



Optimizing the use of ai in elementary school learning: For teachers in the digital era

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ABSTRACT

The digital era requires teachers to have competence in utilizing technology, including artificial intelligence (AI), in the learning process. However, there are still many elementary school teachers who do not understand and implement AI optimally. Therefore, this Community Service activity aims to improve teachers' understanding and skills in using AI as a learning medium through interactive workshops. The community service method used in this activity is Participatory Action Research (PAR), which was carried out at State Elementary School Pejuang 7 Bekasi involving 31 teachers. The success evaluation is conducted through a pre-test before the training and a post-test after the training by measuring several key aspects, namely: (1) understanding of AI concepts in education, (2) technical skills in operating AI-based platforms, and (3) the ability to design AI-based learning strategies. The results of community service showed an increase in teachers' understanding of AI by 31%, which was shown through the difference in pre-test and post-test results. Before the workshop, most teachers did not understand AI in learning. Still, after the workshop, teachers were better able to integrate AI as a tool in designing more interactive and innovative learning. Optimizing the use of AI in elementary schools can contribute to improving the quality of learning that is more effective, interesting, and in accordance with current developments.

Keywords: artificial intelligence; learning; teacher; elementary school

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INTRODUCTION

In the ever-evolving digital era, technology has become an inseparable part of various aspects of life, including in the field of education (Dai et al., 2023). One technology that has revolutionary potential in supporting the learning process is artificial intelligence (AI) (Chujitarom & Panichrutiwong, 2024; Wang & Wang, 2022). However, at State Elementary School Pejuang 7, the use of AI is still relatively minimal. Many teachers do not know or understand how it works and the benefits that can be obtained from the application of AI in learning. This limitation hinders the learning innovation process that can be more adaptive and interactive (L. Han et al., 2024).



The use of conventional methods that tend to be static and less interesting often makes lessons uninteresting to students (Liu et al., 2023). Conventional learning methods certainly do not support the development of student skills that are in accordance with the needs of the times (Li et al., 2024; Tedre et al., 2021). This approach does not utilize the great potential offered by AI in analyzing students' learning needs so that the learning process is less than optimal (Hooda et al., 2022; Yim & Su, 2024). This can create a gap between what can be taught and what should be taught to prepare students to face a fast-paced and technology-based world.

The results of observations and needs analysis at State Elementary School Pejuang 7 Bekasi show that there are still several teachers who do not understand or integrate AI into the learning process. Of the total 31 teachers and 8 education personnel at the school, only 30% of teachers have used AI. However, most of its use is still limited to the use of gadgets for daily communication, not as a learning aid. One of the main factors causing the low utilization of AI in this school is the limited technology facilities.

The school does not yet have adequate Wi-Fi access, LCDs are not yet available in every class, and there are no other supporting facilities that support the integration of technology in learning. In addition, the lack of training or technical assistance for teachers is also an obstacle, so they do not yet have sufficient skills to apply AI optimally in the teaching process. This condition creates a significant gap between the potential use of technology and the reality of its implementation in schools. In fact, if AI can be optimized in learning, teachers can develop teaching methods that are more interactive, innovative, and in accordance with the development of the digital era (Gligorea et al., 2023; Rusmiyanto et al., 2023). Therefore, concrete support is needed in the form of improving technological infrastructure and ongoing training programs for teachers. With this step, the application of AI in learning can be maximized so that it can improve the quality of education and provide a more interesting learning experience for students.

Concrete efforts are needed to overcome this problem. State Elementary School Pejuang 7 needs to hold a special workshop to equip teachers with knowledge and skills in integrating AI into learning. This workshop will present professional lecturers and educators to provide theoretical understanding and practical training in the use of AI in education (Hopcan et al., 2024; Mahmudi et al., 2023). Teachers will not only be introduced to AI concepts but will also be trained to apply them in the learning process so that they can be more innovative in teaching and providing more relevant and interesting materials for students (Bibel, 2014; Díaz & Nussbaum, 2024). Optimizing AI in this training, it is hoped that teachers at State Elementary School Pejuang 7 will become more skilled in using modern learning technology.

The use of AI will not only help in managing more personalized learning but can also increase student interaction and motivation to learn. In addition, by integrating into the AI learning network, teachers can continuously gain insight into the latest and most effective teaching methods that can be directly applied in

the classroom (Alhur et al., 2023; Mei, 2023; N. L. Rane, 2024). The AI optimization workshop activity is an important step in the digital transformation journey at State Elementary School Pejuang 7. By increasing the capacity of teachers to use AI, it is hoped that this school will not only achieve better learning outcomes but also be able to create a dynamic and adaptive learning environment that is ready to face future challenges. The purpose of this activity is to invest in education that will not only impact the current generation but also future generations.

