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THE ROLE OF ELEMENTARY SCHOOL TEACHERS IN INTEGRATING ARTIFICIAL INTELLIGENCE CONCEPTS THROUGH SIMPLE CODING ACTIVITIES

PERAN GURU SEKOLAH DASAR DALAM MENGINTEGRASIKAN KONSEP KECERDASAN BUATAN MELALUI AKTIVITAS PEMROGRAMAN SEDERHANA.

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Abstract

The rapid advancement of Artificial Intelligence (AI) presents both opportunities and challenges for elementary education. Teachers play a strategic role in preparing young learners to understand and adapt to technology critically, creatively, and ethically. This study aims to analyze the role of elementary school teachers in integrating AI concepts through simple coding activities, as well as to identify the strategies and challenges encountered during implementation. The research employed a qualitative descriptive approach, using interviews, classroom observations, and document analysis as data collection techniques. The findings reveal that teachers serve as digital learning facilitators, innovators in designing coding-based learning activities, and ethical guides who help students use technology responsibly. Simple coding activities effectively foster students' logical thinking, creativity, and digital collaboration skills. However, limited technological infrastructure and insufficient teacher training remain major obstacles to sustainable implementation. Therefore, systemic support through educational policy, professional development, and adaptive curriculum design is essential. Integrating AI concepts through simple coding in elementary schools not only enhances digital literacy but also cultivates ethical awareness and social responsibility toward technology. With collaborative support from educators, institutions, and policymakers, elementary education can become a foundational stage for shaping a generation that is intelligent, creative, and morally grounded in the era of artificial intelligence.

Keywords : elementary school teacher, artificial intelligence, simple coding, digital literacy, 21st-century learning.

Abstrak

Kemajuan pesat Kecerdasan Buatan (AI) menghadirkan peluang dan tantangan bagi pendidikan dasar. Guru memainkan peran strategis dalam mempersiapkan peserta didik muda untuk memahami dan beradaptasi dengan teknologi secara kritis, kreatif, dan etis. Studi ini bertujuan untuk menganalisis peran guru sekolah dasar dalam mengintegrasikan konsep AI melalui aktivitas pengkodean sederhana,

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serta mengidentifikasi strategi dan tantangan yang dihadapi selama implementasi. Penelitian ini menggunakan pendekatan deskriptif kualitatif, dengan teknik pengumpulan data berupa wawancara, observasi kelas, dan analisis dokumen. Temuan ini mengungkapkan bahwa guru berperan sebagai fasilitator pembelajaran digital, inovator dalam merancang kegiatan pembelajaran berbasis kode, dan pemandu etika yang membantu siswa menggunakan teknologi secara bertanggung jawab. Aktivitas pengkodean sederhana secara efektif menumbuhkan pemikiran logis, kreativitas, dan keterampilan kolaborasi digital siswa. Namun, keterbatasan infrastruktur teknologi dan pelatihan guru yang tidak memadai tetap menjadi hambatan utama bagi implementasi yang berkelanjutan. Oleh karena itu, dukungan sistemik melalui kebijakan pendidikan, pengembangan profesional, dan desain kurikulum yang adaptif sangat penting. Mengintegrasikan konsep AI melalui pengkodean sederhana di sekolah dasar tidak hanya meningkatkan literasi digital tetapi juga menumbuhkan kesadaran etis dan tanggung jawab sosial terhadap teknologi. Dengan dukungan kolaboratif dari pendidik, lembaga, dan pembuat kebijakan, pendidikan dasar dapat menjadi tahap fundamental dalam membentuk generasi yang cerdas, kreatif, dan berlandaskan moral di era kecerdasan buatan.

Kata Kunci : guru sekolah dasar, kecerdasan buatan, pengkodean sederhana, literasi digital, pembelajaran abad ke-21.

1. INTRODUCTION

Primary education now faces both significant challenges and opportunities in incorporating digital literacy as part of 21st-century competencies. With the rapid development of artificial intelligence (AI) technology, elementary schools have the opportunity to not only teach the use of digital devices but also instill an understanding of how these technologies work and how students can become wise and creative users. Research shows that integrating AI into learning contexts can provide more adaptive and personalized experiences for students and support teachers in designing more meaningful learning interactions(Wang et al., 2024).

In this context, elementary school teachers are not simply transmitters of material but also facilitators, guiding children into the logic, patterns, and processes of computational thinking through simple coding activities. These coding activities can serve as a bridge to AI concepts, as students can learn to create instructions, think algorithmically, and see the direct impact of their designs. A study on the integration of coding and AI into the elementary school curriculum emphasized that these activities not only develop technical skills but also enhance creativity and problem-solving abilities from an early age (Khalifa & Albadawy, 2024).

