasingly being discussed in the world of education is artificial intelligence. This technology enables a more personalized, effective, and data-driven learning process through various features such as automated assessments, the development of learning materials, and the provision of rapid feedback to students. The integration of artificial intelligence in education is also part of efforts to strengthen 21st-century competencies and digital literacy in students, as emphasized in the implementation of the Independent Curriculum (Kemendikbudristek, 2022).

In the context of basic education, the use of artificial intelligence presents unique challenges because students are at a stage of cognitive, social, and emotional development that still requires intensive guidance from teachers. Teachers no longer act merely as transmitters of information but also as learning facilitators capable of integrating technology appropriately and meaningfully into the teaching and learning process. Therefore, teacher readiness is a crucial factor in the successful implementation of artificial intelligence in elementary schools (Wilson & Thompson, 2024). Teachers are required to possess technical, pedagogical, and psychological skills to effectively utilize technology according to student needs.

However, the implementation of artificial intelligence in elementary school learning still faces various obstacles. Previous research shows that teachers' understanding of the basic concepts of artificial intelligence is still relatively low, and most teachers lack experience integrating this technology into their lessons (Anwar & Riyanti, 2022). Teachers also struggle to grasp basic concepts such as machine learning, natural language processing, and the use of artificial intelligence-based applications in learning contexts. This situation impacts teachers' low confidence in utilizing artificial intelligence technology as part of their learning strategies (Widodo & Sutrisno, 2023).

In addition to limited understanding, challenges to implementing artificial intelligence also relate to limited school facilities and infrastructure, lack of training, and concerns about the impact of technology use on students' social and emotional development.

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Recent research shows that uncontrolled use of digital technology can impact the quality of social interactions and communication skills of elementary school students (Anderson & Lee, 2024). Furthermore, teachers still need technical and pedagogical support to effectively and responsibly utilize artificial intelligence in their learning (Suryadi & Permana, 2023).

This situation was also found among elementary school teachers in Southeast Pontianak. Based on a preliminary study, most teachers still experience confusion in understanding the concept of artificial intelligence and its application in learning. Teachers view artificial intelligence as an interesting and useful technology, but still experience limitations in its use, both in terms of competency and learning support facilities. This is despite the government's digital transformation policy in education encouraging the implementation of coding- and artificial intelligence-based learning as part of strengthening students' digital competencies in Indonesia.

Based on these issues, this study was conducted to analyze elementary school teachers' understanding of the concept of artificial intelligence in Southeast Pontianak, identify challenges faced in implementing artificial intelligence-based learning, and describe the efforts teachers have made to overcome these challenges. This research is expected to provide an empirical overview of elementary school teachers' readiness to face the digital transformation of education and serve as a basis for developing training and mentoring programs that are more tailored to teacher needs. Furthermore, the results of this study are expected to contribute to the development of studies on the implementation of artificial intelligence in elementary education, particularly in the context of learning in Indonesia.

II. METHOD

This research employed a qualitative approach with a case study approach. The qualitative approach was chosen because the research aimed to gain a deeper understanding of elementary school teachers in Southeast Pontianak's understanding and challenges in implementing artificial intelligence in their learning. The case study approach focused on the real-world, contextual conditions experienced by teachers in technology-based learning practices in elementary schools. This approach enabled researchers to obtain a holistic picture of teachers' experiences, perceptions, and preparedness for the digital transformation of education.

The research subjects consisted of elementary school teachers in Southeast Pontianak District, Pontianak City, West Kalimantan, from both public and private schools. Subjects were selected using a purposive sampling technique, considering teachers who were familiar with or used artificial intelligence technology in their learning activities. Data were obtained through observation, in-depth interviews, and documentation studies. Observations were conducted to obtain an overview of the use of artificial intelligence in the learning process, the condition of infrastructure, and teacher-student interactions in technology-based learning. In-depth interviews were conducted semi-structured to elicit information regarding teachers' understanding of the concept of artificial intelligence, implementation challenges, and efforts made to overcome barriers to its use in elementary schools. Documentation was used to supplement data in the form of learning tools, school policies, and other supporting documents relevant to the research.

The research instruments consisted of observation sheets, interview guides, and documentation. The observation sheets were used to record learning conditions and technology use in schools. The interview guides were developed based on the research focus, which included teacher understanding, implementation challenges, and efforts in using artificial intelligence in learning. Documentation was used as supporting data to strengthen the results of the observations and interviews.