METHOD

The community service method used in this activity is Participatory Action Research (PAR) (Kindon et al., 2007), which focuses on optimizing the use of artificial intelligence (AI) in learning in elementary schools (Cornish et al., 2023; Cumbo & Selwyn, 2022). This method involves active participation from teachers in every stage so that teachers are not only recipients of material but also contribute to the process of exploring and implementing AI in learning (Lenette, 2022). This activity was carried out at State Elementary School Pejuang 7 Bekasi, with 31 teachers participating. Through this approach, teachers can understand the benefits of AI in more depth and be able to apply it optimally in the classroom. A recapitulation of the stages that have been designed can be seen in the following image.

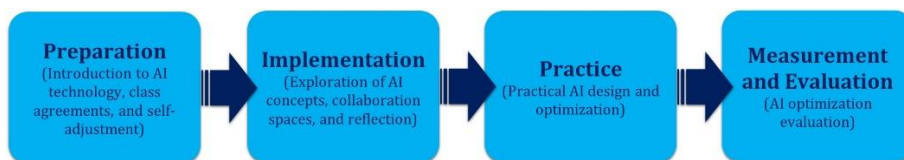


Figure 1. Stages of implementation method

The first stage is preparation, which aims to introduce AI technology to teachers, build class consensus, and help teachers adjust to this new concept. Next, in the implementation stage, teachers begin to explore the concept of AI through various interactive activities, such as collaboration spaces and reflective discussions. In this stage, teachers are invited to understand how AI can be applied in learning, both as a learning medium and as an interactive medium that can increase student engagement and understanding. The third stage, namely self-development practice, is an important part of this activity. In this phase, teachers prepare action plans and develop practical activities to implement AI in learning according to their respective needs.

Finally, the measurement and evaluation stage is carried out to assess the effectiveness of the application of AI in learning. Evaluation is carried out through worksheets filled out by teachers as a reflection of the understanding and skills that have been acquired during the program. In addition, n-gain analysis is used to measure the increase in teacher understanding before and after training quantitatively. This evaluation not only focuses on teacher reflection but also considers specific indicators such as increased student engagement, student

understanding of concepts, and the impact of AI on the quality of learning strategies applied by teachers. With a more measurable and concrete evaluation approach, the application of AI in learning can be more optimal, effective, and sustainable in the digital era. The following is a table of n-gain categories as a guideline for evaluation results.

Table 1. N-gain categorization

N-Gain Range	Enhancement Category
$N\text{-Gain} > 0,7$	High
$0,3 \leq N\text{-Gain} \leq 0,7$	Medium
$N\text{-Gain} < 0,3$	Low

RESULT AND DISCUSSION

Optimizing the use of artificial intelligence (AI) in elementary school learning needs to be improved so that teachers can adapt to technological developments. The digital era requires teachers to have digital competence to effectively integrate AI into learning, create more innovative methods, and increase efficiency in teaching. The use of AI also helps in personalizing learning and analyzing student development, so that the quality of education is increasingly optimal.

The initial step, Community Service activities at State Elementary School Pejuang 7 Bekasi, began with a pre-test using Google Forms. At this preparation stage, teachers were given an initial understanding of the concept of AI so that they could understand it in more detail before attending the workshop. This pre-test aims to measure the level of teacher understanding of AI in learning before they receive training. Teachers who had never attended a workshop before were asked to fill out a questionnaire containing 10 questions to assess their readiness and initial insight. The results of this pre-test became the basis for compiling workshop materials that were more in line with the needs of teachers, as shown in the following table.

Table 2. Pre-test results

No	Question	Number of participants	Percentage (%)	
			Yes	No
1	Have you ever used AI-based applications in your classroom?	31		100
2	Do you understand the difference between AI and traditional automation in the context of education?	31		100
3	Have you heard of adaptive learning systems that use AI to tailor content to students' needs?	31		100
4	Do you believe that AI can help increase student engagement in learning?	31		100
5	Do you believe that AI can help in the automated grading of student work?	31		100
6	Have you used AI chatgpt to answer students' questions in real-time in class?	31		100
7	Do you think that the use of AI in education requires special training for teachers?	31		100
8	Do you think that AI can replace teachers in some aspects of learning?	31	100	
9	Are you familiar with the privacy and data security policies associated with the use of AI in schools?	31		100

10	Do you believe that the introduction of AI in education will bring positive changes in student learning outcomes?	31	100
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Table 2 shows that the average pre-test results of teachers answered "no" by 100%, except for question 8, which answered "yes", indicating that teachers' understanding of AI in learning is still very limited. The implementation of AI workshops in elementary school learning needs to be carried out to equip teachers with insight and skills in integrating AI effectively into the teaching process. This workshop will provide basic understanding, benefits, and practical training so that teachers can utilize AI as an innovative learning tool that is relevant to technological developments. The following figure explains further the implementation of the AI workshop.



