Integration of Digital Tools in Primary Education: A Case Study on The Impact of Interactive Learning Platforms Using Artificial Intelligence

Yurika Oktaviane[a] and Sardjijo Sardjijo[b]
[a]Department of Elementary School Teacher Education, Faculty of Education, Magister Pendidikan Dasar, Universitas Terbuka, *yurikaoktaviane10@guru.sd.belajar.id*[1]
[b] [a]Department of Elementary School Teacher Education, Faculty of Education, Magister Pendidikan Dasar, Universitas Terbuka, *sarjiyo@ecampus.ut.ac.id*[2]

Abstract
This research aims to explore the impact of integrating artificial intelligence (AI)-based digital tools in primary school learning and evaluate the influence of using these tools on students' creativity, engagement and collaboration, as well as teachers' digital competencies. This study is a case study in design, using a mixed method approach. Data were collected through classroom observations, Likert questionnaires to students and teachers, semi-structured interviews, and analysis of student assignments done using the AI platform. The results showed that the use of AI-based digital tools significantly increased students' creativity and engagement, while teachers' digital competencies played an important role in determining the successful implementation of this technology. However, challenges in terms of technology access and digital divide among students from different socioeconomic backgrounds remain. The novelty value of this research lies in its specific focus on primary education, as well as the use of AI platforms that have not been widely explored in the context of primary school student learning. The findings provide new insights into the potential and challenges of AI integration in primary education.

Keywords: *Artificial Intelligence (AI), interactive learning platforms, primary education*

1. Introduction

The development of information and communication technology has changed teaching and learning methods, including in primary schools. The use of artificial intelligence (AI)-based interactive learning platforms has great potential in improving student engagement, creativity and 21st century skills(Sperling et al., 2024). However, the utilisation of AI in primary schools is still minimal, and many teachers are not ready to integrate this technology. Disparities in access to technology are also a challenge, exacerbating the digital divide between schools(Stolpe & Hallström, 2024). This research aims to explore the impact of interactive digital tools in improving student motivation and skills, as well as widening access to education.

The adoption of AI technologies in education, especially in personalised adaptive learning, provides opportunities to improve the quality of student learning(S. Wang et al., 2024). This research examines how AI can influence student motivation, engagement and learning outcomes, while considering challenges such as data security and the role of teachers in the learning process. AI is expected to provide more efficient and scalable learning solutions, and enrich student interactions with materials tailored to individual needs, without neglecting social and pedagogical aspects (Alfredo et al., 2024).

2. Method

This study uses a qualitative approach with an experimental method to explore the impact of using an artificial intelligence (AI)-based learning platform on creativity, collaboration, and engagement of students in grades V and VI of elementary school. The experimental method is a research approach that involves giving treatment or manipulation of independent variables to certain groups, with the aim of observing and measuring the impact on the dependent variable, usually carried out under controlled conditions, in order to determine cause-and-effect relationships scientifically(Joo & Park, 2024). The research focuses on how students respond to and utilise AI platforms in learning to develop creativity and collaborative skills, as well as increase their participation in learning activities. Data were collected through participatory observation, questionnaires, semi-structured interviews, and documentation of students' learning activities, which were analysed to measure changes in their creativity, collaborative skills, and active engagement after using the AI platform. Through a qualitative approach, this research also explores how teachers' digital competencies affect the effectiveness of integrating such technologies in the classroom (Galindo-Domínguez et al., 2024) .

2.1 Data Source

The research was conducted from July to September 2024 involving 215 elementary school students and 7 teachers grades V and VI who teach natural and social science (IPAS) subjects based on their involvement in using the Canva with AI platform during learning in SDN. Cengkareng Barat 05, as well as teachers who play a role in facilitating the use of the technology. The object of the research is the AI-based learning platform and its integration in the classroom. In addition, this study analyses how teachers' digital competencies affect the application of AI, as well as identifies accessibility and equity challenges in the application of AI technology in primary school settings. The results of this study are expected to provide practical recommendations related to increasing access to technology among students, as well as efforts to improve teacher competencies to maximise the benefits of using AI in the learning process (Martínez-Moreno & Petko, 2024).

2.2 Data Analysis

This research combines quantitative and qualitative methods. The results of the experiment, semi-structured interviews, and class observation were analysed by content analysis. However, the questionnaire was analysed descriptively through calculating the total score of students' projects. Besides, the document analysis was also done to help the researchers check the teachers' readiness before the teaching practices and the students' outcome after given the treatment. The content analysis technique was applied to various data generated, such as observations of student interactions with the platform, teacher responses in interviews, as well as documents of student work produced through Canva with AI. Through content analysis, researchers can identify themes related to creativity, collaboration, and student engagement during the use of the platform. This included analysing students' creative work, the pattern of collaboration between them while using Canva, and their level of participation in learning activities.

