Aktual

OPEN ACCESS

Jurnal Pengabdian Kepada Masyarakat
https://ejournal.gomit.id/index.php/aktual

Training on Improving Artificial Intelligence Literacy in Supporting 21st Century Learning for Students at SMAN 6 Central Bengkulu

Netriani Veminsyah Ahda[1*], Rosane Medriati[2], Andik Purwanto[3], Desy Hanisa Putri[4], Dennis Jovani Harryson Siregar[5], Ahmad Khairul Fajri[6].
[1,2,3,4,5,6] University of Bengkulu
Bengkulu, Indonesia
✉ Corresponding Email: nvahda@unib.ac.id*

Article Information:
Received September 15, 2025
Revised September 26, 2025
Accepted September 28, 2025

Keywords:
Artificial Intelligence; Chatbot; High School; Physics; Visualization.

Abstract

Background of Study: The utilization of artificial intelligence (AI) in physics learning in Indonesia is still relatively new and requires further implementation regarding its effectiveness, so that it becomes a challenge in itself, especially in understanding abstract concepts and materials.

Aims and scope of paper: The Chatbots and AI Visualizations training at SMAN 6 Central Bengkulu aims to improve students' skills and knowledge in utilizing modern technology to deepen their understanding of physics concepts.

Methods: This study used a quantitative approach through pre-test and post-test of 41 students in grades X and XI, with instruments in the form of multiple-choice questions to measure basic understanding of AI, ability to write prompts, understanding and visualization skills on physics concepts, and understanding the ethics of using AI in learning activities.

Results: The results showed high enthusiasm and interest in AI-based learning, with all respondents expressing interest in this technology. After the training, there were improvements in the understanding of physics concepts through AI, the ability to write prompts, understanding and visualization skills using AI, and ethical knowledge in the use of AI in learning.

Conclusion: The findings indicate that the integration of AI in physics learning not only increases the effectiveness and interactivity of the learning process, but also equips students with relevant 21st century competencies in the digital era.

A. Introduction

The development of artificial intelligence (AI) technology has brought significant changes in various fields, including education. In the context of physics learning at the high school (SMA) level, one of the main challenges faced is the difficulty of understanding concepts due to abstract and complex material (Alarbi et al., 2024). A survey shows that 88% of students experience physics learning primarily through lectures, which they consider less effective.

SMAN 6 Central Bengkulu as one of the educational institutions in the region, also faces similar challenges in learning physics with limited facilities, including limited physics laboratories, physics teachers at this school continue to seek learning innovations that can improve student understanding and

How to Cite : Ahda, N. V., Medriatu, R., Purwanto, A., Putri, D.H., Siregar, D.J.H., & Fajri, A.K. (2025). Training on Improving Artificial Intelligence Literacy in Supporting 21st Century Learning for Students at SMAN 6 Central Bengkulu. *Aktual: Jurnal Pengabdian Kepada Masyarakat*, 3(3), 126-134. https://doi.org/10.58723/aktual.v3i3.474
ISSN : 2987-6052
Published by : CV Media Inti Teknologi

motivation (Sudirman et al., 2023). One potential solution to overcome the challenges of physics learning is the use of AI technology, especially through the use of educational chatbots and AI-based visualizations (Kotsis, 2025).

Several studies have confirmed the potential of AI in education for example research from Essel et al. in 2022 shows that AI chatbots can act as responsive learning assistants, providing explanations, answering student questions, and providing interactive practice questions. A recent bibliometric study analyzing 448 documents from the Scopus database shows a significant trend of using AI-based chatbots in physics education over the past decade. AI visualizations, on the other hand, allows students to see live simulations of physics concepts, thus helping them understand the processes and relationships between physics variables in a more concrete and engaging manner. Earlier studies such as Kaufmann & Meyer (2009) have already shown Technologies such as Augmented Reality (AR) and Virtual Reality (VR) have been shown to improve students' conceptual understanding of abstract physics concepts by up to 30%, while AI provides adaptive learning and real-time diagnostics of learning difficulties. The students who learned with AI simulations showed a significant increase in concept understanding compared to those who only learned through conventional methods (Media et al., 2025).

The integration of AI in physics learning not only improves concept understanding but also develops students' problem-solving skills (Verawati & Nisrina, 2024; Taufik, 2024). AI can analyze students' learning data to provide quick and accurate feedback, allowing teachers to understand students' patterns of difficulty and adjust teaching methods accordingly. A study showed that students who received prompt and relevant feedback from an AI-based system showed a significant increase in scores in physics concept understanding (Wang & Fan, 2025; Media et al., 2025).