Figure 2. Implementation of the ai workshop

Figure 2 explains the implementation stage, where teachers begin to explore the concept of artificial intelligence (AI) in learning in more depth. At this stage, teachers not only understand the theory of AI but also engage in interactive discussions and reflections on the potential and challenges of implementing it in the classroom. Through this exploration, teachers gain clearer insights into how AI can be integrated into learning strategies. Figure 3 below explains the implementation stage, where teachers begin to practice using AI as a learning medium. Teachers at this stage apply the concepts they have learned by trying out various AI-based tools that can improve teaching effectiveness, such as ChatGPT, Napkin, Wordwall, Canvas, Quizizz, DeepSeek, and adaptive learning platforms, or automatic evaluation systems so that AI can truly be utilized in the teaching and learning process in elementary schools.



Figure 3. Implementation of ai for learning media

Figure 3 describes the implementation stage, where teachers begin to apply the material, they have learned about artificial intelligence (AI) in learning. Teachers at this stage responsively and interactively explore various AI applications that can be used as learning media so they can understand how to integrate AI into the learning process. Figure 4 illustrates the evaluation stage, where teachers are asked to provide feedback on the material that has been delivered and fill out a post-test questionnaire to measure the increase in teacher understanding after attending the workshop. Evaluation is carried out to see the effectiveness of the training and to identify the extent to which teachers can apply AI in the learning process so that the results can be used as material for further improvement and development in the application of AI in elementary schools.



Figure 4. Teacher evaluation and feedback

Figure 4 explains the evaluation and feedback stage, where teachers participate in a post-test by filling out questions that have been provided to measure their understanding improvement after attending the workshop. Teachers at this stage gave very positive and enthusiastic responses, considering that workshops on AI in learning are still relatively rare for them to get. The extraordinary response from the teachers shows their high interest and need for the use of AI in the teaching process. The results of the post-test are an indicator of the extent to which the workshop has succeeded in improving teachers'

understanding and skills in integrating AI into learning. A summary of the post-test results can be seen in the following table.

Table 3. Post-Test Results

No	Question	Number of participants	Percentage (%)	
			Yes	No
1	Have you ever used AI-based applications in your classroom?	31	100	
2	Do you understand the difference between AI and traditional automation in the context of education?	31	100	
3	Have you heard of adaptive learning systems that use AI to tailor content to students' needs?	31	100	
4	Do you believe that AI can help increase student engagement in learning?	31	100	
5	Do you believe that AI can help in the automated grading of student work?	31	100	
6	Have you used AI chatgpt to answer students' questions in real-time in class?	31	100	
7	Do you think that the use of AI in education requires special training for teachers?	31	100	
8	Do you think that AI can replace teachers in some aspects of learning?	31		100
9	Are you familiar with the privacy and data security policies associated with the use of AI in schools?	31	100	
10	Do you believe that the introduction of AI in education will bring positive changes in student learning outcomes?	31	100	

Table 2 shows that the implementation of the workshop on AI in learning provided significant benefits for teachers, especially for teachers who had not previously received related training. The post-test results illustrate a significant increase in understanding compared to the pre-test results before the workshop was held. From the table, most teachers' answers after the workshop were "yes", which indicates an increase in insight into the application of AI in learning. The only exception occurred in question number 8, where most teachers still answered "no", which was related to teachers' concerns about the possibility of the teacher's role being replaced by AI. To see more clearly the difference in the level of understanding before and after the workshop, Table 3 presents a comparison of the pre-test and post-test results summarized in the n-gain results, which measure the effectiveness of increasing teachers' understanding after participating in this training.