This technique also facilitated the analysis of teachers' digital competencies by assessing how they facilitate AI-based learning, as well as identifying the challenges they face regarding technological accessibility and equity in the classroom (Kim & Kwon, 2023). The researcher analysed the teaching materials prepared by teachers and their responses to the use of Canva with AI. Thus, content analysis enabled a comprehensive and systematic understanding of various aspects of the use of AI technology in learning, by mapping relevant data patterns to answer the research objectives.

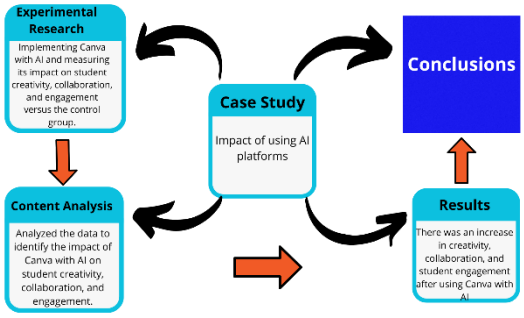

Fig. 1. Research Framework

3. Results and Discussion

3.1 Results

a. Learning Impact Before and After the Use of AI-Based Digital Platforms

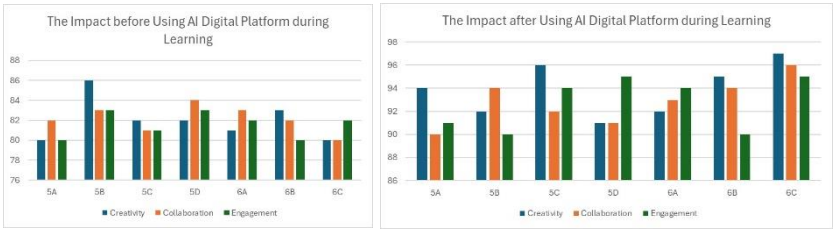

Fig. 2. The Impact of Using AI Digital Platform during Learning

The analysis of the data before using the AI-powered digital learning platform reveals that the levels of creativity, collaboration, and engagement (Zhang & Song, 2024) across the various groups (5A, 5B, 5C, 5D, 6A, 6B, 6C) were moderately high but showed notable variations. The difference between the two diagrams is not very significant because, in the current 5.0 era, technology integration in education is already well-established, meaning students are generally familiar with digital tools (Herlambang & Rachmadi, 2024). However, the introduction of AI-based platforms, like Canva with AI, marks a novel approach to enhancing learning experiences. While technology has long been used for creativity, collaboration, and engagement, AI brings more targeted, personalized, and intelligent solutions that fine-tune these processes (Li et al., 2024). Thus, the improvement, though noticeable, reflects the incremental advancements AI offers over already well-established digital tools, enhancing learning outcomes rather than revolutionizing them (Chonraksuk & Boonlue, 2024). For instance, creativity peaked in class 5B with a score above 86, while collaboration and engagement had relatively consistent averages across the groups, ranging mostly between 78 and 84. The data suggests that while student interaction and creativity were actively present, there was room for improvement, particularly in engagement levels, which tended to fluctuate more compared to the other categories.

In contrast, after the integration of Canva with AI, all three variables—creativity, collaboration, and engagement—demonstrated significant improvements across all groups. Creativity scores rose notably, with class 5C reaching the highest levels, and engagement saw substantial growth, particularly in classes like 6C and 5D, which showed a rise to scores in the mid-90s. This demonstrates that the AI platform had a positive impact, fostering higher levels of creative thinking, better collaborative learning, and increased student participation across different learning environments(Zhang et al., 2024). The results indicate that integrating AI-based tools can significantly enhance students' learning experiences and interactions.

b. Teachers' Readiness to Use AI-Based Digital Platforms during Learning

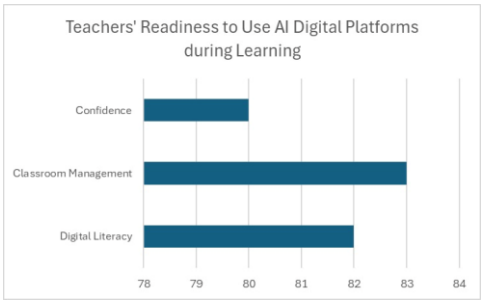

Fig. 3. Teachers' Readiness to Use AI Digital Platforms during Learning

The diagram presented shows the percentage of teachers' readiness to use artificial intelligence (AI)-based digital platforms during learning, based on three main indicators: Confidence, Classroom Management, and Digital Competence (Chiu et al., 2024). From the diagram, it can be seen that the Classroom Management aspect has the highest percentage, which is around 83%, indicating that teachers feel most prepared in managing the classroom when using AI-based technology. This indicates that teachers have high confidence in their ability to utilise digital platforms to support classroom management and interaction. Meanwhile, Digital Competence stands at a fairly high 82%, indicating that most teachers have adequate skills in using digital technology for learning.

