Artificial Intelligence-Based Mathematics Learning Training for Vocational High School Students

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Abstract

The rapid development of Artificial Intelligence (AI) technology has brought significant changes to the field of education, particularly in the teaching and learning of mathematics. The growing demand for AI integration in education calls for immediate action to equip both students and teachers with the necessary understanding and skills. However, initial analysis indicates that the majority of students and teachers at the partner school still lack a clear understanding of how to effectively utilize AI in the learning process. This community service activity aimed to enhance the understanding of vocational high school (SMK) students in utilizing AI technology to support more interactive and effective mathematics learning. The program was conducted in the form of a training session at SMKN 1 Cihampelas, involving 80 students. The implementation methods included the delivery of basic AI concepts, demonstrations of AI-based applications (such as ChatGPT, Photomath, and MathSolver), as well as hands-on practice and discussion sessions. Evaluation results showed that students responded positively, with 77% demonstrating an understanding of AI application in mathematics learning. This activity is expected to serve as an initial step toward the sustainable integration of AI technology in the vocational school environment.

Keywords: Artificial Intelegent, Vocational Student, Mathematic Learning, Application

Abstrak

Perkembangan teknologi kecerdasan buatan (Artificial Intelligence/AI) telah membawa perubahan signifikan dalam dunia pendidikan, khususnyaPesatnya perkembangan teknologi Artificial Intelligence (AI) menuntut integrasi teknologi ini ke dalam dunia pendidikan, termasuk dalam pembelajaran matematika. Namun, hasil analisis awal menunjukkan bahwa sebagian besar siswa dan guru di sekolah mitra masih belum memahami bagaimana memanfaatkan AI secara optimal dalam proses pembelajaran. Kegiatan pengabdian ini bertujuan untuk meningkatkan pemahaman siswa Sekolah Menengah Kejuruan (SMK) dalam memanfaatkan teknologi AI untuk mendukung proses pembelajaran matematika yang lebih interaktif dan efektif. Kegiatan dilaksanakan dalam bentuk pelatihan di SMKN 1 Cihampelas, yang melibatkan 80 siswa. Metode pelaksanaan meliputi penyampaian materi konsep dasar AI, demonstrasi penggunaan aplikasi berbasis AI (seperti ChatGPT,Photomath, dan MathSolver), serta sesi praktik langsung dan diskusi. Hasil evaluasi menunjukkan respon siswa termasuk didalamnya pemahaman peserta terhadap penerapan AI dalam pembelajaran matematika sebesar 77%, terhadap penggunaan AI tersebut dalam proses belajar mengajar. Kegiatan ini diharapkan menjadi langkah awal dalam integrasi teknologi AI secara berkelanjutan di lingkungan sekolah vokasi.

Kata Kunci: *Artificial Intelegent, Siswa SMK, Pembelajaran Matematika, Aplikasi.*

Introduction

Over the past decade, advancements in Artificial Intelligence (AI) technology have spurred innovation in numerous sectors, notably in education (Crawford et al., 2023; Dogan & Dogan, 2023; Fahimirad, 2018; Gligorea et al., 2023; Potode & Manjare, 2015; Stefan et al., 2017). In the context of mathematics learning, AI can help simplify complex concepts, provide instant feedback, and tailor materials to the individual needs of students. Research by Katalenić & Kolar-Begović (2022) shows that the integration of AI in mathematics learning significantly enhances students' conceptual understanding and engagement.

However, the utilization of AI technology in vocational high schools (SMK) still faces various challenges, particularly students' lack of understanding regarding its application. Based on initial observations at SMKN 1 Cihampelas, the majority of students are not yet familiar with or have not utilized AI-based applications in their learning process. Among the 80 students targeted in this community service program, more than 85% had never used platforms such as ChatGPT, Math Solver, GeoGebra AI, or Photomath. Furthermore, teaching methods employed by teachers remain conventional, with limited access to advanced technology being one of the main obstacles.