Data validity was ensured using source triangulation and technical triangulation. Source triangulation was conducted by comparing data obtained from several informants, while technical triangulation was conducted by comparing the results of observations, interviews, and documentation to obtain valid and consistent data. The data analysis technique used thematic analysis with the stages of data reduction, data presentation, and drawing conclusions, as proposed by Matthew B. Miles, A. Michael Huberman, and Johnny Saldaña. The data obtained were analyzed continuously from the data collection process to the final conclusions to identify themes related to teacher understanding, implementation challenges, and efforts to use artificial intelligence in learning in elementary schools.

III. RESULTS

This study was conducted to determine the understanding of elementary school teachers in Southeast Pontianak regarding the concept of artificial intelligence, the challenges faced in implementing artificial intelligence-based learning, and the teachers' efforts to overcome these obstacles. Data were obtained through in-depth interviews, observations, and documentation with elementary school teachers from public and private schools in Southeast Pontianak. The results are presented based on the predetermined research focus and analyzed by linking them to relevant theories and previous research findings.

Before presenting the research results, the following is a profile of the research informants who served as the primary data sources for this study.

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Table 1: Informant Profile

No.	Name	School Name	Age	Gender	Last education	long time teaching	Classroom Teacher
1	Rizky Herman Susilo, S.Pd	Al-Mukhlisun Islamic Elementary School	28	Man	S1	2 years	5
2	Agus Widiyanto, S.Pd	SDN 09, Southeast Pontianak	28	Man	S1 Pend. Matematika	5 years	5
3	Kartika Citra, S.Pd	Plus Gembala Baik Elementary School	37	Woman	S1 Pend. Kimia	16 years	6

Based on Table 1, the research informants consisted of three elementary school teachers with varying educational backgrounds, ages, and teaching experience. The informants came from both public and private schools, allowing the data to provide a snapshot of the implementation of artificial intelligence in learning across diverse elementary school environments.

The results indicate that teachers are familiar with and have begun utilizing artificial intelligence in their teaching. However, the level of understanding and implementation of artificial intelligence varies among teachers. A summary of the interview results can be seen in Table 2 below.

Table 2: Summary of Interview Results

	Question		
Informant	Teachers' understanding of the concept of artificial intelligence	Challenges for Teachers in Implementing Artificial Intelligence Learning	Teachers' efforts to overcome the challenges of implementing artificial intelligence learning
Informant 1	a. Technology created to assist human work b. Typically used to assist teachers in creating teaching materials and finding references c. Using applications to automatically create questions or help explain material	a. Sometimes confused about how to use it appropriately in learning. b. Quite influential: not all students have their own devices, and internet access is sometimes unstable, so the use of AI hasn't been fully implemented in the classroom. At our school, children don't bring cell phones or other devices. c. Quite ready to accept learning involving AI because they are now quite familiar with technology from an early age.	a. I've tried to learn independently first, for example, by watching tutorials and asking fellow teachers. b. For my teaching, I've adapted my methods, not solely using AI, but combining them with traditional teaching methods so that students still understand. c. A suitable learning model doesn't rely entirely on technology; it's better to combine it with other technologies.
Informant 2	a. a machine to imitate human thinking b. a human-like way of thinking using AI to create images or posters c. creating videos and quizzes	a. a dense curriculum, lack of in-depth training, and concerns about children becoming dependent on AI b. very limited, no computer labs, and no computer equipment c. children are ready, but their ethics regarding AI are not yet ready and they are still emotional	a. Direct tutorials for children, developing lesson plans with AI, and providing digital literacy information b. Adapted to the lesson plan but not yet optimal c. Mixed model of hands-on and hands-on learning
Informant 3	a. Artificial intelligence to assist humans b. Understandable enough to lighten teachers' workload c. Yes, create assessment rubrics and assessment materials	a. The language used is inappropriate. b. It's quite influential; for example, if there's no internet, database access will be reduced, resulting in slower work. c. Be prepared and make your writing more engaging.	a. Limitations in editing the language mean it takes longer. b. Yes, you have to choose the right combination of AI and materials. c. Project-Based Learning (PjBL) and Problem-Based Learning (PBL)

IV. DISCUSSION

Teachers' understanding of artificial intelligence demonstrates that teachers perceive artificial intelligence as a technology that assists human work and learning, such as creating teaching materials, questions, learning media, videos, and searching for

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references. Regarding challenges in implementing artificial intelligence, teachers encounter obstacles such as limited technological understanding, lack of training, limited devices and internet access, and concerns about the impact of artificial intelligence on students. However, teachers strive to overcome these challenges by engaging in independent learning, discussing with fellow teachers, improving digital literacy, and implementing blended learning.