Furthermore, the success of such integration depends heavily on teachers' competence in understanding technology and designing engaging, relevant learning experiences for students, while also addressing ethical and inclusive aspects. Studies on the teaching profession and the adoption of AI technology in learning highlight that teacher readiness, in terms of knowledge, attitudes, and infrastructure support, is a critical factor determining the sustainability and quality of AI integration in elementary education.

Therefore, this article aims to explore the role of elementary school teachers in integrating artificial intelligence concepts through simple coding activities, including the challenges faced and practical strategies that can be implemented in the classroom. It is hoped

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that this discussion can serve as a reference for schools, teachers, and policymakers in designing learning that is relevant to current and future digital needs.

2. RESEARCH METHOD

This study used a descriptive qualitative approach with the aim of gaining a deeper understanding of the role of elementary school teachers in integrating artificial intelligence (AI) concepts through simple coding activities in the classroom. This approach was chosen because it can describe phenomena naturally and contextually based on teachers' experiences in the learning process. Qualitative methods are effective for exploring individual meanings and experiences in dynamic educational contexts (Creswell, J. W., & Poth, 2018).

The research subjects consisted of elementary school teachers who had participated in basic coding training and the application of digital technology in learning. Informants were selected using purposive sampling, selecting participants deemed to have the best understanding of the topic and direct experience with AI and coding implementation in schools. This approach is relevant for obtaining rich and in-depth data (Prabandari 2020) (Etikan, I., Musa, S. A., & Alkassim, 2016).

Data were collected through semi-structured interviews, classroom observations, and analysis of learning documents. Interviews were conducted to elicit teachers' perceptions of the benefits and challenges of AI integration, while observations were used to identify teaching strategies used. Documents such as lesson plans (RPPs) and simple coding modules were analyzed to determine the extent to which AI was integrated into the planning. This combination of techniques strengthened the validity and integrity of the research data(Merriam, S. B., & Tisdell, 2015).

Data analysis was conducted using an interactive model consisting of three stages: data reduction, data presentation, and conclusion drawing (Miles, M. B., Huberman, A. M., & Saldaña, 2014). Data from interviews and observations were coded based on themes such as teachers' understanding of AI, coding strategies, and supporting and inhibiting factors in schools. Data validity was strengthened through triangulation of sources and methods, as well as peer debriefing. This approach ensured the accuracy and consistency of the interpretation of the research results.

3. RESULT AND DISCUSSION

a. Overview of AI Integration Implementation in Elementary Schools

Interviews and observations indicate that most elementary school teachers participating in the study were familiar with the basics of coding, primarily through learning platforms such as Scratch, Code.org, and Tynker. These activities were used to introduce algorithmic thinking logic and decision-making principles, which are also fundamental to artificial intelligence (AI).

Teachers stated that simple coding lessons helped students understand the concept of cause and effect, think systematically, and collaborate in completing assignments. This finding

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aligns with (Wang et al., 2024) finding that coding-based activities improve children's problem-solving skills and digital literacy from an early age.

Table 1. Integration of AI Concepts in Simple Coding Activities in Elementary School

Learning Aspects	Simple of Coding Activities	AI Concepts Instilled	Impact on Students
Understanding Logic and Algorithms	Creating animated characters with Scratch.	Processing sequences of commands (sequencing)	Improving logical and systematic thinking skills
Pattern Recognition	A "guess the color" game based on command blocks	Basic pattern recognition, similar to machine learning	Student are able to recognize patterns from experimental results
Automated Decision Making	Sensor-based mobile robot simulation	The "if-then-else" principle as the basisi of AI logic	Training students to make condition-based desisions
Digital Collaboration	Group coding with code.org	Digital-based social learning	Developing droup communication and responsibility