SMKN 1 Cihampelas is located in West Bandung Regency, a semi-urban area. The socio-economic conditions of the surrounding community show positive development, with relatively stable internet access and strong support from the school for educational technology integration. These factors make the region highly potential to serve as a pilot area for the implementation of AI-based learning technology at the vocational school level. Therefore, the main objective of this training program is to enhance students' understanding of AI by providing technical training on the use of AI applications in mathematics learning.

The integration of Artificial Intelligence (AI) in education has been extensively examined across numerous studies. Kadarisma, (2024); Wahyudinarti et al., (2025) emphasize that AI holds great potential to enhance learning effectiveness through personalization and learning data analysis. Rifa (2024) found that applications such as Photomath and WolframAlpha help students better understand the steps involved in solving mathematical problems in a clearer and more systematic manner. The use of digital technology among vocational high school (SMK) students remains limited to basic tools such as presentation media, while the integration of AI has not yet become a common practice. Several AI training programs for teachers and students have been conducted (Annas et al., 2024; Hanila et al., 2023; Puspita et al., 2023; Rahayu & Hadi, 2023) but these initiatives have generally remained broad in scope and have not specifically targeted vocational high school students

Therefore, this community service program serves as a need-based intervention designed to address real challenges in the field, particularly in improving the quality of mathematics education. Through this approach, students are not only introduced to the concept of Artificial Intelligence (AI), but also receive hands-on training in integrating AI technology into their learning process. The program aims to equip students with 21st-century skills, enhance their interest and understanding of mathematics, and create a more interactive, adaptive, and contextual learning experience. Thus, this initiative is not only a responsive solution to current educational needs but also a forward-looking effort to prepare the younger generation to compete in the digital era.

Method

This community service activity employed an educative-participatory approach, using direct and demonstrative training methods designed to enhance students' ability to utilize Artificial Intelligence (AI) technology for learning mathematics. The target participants were 80 students from various departments at SMKN 1 Cihampelas who had an interest in or a need for improving their mathematical understanding with the help of technology. The program was conducted over two days, on May 14–15, 2025, and was divided into three main phases.

The first phase was Preparation and Needs Assessment, which included coordination with the school to schedule the training sessions, preparation of presentation tools and internet access, and distribution of a preliminary questionnaire to identify students' levels of digital literacy, prior experience with AI in learning, and mathematics topics they found difficult. This phase was conducted on May 14, 2025.

The second phase was the Training Implementation, held on May 15, 2025. The training was conducted in two main sessions over a full day: Session 1: Introduction to AI Concepts and Their Applications in Education, including demonstrations of AI-based applications such as ChatGPT, Photomath, and MathSolver. Session 2: Independent Practice and Mathematical Problem-Solving, where students were divided into small groups to solve math problems using AI applications under the guidance of facilitators.

The third phase was Evaluation and Reflection. At the end of the sessions, a group reflection was conducted to assess students' understanding, followed by a post-training questionnaire to evaluate the impact of the training on students' comprehension of AI.

The success of the activity was measured both quantitatively and qualitatively using several instruments: Pre- and Post-Training Questionnaires, to assess changes in students' understanding and responses toward AI, their frequency and willingness to use AI in learning mathematics, and their perception of the ease of learning after using AI.Facilitators also recorded students' active participation, enthusiasm, and ability to solve problems using AI applications. The activity was considered successful if at least 70% of students demonstrated improved post-training scores in the questionnaires.

Result and Disccusion

The community service activity conducted at SMKN 1 Cihampelas successfully achieved its primary objective, namely providing training on the use of Artificial Intelligence (AI) in mathematics learning for students. A total of 80 students from various majors enthusiastically participated in the program, reflecting a strong interest in the integration of technology in education. During the training, students were introduced to several AI-based applications that are relevant and easy to use for supporting mathematics learning, such as ChatGPT for understanding concepts and theoretical explanations, Photomath for solving problems visually, and GeoGebra AI for interactive exploration of geometry and algebra concepts. The training was conducted in two main sessions: a theoretical session introducing AI concepts and applications, and a hands-on practice session guided by facilitators.