The utilization of AI in physics learning is still relatively new and requires further study (Maison et al., 2022). The potential of AI to transform physics education is enormous, especially in creating a learning environment that is more dynamic, interactive, and responsive to student needs (Verawati & Nisrina, 2024) and also, challenges in measuring its effectiveness include technology adaptation to the curriculum, educator readiness, and student engagement in the learning process (Taufik, 2024). Use of chatbots in physics learning with 100 respondents can significantly improve students' academic performance, with 66% of students reporting that chatbots helped them in their learning, and 90% reporting that chatbots helped them identify misconceptions in their reasoning (Duy et al., 2024).

Building on these research findings, this community service activity was designed to provide training was held with the aim that students of SMAN 6 Central Bengkulu have the skills and knowledge in utilizing the latest technology for physics learning. Through this training, it is expected that the physics learning process will become more interactive, effective, and able to improve students' understanding of concepts significantly. In addition, this training also aims to support the efforts of the Central Bengkulu regional government in improving the quality of education and developing students' potential, as emphasized in the district's education program.

Considering the challenges of learning physics at SMAN 6 Central Bengkulu and the transformative potential of AI technology, this training is expected to be the first step in integrating modern technology into physics teaching practices at the school. The use of AI Chatbots and AI Visualizations will not only support students in mastering complex physics concepts but also equip them with essential 21st-century digital skills.

B. Methods

The method used in community service activities is This activity employed a training-based method combined with a quantitative approach to measure the effectiveness of using an AI chatbots and AI visualizations in learning physics at the high school level. This community service was carried out on 41 students in grades X and XI at SMAN 6 Central Bengkulu, located at Jalan Raya *Kabupaten* Benteng, Air Sebakul, Talang Empat District, Central Bengkulu Regency, Bengkulu Province, Indonesia.

Figure 1. SMAN 6 Central Bengkulu.

This activity was carried out through a series of systematic stages, namely the preparation stage and the implementation stage. In the preparation stage, researchers coordinated with the school to determine the participants who would be involved in the research. In addition, evaluation instruments in the form of pre-test and post-test questions were prepared to measure students' initial and final knowledge. Researchers also prepared materials on the introduction of artificial intelligence (AI), chatbots, AI-based visualizations, and the ethics of using AI for physics learning.

In the implementation stage, students were first given pre-test to determine their initial level of knowledge and interest in the concepts of artificial intelligence and chatbots. After that, students were exposed to the basic concepts of AI, the role of AI in education, the introduction of chatbots, the use of AI visualizations for physics learning, and the ethics of using AI for physics learning.

Figure 2. Presentation of basic AI concepts.

Students conducted hands-on practice, including using chatbots to discuss and explore physics concepts, as well as utilizing AI visualization tools, such as interactive simulations and AI images, to deepen their understanding of certain physics materials. Afterwards, students conduct group discussions and present the results of their exploration as a form of learning reinforcement. At the end of the activity, students take a post-test to measure the improvement of understanding of physics concepts after following the whole series of AI-based learning.

Figure 3. Practical process of using AI and Chatbots in Physics subject.

Evaluation and data analysis in this study were conducted quantitatively. Quantitative analysis was carried out using the data from the pre-test and post-test results analyzed descriptively by calculating mean scores and percentages of students' concept understanding. The instruments used in this study include multiple-choice pre-test and post-test questions. The assessment used has several aspects including measuring students' basic understanding of how AI works, students' ability to write questions (prompts) properly, the ability of students' understanding and skills in visualizing images using AI on physics concepts, and the ethics of using AI in learning and school assignments, especially in physics lessons. This approach is expected to obtain a comprehensive picture of the impact and quality of the learning media introduced and developed at SMAN 6 Central Bengkulu.

The entire series of learning activities is fully documented through photos, videos, and field notes so that they can be evidence of implementation and reflection materials for improving future learning programs. This method adapted steps from previous research on AI learning media development in physics and chatbots training in schools. Such approaches have proven effective in improving student understanding and learning independence (Afiliyani et al., 2024); (Widiasih et al., 2025).

C. Results and Discussion

Pre-test Evaluation of Using AI Chatbots and AI Visualizations to Improve Physics Concept Understanding.

The pre-test data revealed interesting findings regarding the perception and interest of 41 students at SMAN 6 Central Bengkulu towards AI technology. Based on Diagram 1, students' interest in learning and participating in community service activities in terms of using AI Chatbots and AI Visualizations to understand Physics Concepts. As many as 82.9% of respondents answered Interested, and 17.1% answered Very interested, which showed that all respondents have a positive interest in AI technology in physics learning.

