

Digital Transformation: Artificial Intelligence and Coding Learning Planning for Indonesian Elementary School Children 2024

Tutik Lestari^{1*}, Arni Retno Mariana²

¹Faculty of Science and Technology, System and Information Technology, Darunnajah University, Jakarta, Indonesia

²Faculty of Computer Science, Digital Business, Bina Sarana Global Institute of Technology and Business, Tangerang, Indonesia

Email: ¹tutik.lestari@darunnajah.ac.id, ²arnie.mariana354@gmail.com

Abstract– The rapid advancement of technology necessitates early education on digital skills to prepare future generations for the challenges of the 21st century. This initiative focuses on integrating Artificial Intelligence (AI) and coding into the elementary school curriculum in Indonesia, starting in 2024. The program aims to equip students with foundational digital literacy, critical thinking, and problem-solving skills through interactive and age-appropriate learning methods. By combining theoretical knowledge and practical applications, this initiative seeks to foster innovation, creativity, and adaptability among young learners. The project also includes training for educators, development of localized educational resources, and collaboration with technology partners to ensure effective implementation. This paper outlines the strategic planning, curriculum design, and expected outcomes of this transformative educational initiative.

Keyword: Computational Thinking, Digital Literacy, AI Education, Coding, Curriculum Development

1. INTRODUCTION

The 21st century is marked by rapid advancements in technology, transforming the way individuals live, work, and learn. Among these advancements, Artificial Intelligence (AI) and coding stand out as pivotal tools shaping the future of global economies and societies (Alan et al., 2022). Digital literacy is no longer an optional skill but a foundational necessity for addressing future challenges (Smith & Jones, 2021). Early exposure to these technologies is becoming increasingly essential to prepare younger generations for the digital era (Lee et al., 2020).

In Indonesia, the integration of AI and coding into education remains in its early stages, particularly at the elementary school level (Rahman & Yusuf, 2020). However, the country's commitment to embracing the opportunities of the Fourth Industrial Revolution highlights the importance of cultivating digital literacy and computational thinking from a young age (Wijaya, 2021). The "Artificial Intelligence and Coding Learning Planning for Indonesian Elementary School Children 2024" initiative aims to transform the educational landscape by introducing students to foundational AI and coding concepts (Lestari et al., 2023).

This initiative aligns with Indonesia's broader national strategy to foster innovation, improve human resources, and compete on a global scale (Putri & Nugroho, 2022). By integrating AI and coding into the curriculum, the program aspires to develop critical thinking, creativity, and problem-solving skills among students (Adams et al., 2019). It also seeks to familiarize them with technologies that will define their future (Siregar, 2020).

The development of information and communication technology has revolutionized education, replacing traditional teaching methods with innovative digital approaches (Cahyono & Dewi, 2022). Mobile phones and wireless networks have facilitated access to knowledge, enhancing learning opportunities for students worldwide (Kim et al., 2021). Despite these advancements, there are significant challenges in implementing AI and coding education, such as limited resources, lack of teacher training, and unequal access to infrastructure (Hidayatullah et al., 2023).

Based on data from the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), improving digital literacy among children is critical to ensuring equitable educational outcomes (Santoso & Hasan, 2022). Research has shown that early exposure to AI and coding can significantly enhance students' logical thinking and problem-solving abilities (Chen et al., 2020). Furthermore, integrating these technologies into the curriculum can inspire innovation and adaptability among young learners (Widodo, 2021).

Global trends also indicate a growing emphasis on STEM (Science, Technology, Engineering, and Mathematics) education, which provides a robust framework for introducing AI and coding at the elementary level (Taylor et al., 2019). By contextualizing these subjects in real-world scenarios, educators can make learning more engaging and relevant (Yusuf & Hamid, 2021). The use of interactive tools, such as Scratch and Blockly, has proven effective in teaching basic programming concepts to children (Anderson & Brown, 2020).

This paper outlines the strategic planning, curriculum design, and expected outcomes of this transformative educational initiative. It emphasizes the need for collaboration among stakeholders, including educators, policymakers, and technology partners, to ensure the program's success (Wibowo et al., 2023). By addressing existing challenges and leveraging available resources, Indonesia can pave the way for a more inclusive and adaptive education system (Rahman et al., 2022).