Table 2 shows that teachers have a basic understanding of the concept of artificial intelligence and its benefits in learning. Teachers also utilize artificial intelligence to assist with learning administration, material development, and learning media. This finding indicates that technological developments are beginning to be accepted in elementary education environments, although implementation is not yet fully optimal.

The results of the study indicate that teachers' understanding of artificial intelligence remains at a basic level and is more oriented towards the practical functions of technology. Teachers perceive artificial intelligence as a tool that can simplify tasks such as creating questions, searching for references, and creating learning media. These findings align with UNESCO's opinion that artificial intelligence in education can support learning automation, material personalization, and the development of digital learning resources (UNESCO, 2023). Furthermore, Wayne Holmes explains that artificial intelligence can assist teachers in developing materials and improving learning effectiveness (Holmes, 2022). Thus, the research findings indicate that teachers already have an initial awareness of the benefits of artificial intelligence in education.

However, the implementation of artificial intelligence-based learning still faces various challenges. Teachers stated that limited technological capabilities are a major obstacle to the use of artificial intelligence in learning. Furthermore, limited school facilities, such as unstable internet access and a lack of digital devices, prevent the use of artificial intelligence from being fully implemented in the classroom. This finding aligns with Dirk Ifenthaler's research, which states that teachers' low digital readiness and limited training are the main challenges to implementing artificial intelligence in education (Ifenthaler & Schumacher, 2023). Teachers also expressed concerns about the impact of artificial intelligence use on elementary school students, particularly regarding dependence on technology and the ethical aspects of its use. In the context of elementary education, the use of digital technology requires appropriate supervision and guidance because students are still in the social and emotional developmental stage. This aligns with Neil Selwyn's opinion, who stated that the use of artificial intelligence in education must be carried out wisely to avoid negatively impacting students' mindsets and learning behaviors (Selwyn, 2022).

To overcome these challenges, teachers are implementing several efforts, including self-study through tutorials, discussions with fellow teachers, and improving digital literacy. Teachers also implement blended learning, combining the use of artificial intelligence with conventional teaching methods to ensure students continue to receive direct support. Furthermore, some teachers employ Project-Based Learning (PjBL) and Problem-Based Learning (PBL) models to maintain student active engagement.

The findings of this study indicate that the implementation of artificial intelligence in elementary schools in Southeast Pontianak is still in its early stages of development. Teachers have positive attitudes toward the use of artificial intelligence, but still need support in the form of training, improved school facilities, and strengthening digital competencies. With this support, the implementation of artificial intelligence in learning is expected to be more optimal and support improvements in the quality of education in the digital era.

V. CONCLUSION

Based on research on the implementation of artificial intelligence learning in elementary schools in Southeast Pontianak, it can be concluded that teachers have a basic understanding of the concept of artificial intelligence as a technology that assists human work, particularly in learning processes such as creating teaching materials, compiling questions, developing learning media, and assessing. However, teachers' understanding is still predominantly practical and has not yet fully led to in-depth pedagogical application. The implementation of artificial intelligence-based learning also faces various challenges, including limited teacher technological competence, lack of training, limited school facilities and infrastructure, unstable internet access, and concerns about the impact of technology use on elementary school students. Nevertheless, teachers demonstrate a positive and open attitude to technological developments by undertaking various efforts, such as independent study, discussions with fellow teachers, participating in training, and implementing blended learning through Project-Based Learning (PjBL) and Problem-Based Learning (PBL) models. The findings of this study indicate that the successful implementation of artificial intelligence-based learning in elementary schools requires the support of teacher competence, supporting facilities, and sustainable educational policies to ensure effective technology use and appropriateness to the characteristics of elementary school students. Based on the research findings, it is recommended that teachers continue to improve their digital competencies and pedagogical skills in utilizing artificial intelligence through training and ongoing professional development. Schools are expected to provide adequate technological facilities and support digital transformation programs for learning. The government and education offices also need to expand training and mentoring related to the implementation of artificial intelligence in primary education to better prepare teachers for developments in educational technology in the digital era.

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VII. DISCLOSURE

The author declares that there are no conflicts of interest related to this research entitled "*Implementation of Artificial Intelligence Learning in Elementary Schools (A Study on the Understanding and Challenges of Elementary School Teachers in Southeast Pontianak)*". This study was conducted independently for academic purposes and did not receive any commercial or financial support that could influence the research process, findings, or interpretation of the results.

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