Quantitatively, the effectiveness of the training was measured using pre-test and post-test questionnaires covering three main indicators: students' knowledge of AI, their ability to use AI applications to solve mathematical problems, and their attitudes toward using technology in

learning. The results showed that 82% of students experienced an increase in their knowledge of AI, 75% were able to independently use the applications to solve mathematical problems they had previously found difficult, and 78% expressed a positive attitude toward using technology in their learning process.

Additionally, qualitative observations conducted by the community service team supported these findings. Students demonstrated active engagement during the practice sessions, asked critical questions, and showed curiosity about the features of the AI tools presented. Peer interaction also increased through small group discussions when working collaboratively on problem-solving tasks, indicating that the training not only improved students' technological literacy but also fostered a spirit of collaboration.

Figure 1. Practice of Using AI for Mathematics Learning

The documentation of the AI training activity in mathematics learning at SMKN 1 Cihampelas is presented in Figure 1. The image captures a student presenting the solution to the problem "How many triangles?" in front of the class, utilizing ChatGPT as a cognitive aid. The student explained the step-by-step process of identifying the shapes and counting the hidden triangles in the figure, while demonstrating how they interacted with ChatGPT to verify their understanding and clarify the problem-solving strategy.

Facilitators and teachers accompanied the presentation, providing guidance and feedback on the use of AI in mathematical reasoning. This activity was part of the hands-on session designed to introduce an integrative approach to using Artificial Intelligence (AI) specifically ChatGPT - as a learning partner in solving mathematics problems that challenge logic and conceptual understanding. The training also aimed to build students' confidence in articulating their thought processes and to develop technological literacy aligned with 21st-century learning needs.

The session continued with small-group discussions in which students worked collaboratively to solve contextual mathematics problems using ChatGPT. Each group, consisting of 3–4 students, discussed problem-solving strategies while exploring relevant questions to ask the AI. In this process, students were trained to formulate questions clearly and logically, read and evaluate AI-generated responses, and compare them with their own reasoning.

These small-group discussions encouraged active, collaborative, and reflective engagement, where students did not merely accept AI answers passively, but critically examined their validity and considered alternative solutions. This approach indirectly fostered critical thinking skills, mathematical communication, and responsible technology use. Facilitators accompanied each group to ensure that the use of AI remained educational and was not solely result-oriented.

In terms of impact, this activity has provided short-term benefits for both students and the school environment. Students experienced a different and more interactive learning process compared to conventional methods, which typically rely on lectures or traditional tools such as calculators. With the support of AI, students found it easier to grasp abstract mathematical concepts such as derivatives, integrals, or geometric transformations thanks to the applications' ability to offer visualizations and systematic problem-solving steps.

The school welcomed the activity and expressed interest in integrating AI into future teaching practices. Several teachers even showed enthusiasm for participating in similar training sessions to better understand AI technology and how it can be applied to other subjects. This indicates the long-term potential of the program to promote digital transformation within the school environment.

However, this activity also encountered several challenges that serve as important notes for future development. One of the main obstacles was the limited availability of personal devices among students (Mustajab et al., 2021; Suprapmanto, 2021). Not all participants owned their own gadgets, requiring them to share devices within their groups, which ultimately reduced the effectiveness of the hands-on practice time. Additionally, unstable internet connectivity in some parts of the classroom posed difficulties in accessing AI features that rely on a stable network. The varying levels of digital literacy among students also presented a challenge. Some students needed more time to adapt to the application interfaces, particularly those who had never used AI-based tools before. Nevertheless, through the implementation of small-group mentoring and visual tutorials, these obstacles were gradually overcome throughout the training process. This highlights the necessity for technical preparedness and the flexibility to adapt teaching strategies when integrating technology-based learning. Considering both the successes and challenges, this community service activity demonstrates strong potential for further sustainable development in the future.