Table 4. N-Gain Results

No	Assessment Results	N Gain
1	Pre-Test Results	0.21
2	Post-Test Results	0.52

Table 3 shows a positive increase after the implementation of the AI workshop in learning, which provided new insights for teachers. Through this workshop, teachers were not only introduced to the concept of AI but also trained to optimize its use in the learning process. Teachers learned how AI can be used as a learning medium and used to design learning strategies to be more interesting and interactive for students. The n-gain results indicated an increase in understanding of 31%, which was in accordance with the initial planning, namely

for teachers to understand the concept of AI and be able to implement it in learning. The recapitulation of the n-gain results can be seen further in the following diagram, which provides a visual depiction of the differences in teacher understanding before and after the workshop.

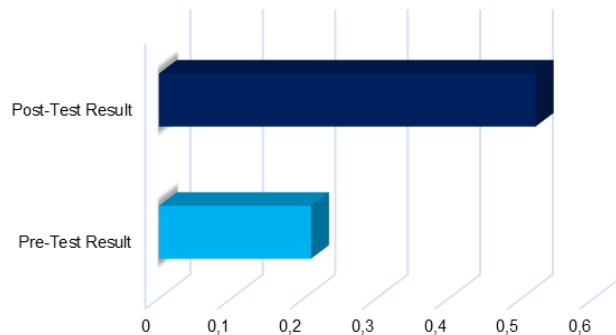


Figure 5. N-Gain results

Figure 5 shows that the pre-test and post-test results showed a significant difference, indicating that the activity of optimizing the use of AI in elementary school learning has had a positive impact on teachers. This increase reflects that the workshop not only increased their understanding of AI but also equipped them with practical skills to apply it in the learning process. Teachers are now more confident in using AI as a learning aid, both in designing more interactive materials and in developing more innovative teaching strategies. With these positive results, teachers can continue to develop themselves and integrate AI sustainably into elementary school learning.

Optimizing the use of artificial intelligence (AI) in elementary school learning has had a significant positive impact on teacher competence in designing more innovative and interactive learning (Johannesson, 2022). Teachers not only gained new knowledge about the concept of AI but also understood practical ways to integrate it into the learning process (Warella & Jaya, 2024). This increase in understanding was reflected in the pre-test and post-test results, which showed a significant difference in scores (Tannady, 2024).

This difference in results not only shows an increase in understanding but also reflects the effectiveness of certain elements in the training (Kadaruddin, 2023; Yu, 2024). Factors such as the type of material provided, interactive delivery methods, and active involvement of participants in discussion sessions and direct practice play a role in influencing the level of teacher understanding (Xu, 2024). Teachers who were more active in the workshop sessions tended to show a greater increase in understanding than those who only participated passively (Darmayanti, 2024). In addition, a hands-on, practice-based approach, where participants were given the opportunity to try out the use of AI in designing learning strategies, proved to be more effective in improving their technical skills than just providing theory (Han et al., 2024).

The workshop activities have provided new insights for teachers on how AI can be utilized to create a more engaging and relevant learning experience for students (Jauhiainen & Guerra, 2023; N. Rane, 2023). AI not only helps present material visually and interactively but also supports teachers in making more efficient learning evaluations through an automated assessment system (Monib et al., 2025a, 2025b). In addition, the application of AI allows teachers to develop adaptive learning media, which can be adjusted to the abilities and needs of students, supporting the differentiated learning approach that is essential in modern education (Gligorea et al., 2023; Natarajan et al., 2024). The results of the workshop proved that with the right training, elementary school teachers can adapt to technological developments and utilize them to improve the quality of learning. In the future, teachers are expected to continue to develop themselves and apply AI sustainably in the learning process. Therefore, similar training activities need to be carried out continuously so that more teachers have digital competence and can provide a more dynamic, creative, and appropriate learning experience for students in the digital era.

CONCLUSION

Optimizing the use of artificial intelligence (AI) in elementary school learning has been proven to provide significant benefits for teachers in improving their understanding and skills in digital technology. Teachers, through the workshops held, not only gained insight into the concept of AI but were also trained to apply it in designing more interactive and adaptive learning. The results of the pre-test and post-test showed an increase in teacher understanding by 31%, indicating that this activity was successful in improving teachers' digital competence and teacher readiness in integrating AI into the teaching and learning process.

The implications of this community service show that training and mentoring related to AI in learning are very much needed to improve teacher readiness in facing the digital era. With optimal use of AI, teachers can create a more effective, attractive, and appropriate learning environment for students, thereby improving the quality of education in elementary schools. Therefore, similar training programs need to be continuously developed and expanded so that more teachers have adequate digital competence, so that technology-based education can be applied more widely and sustainably in various elementary schools.

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