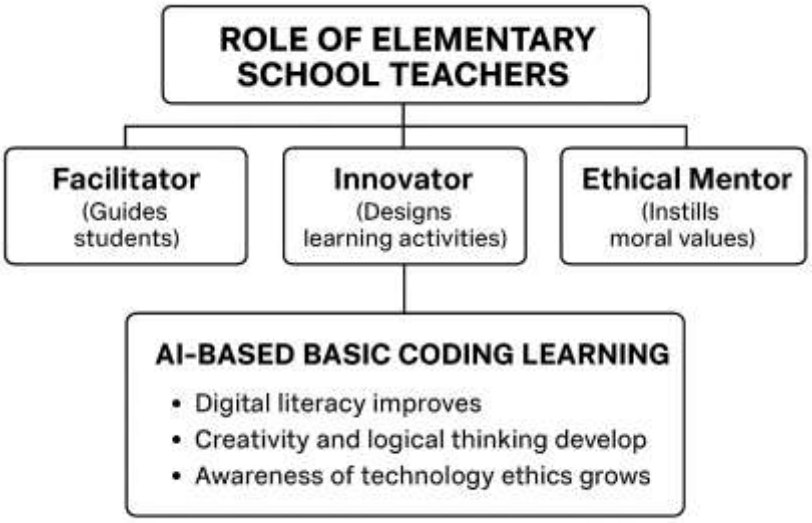
(Data source: observation & interview results, 2025).

b. The Role of Teachers as Facilitators and Innovators

Teachers play a crucial role in adapting the complexity of the material to the level of students' cognitive development. Based on the analysis, teachers not only teach how to code but also instill ethical values in the use of technology.

This approach is consistent with UNESCO research (2024), which emphasizes that teachers need to be "AI-Ready Educators," meaning they need to guide students in understanding the benefits, risks, and responsibilities of using artificial intelligence (Memarian & Doleck, 2024).

Figure 1. Teacher Role Scheme in Integrating AI and Coding in Elementary Schools



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The diagram above shows that the role of teachers is no longer merely as transmitters of knowledge, but also as architects of digital learning. Teachers are innovating by creating coding activities relevant to students' daily lives (e.g., intelligent traffic simulations or virtual animals that learn from user input) (Skills, 2025).

c. Challenges and Implementation Strategies

Despite high teacher enthusiasm, research has identified several key challenges, including(Temitayo et al., 2024):

- ✓ Limited devices and internet connections.
- ✓ Lack of ongoing AI and coding training for teachers.
- ✓ Minimal school policy support for the integration of new technologies.

To address this, several strategies have been proposed:

- ✓ Conducting collaborative training between teachers (peer mentoring).
- ✓ Utilizing open-source platforms (e.g., offline Scratch).
- ✓ Integrating AI activities into thematic subjects without increasing the curriculum burden.

This is supported by research (Kim, H., Park, S., & Lee, 2024), which suggests that teacher collaboration and the use of open sources can strengthen the sustainable implementation of AI at the elementary level.

d. Impact of Learning on Students

Observations showed that students showed improvements in:

- ✓ Critical thinking and problem-solving skills (82%)
- ✓ Digital collaboration skills (74%)
- ✓ Creativity and idea exploration (69%)

These results indicate that simple coding-based learning can introduce AI concepts in a fun and meaningful way.

These findings support a study by (Angeli, C., & Valanides, 2023) that coding in elementary schools is not just a technical skill, but also an instrument for developing students' reflective and metacognitive thinking.

The integration of artificial intelligence through simple coding activities in elementary schools has been shown to expand students' digital competencies while simultaneously affirming the role of teachers as agents of educational change. Teachers act as creative facilitators, learning innovators, and digital ethics mentors(Chassignol et al., 2018). Sustainable implementation requires systemic support in the form of teacher training, technological infrastructure, and school policies that adapt to the digital transformation of elementary education.

4. CONCLUSION

The integration of artificial intelligence (AI) concepts through simple coding activities in elementary schools has demonstrated a positive impact on the development of digital competence, logical thinking, and student creativity. Coding-based learning not only trains

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technical skills but also fosters systematic, reflective, and collaborative thinking. The role of teachers is a key factor in successful implementation, serving as facilitators who guide the learning process, innovators who design contextual coding activities, and ethical guides who instill the value of responsibility in technology use.

The integration of artificial intelligence through simple coding activities in elementary schools has proven effective in improving digital literacy, logical thinking skills, and student creativity. Teachers play a central role as facilitators, innovators, and ethical guides, guiding students to understand technology critically and responsibly. Simple coding lessons provide an initial means of introducing AI concepts through fun and meaningful exploratory activities. The success of this integration is greatly influenced by teacher readiness, school policy support, and the availability of adequate technological resources.

The research results show that through adaptive teacher support and engaging learning strategies, basic AI concepts can be introduced at an early age in a simple yet meaningful way. Thus, coding learning in elementary schools can provide an important foundation for strengthening digital literacy and preparing the younger generation for the era of artificial intelligence..

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