2. RESEARCH METHODOLOGY

2.1. Definition and Basic Concepts

a. Theoretical Basis Related to AI for Elementary Schools

Artificial Intelligence (AI) is a branch of computer science that focuses on developing systems that can perform tasks that usually require human intelligence. Although the concept of AI is usually associated with complex technology, for elementary schools, its understanding and application can be adjusted to be simpler and more relevant to the needs of elementary education.

b. Definition and Basic Concepts of AI

AI can be introduced to elementary school students as a technology that allows computers to "learn" and "think" like humans, even though they are actually just the result of programs created by humans. Some basic concepts that can be taught include:

- **Patterns and Recognition:** AI is able to recognize patterns in data, such as recognizing images, sounds, or text.
- **Machine Learning:** AI learns from data, such as how children learn from experience.
- **Simple Algorithms:** Step-by-step processes to solve problems, such as following game instructions.

c. Objectives of Introducing AI in Elementary Schools

- **Introducing Future Technology:** Students are introduced to AI as part of the modern world that they will face.
- **Development of Logical Thinking:** Through activities related to AI, students are trained to think critically and logically.
- **Ethics and Use of AI:** Teaching students about responsibility in using technology.

d. Philosophical and Pedagogical Foundations

- **Learning Through Experimentation:** A constructivist approach can be applied, where students learn by trying and exploring AI technology directly.
- **STEM Integration:** Introduction to AI can be included in the STEM (Science, Technology, Engineering, and Mathematics) approach.

The dimensions of our model of integrated STEM teacher identity are defined in Figure 1.

STEM learner identity dimensions	Teacher identity dimensions
<ul style="list-style-type: none"> • Performance: How capable do I believe I am to perform STEM tasks? 	<ul style="list-style-type: none"> • Motivation: Why am I teaching integrated STEM?
<ul style="list-style-type: none"> • Competence: How capable do I believe I am to understand STEM content? 	<ul style="list-style-type: none"> • Self-image: How do I see myself as a STEM teacher?
<ul style="list-style-type: none"> • Recognition: How am I recognized by others and self as being a STEM person? 	<ul style="list-style-type: none"> • Self-efficacy: How capable do I believe I am to teach integrated STEM?
<ul style="list-style-type: none"> • Content Interest: How curious am I about STEM content? 	<ul style="list-style-type: none"> • Task perception: What is my task as an integrated STEM teacher? • Teaching Interest: How much do I think about and understand STEM teaching?

Figure 1. Definitions of Integrated STEM Teacher Identity Dimensions.

- **Contextualization:** Making AI learning relevant to students' daily lives.



Figure 2. Philosophical and Pedagogical Foundations

e. AI Teaching Methods for Children

- Using Simple Tools and Applications: such as scratch, blockly, or other applications designed for children.
- Interactive Games and Activities: Games that teach AI logic, such as image recognition games or simple programming robots.
- Discussion and Narration: Using stories to explain how AI works in everyday life (e.g., how AI helps weather apps predict rain).
- The introduction of AI at the elementary school level not only provides technical knowledge but also forms a generation that is more adaptive to technological developments and has a critical awareness of its impact.

3. RESULT AND DISCUSSION

3.1. Results of Teaching Method Analysis

- a. Game-based Learning: Making coding fun with platforms like Scratch.
- b. Project Learning: Children learn through creating simple projects like chatbots or animations.
- c. Curriculum Integration: AI and coding are integrated into subjects like math and science.

3.2 Benefits of the results of the work

- a. Problem Solving Skills: Students learn to think logically and analytically.
- b. Creativity: Coding allows students to create something new.
- c. Future Readiness: Equipping students with skills relevant to the world of work in the future.

3.3 Challenges faced

- a. Lack of Teacher Training: Many teachers are not familiar with the concepts of AI and coding.
- b. Access to Infrastructure: Not all schools have adequate facilities.
- c. Digital Divide: There is a difference in access between schools in urban and rural areas.

3.4 Recommendations

- a. Teacher Training: Organize intensive training for teachers on AI and coding.
- b. Provision of Infrastructure: Provide assistance with devices and internet access to schools.
- c. Cooperation with Industry: Partnering with technology companies to provide learning modules.
- d. Parental Awareness: Educating parents about the importance of technology in children's education.