Table 1. Recapitulation of Student Response Questionnaire for AI Training

No	Statement	Pre-Training	Post-Training	Improvement
1	AI helps me solve math problems.	14%	68%	54%
2	AI is not useful for solving math problems.	25%	76%	51%
3	Solutions from Math Solver/Photomath are easier to understand than teacher explanations.	32%	80%	48%
4	I worry that using AI reduces my critical thinking skills.	45%	88%	43%
5	AI gives instant answers, making me less motivated to understand the concepts.	33%	78%	45%
6	I prefer learning math with AI because it is more interactive.	22%	81%	59%
7	I doubt the accuracy of AI answers in math.	44%	88%	44%
8	AI helps me do my math homework faster.	31%	67%	36%

No	Statement	Pre-Training	Post-Training	Improvement
9	Using AI makes me more interested in learning math.	34%	77%	43%
10	I find it difficult to use AI because there are too many unclear steps.	20%	81%	61%
11	I can use AI to solve math problems.	15%	73%	58%
12	I feel I don't need to memorize formulas because AI can always help.	33%	71%	38%
13	AI provides varied example problems that help my understanding.	30%	72%	42%
14	I feel more confident solving math problems after using AI.	15%	78%	63%
15	I cannot use AI effectively.	10%	74%	64%
	Average Percentage	**27%**	**77%**	

The survey results indicate a significant increase across all indicators after students participated in the training on the use of Artificial Intelligence (AI) in mathematics learning. Following the training, there was a noticeable surge in agreement percentages for all statements. For example, one of the statements reached 77% post-training, reflecting an increase in students' confidence in the benefits of AI. Notably, some indicators—such as the ease of understanding solutions through applications like Math Solver and Photomath—achieved up to 80% agreement, indicating that the training effectively equipped students with practical understanding and increased their comfort and confidence in using AI to solve mathematical problems.

The highest increase recorded was 48% for several statements, reinforcing the evidence that this training program had a tangible impact on students' comprehension. This improvement further emphasizes that AI serves not only as a technical tool but also as a learning medium that enhances interactivity and students' interest in mathematics. Overall, all statements showed post-training achievement levels above 70%, highlighting the program's success in improving AI literacy and utilization among vocational high school students.

In the long term, schools can design advanced training programs not only for students but also for teachers, ensuring that the integration of technology into learning becomes comprehensive and sustainable (Kadarisma et al., 2020; Kadarisma & Ahmadi, 2019). This AI training for mathematics learning also holds the potential to be expanded into other subjects such as physics, economics, and computer programming. Moreover, the activity can serve as a replicable model for other schools in surrounding areas with similar social contexts and resource availability. Supporting documentation—including photos of the activity, questionnaire results, screenshots of AI application usage, and student worksheets—serves as concrete evidence of the program's success. Overall, the AI training in mathematics has brought about positive changes for students at SMKN 1 Cihampelas in terms of digital skills, learning motivation, and readiness to face 21st-century educational challenges.

The use of Artificial Intelligence (AI) in mathematics learning is not intended to make students passive or discourage critical thinking. Rather, it serves as an exploratory tool that enhances conceptual understanding through more visual, interactive, and contextual methods(Auna et al., 2024; Muhammadiyah et al., 2024). AI does not replace students' critical thinking processes; instead, it supports them in understanding solution steps, visualizing

relationships between concepts, and exploring various problem-solving approaches. By utilizing AI-based applications, students can engage in self-directed learning and adjust their learning pace according to their individual needs. Thus, AI acts as a learning facilitator that strengthens understanding, rather than a shortcut to obtaining answers without cognitive effort.

Conclusion

Based on the results and discussion, it can be concluded that students' responses to the use of Artificial Intelligence (AI) in mathematics learning showed a significant improvement in understanding after participating in the training. This is evidenced by the achievement of over 70% across all measured indicators, including understanding of AI usage, confidence, and the ability to utilize AI-based tools such as ChatGPT, Photomath, and Math Solver. These outcomes demonstrate that the training successfully equipped students with practical knowledge and relevant skills to utilize technology in supporting their mathematics learning process.

It is recommended that schools begin gradually integrating AI use into mathematics instruction, both through the development of technology-based teaching materials and through further training for both teachers and students. The use of AI tools such as ChatGPT, Photomath, or Math Solver has been proven to enhance students' understanding and interest in mathematics, and should therefore be maximized. To support its effectiveness, schools should also develop ethical guidelines for AI usage to prevent passive dependence, and conduct regular evaluations to ensure AI is used as a productive learning aid, including for remedial programs and material enrichment.

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