On the other hand, the Self-Confidence aspect appears slightly lower than the other two indicators, with a percentage of around 80%. This may indicate that while teachers generally feel capable of using AI-based platforms, there are some who still feel doubt about their personal ability to utilise this technology optimally. Overall, this data illustrates a fairly good readiness among teachers in adopting AI-based technology in the learning process, although there is still room for improvement especially in terms of confidence and deeper mastery of technology.

c. Accessibility and Equity Challenges in the Application of AI Technology in the Primary School Environment

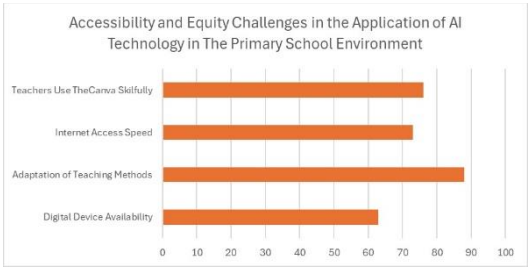

Fig. 4. Percentage of Accessibility and Equity Challenges in the Application of AI Technology in The Primary School Environment

The diagram presented shows the research results regarding the percentage of challenges faced in the implementation of artificial intelligence (AI) technology in the Primary School environment, focusing on the aspects of accessibility and equity(van Haastrecht et al., 2024) . Based on the chart, four main challenges were identified: limited teacher skills, speed of internet access, adaptation of teaching methods, and availability of digital devices. Each of these challenges has a similar level of difficulty, with percentage values ranging from 60-80%. The most dominant challenge was ‘adaptation of teaching methods,’ with around 80% of respondents considering it as the main obstacle to AI integration in primary schools.

Other significant challenges include limited teacher skills and speed of internet access, both reaching around 70%, followed by the availability of digital devices at close to 65%.

This shows that in addition to technical factors, the ability of human resources, especially teachers, to understand and utilise AI-based technologies is one of the crucial factors. In conclusion, to support the implementation of AI technology in primary schools, improvements are needed in various aspects, ranging from improving teacher skills, improving digital infrastructure such as the internet, to providing adequate devices to support technology-based teaching and learning processes (Yang, 2022).

3.2 Discussion

This research provides some important findings. The following are some of the key points that can be drawn from the discussion of the results of this study:

1. Increased Student Creativity and Engagement
   The use of AI-based tools in primary school learning has been shown to significantly increase student creativity and engagement. AI helps to create a more interactive learning environment, where students can be more involved in the learning process through challenging and collaborative activities (Al Shloul et al., 2024).

2. Influence of Teachers' Digital Competence
   Teachers' digital competence greatly influences the successful implementation of AI-based technologies in the classroom. Teachers who are more skilled in using digital technologies tend to be able to integrate AI tools more effectively, which in turn enhances students' learning experience (Runge et al., 2023) . This research highlights the importance of training and developing teachers' digital competencies so that they can maximise the use of these technologies.

3. Barriers to Technology Access
   While the benefits of AI in learning are highly visible, there are significant challenges related to technology access. This research found a digital divide between students from different socio-economic backgrounds. Students from families with limited access to technology are less likely to be able to utilise AI-based platforms to their full potential compared to better-off students.

4. Collaboration and 21st Century Skills
   AI-based learning platforms also contribute to the improvement of 21st century skills, including collaboration, problem-solving, and critical thinking (Segbenya et al., 2023). Students work together more often on tasks that require creative and innovative thinking, which is a key focus of 21st century education.

5. Development Recommendations
   Based on the results of this study, some recommendations for answering the case study on the impact of learning platform using created intelligence include:
   - Improving teacher training in the use of AI-based tools (Al Darayseh, 2023).
   - Expanding technology access for all students to reduce the digital divide (Hanaysha et al., 2023).
   - Integrating more AI platforms in the learning curriculum to promote 21st century skills (Fundi et al., 2024) .

This discussion shows that the integration of artificial intelligence in basic education has enormous potential in improving the quality of learning, although challenges such as technology access need to be addressed.

4. Conclusion

The conclusion of this study shows that the integration of artificial intelligence (AI)-based learning platforms in basic education significantly improves students' creativity, engagement and 21st century skills, such as collaboration and problem-solving(Southworth et al., 2023). In addition, teachers' digital competencies play an important role in the successful implementation of these technologies, where more digitally skilled teachers can maximise the potential of AI in learning (Nagel et al., 2023). However, significant challenges related to technology access and the digital divide among students from different socio-economic backgrounds are still obstacles that need to be overcome (X. Wang et al., 2023). Therefore, improving teacher training and equalising access to technology are strategic steps to ensure optimal utilisation of AI in basic education.

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