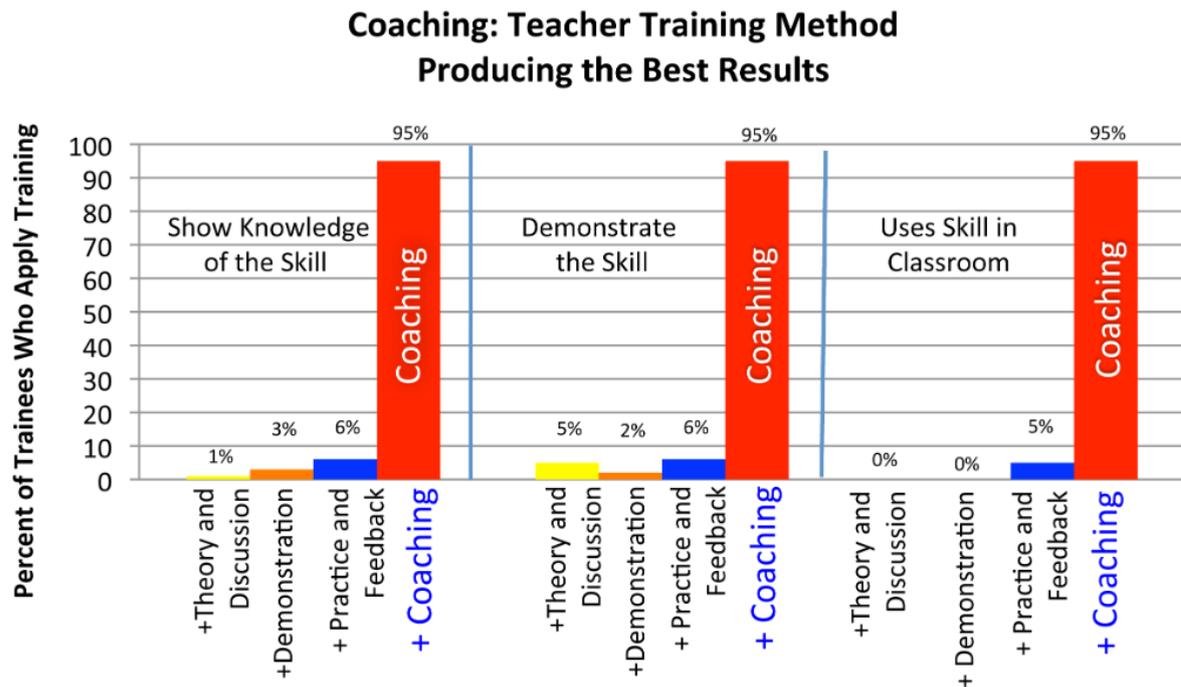


Figure 3. Teacher Training Method Producing the Best Results

Result(s): The most effective training occurred when teachers were exposed to all four of the training methods.

1. The traditional lecture method of in-service training did not result in teachers applying newly taught skills in the classroom.
2. The introduction of skill demonstrations by the trainer was insufficient in insuring the transfer of the skill from the demonstrator to the staff being trained.
3. Only when coaching was added did significant transfer to using skills in the classroom occur.

Implication(s):

1. Regardless of what training method is used, participants must have sufficient opportunity to practice skills in real classroom settings.
2. If the content of training is new to trainees, training will have to be more extensive than for material that is relatively familiar.
3. If the purpose of training is for staff to use the skills on the job, training must be collaborative so that trainer and trainee can solve any problems that arise when putting the training into practice in the classroom.

4. CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that: The application of AI and coding in elementary schools in Indonesia has great potential to shape a young generation that is ready to face the digital era. With the right implementation strategy, existing challenges can be overcome, so that education in Indonesia becomes more inclusive and adaptive to technological developments. And suggestions it can be concluded that: Personalized Learning in AI can help assess individual student needs and provide materials according to their abilities and learning styles. For example, platforms such as reading or math applications that adjust the level of difficulty according to student progress. Progress Monitoring in AI can automatically track student progress and provide reports to teachers and parents, so that intervention can be carried out if necessary.

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