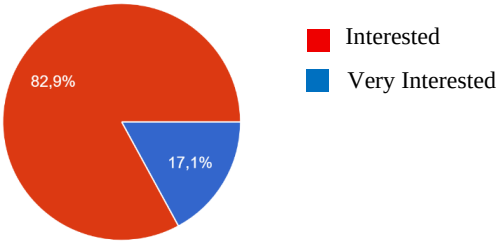


Diagram 1. Students' interest in learning AI technology

Diagram 2 showed that students have previously had experience interacting with AI chatbots, although the intensity of use varies, with half of the respondents (51.2%) answering rarely, while 46.3% answered often, and only 2.5% answered never. Based on the pre-test questionnaire given in Graph 1, the Chatbots/ AI applications used by students include GPT Chat, Meta AI, Google, and Cici-AI. The majority of students with a total of 40 respondents, indicated that the AI Chatbots that they often use is Chat GPT. Therefore, ChatGPT became the AI chatbots used in this activity. ChatGPT has indeed become an AI chatbots that is widely used by high school students, both to support learning, increase motivation, and help complete school assignments (Noviyanti et al., 2025); (Putri et al., 2024). 73% of students stated using ChatGPT in learning, 68% were interested in continuing to use it, and 83% felt their learning experience became more enjoyable and helpful with ChatGPT (Hermila et al., 2024).

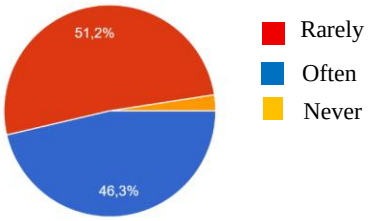
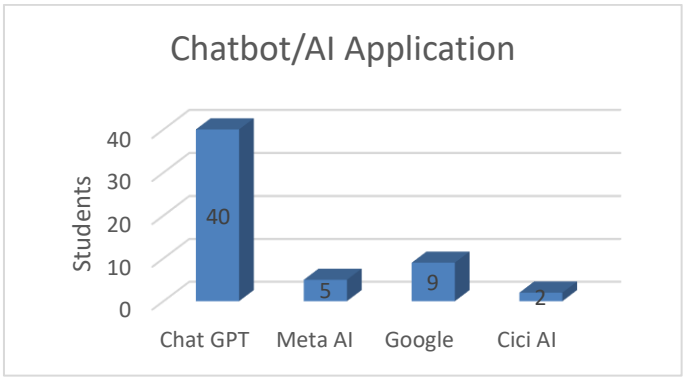


Diagram 2. Students' experience response before training



Graph 1. The chatbots/AI applications that students use before.

This section is the main part of the community service article and is usually the longest section, with the length of the results and discussion section around 60% of the total body of the article of article. In this section, the results of the community service are explained, and at the same time, a comprehensive discussion is given. Results can be presented in the form of figures, graphs, tables, and other formats that make it easier for readers to understand.

These findings align with students' concerns in hand with students' concerns about AI that could potentially replace human roles in the future. Based on diagram 3, most students with 58.5% of respondents answered Agree and 19.5% answered Strongly Agree, expressing concerns that AI/chatbots could potentially replace human roles in the future, while only 22% answered Disagree. This is the basis for the ethical use of AI, especially in physics subjects.

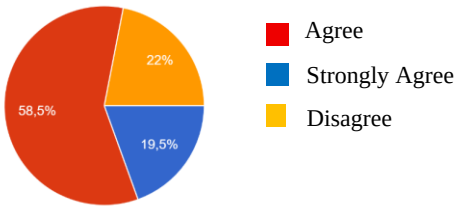


Diagram 3. Students' concerns about AI/Chatbots.

Overall, the pre-test results highlight both students' strong interest in AI-based learning and their concerns about potential negative impacts, providing a foundation for training on the ethical and responsible use of AI.

The Process of Using AI Chatbots and AI Visualizations to Improve Understanding of Physics Concepts.

Training and socialization on AI use were conducted through hands-on student activities. In the implementation, students were previously equipped with knowledge on understanding how AI works, writing good prompts, material on the process of visualizing images using AI on physics concepts, and the ethics of using AI in learning and school assignments. Afterwards, students discussed and explored physics concepts by utilizing AI-based visualization tools, such as interactive simulations and AI images using ChatGPT to deepen their understanding of physics materials.

In the process of discussion activities carried out, students were able to explain physics concepts, such as Newton's First, Second, and Third Laws with a variety of language styles and can carry out a game titled "physics detective" (developing problem-solving skills, linking theory to real life) interactively with students asked to analyze an event in everyday phenomena, then look for explanations and visualize using AI(Chat GPT). The results indicated high student enthusiasm, making the learning process more interesting, interactive, and meaningful.

Post-test evaluation of using AI Chatbots and AI Visualizations to Improve Understanding of Physics Concepts.

Based on the post-test results, there are several aspects of AI-based learning that overall showed positive results. Students' basic understanding of how AI works in physics subjects is shown in Diagram 4 where 41.5% of students answered Understand, while 58.5% answered Slightly Understand. No students answered 'Not Understood,' indicating that all students already have initial knowledge about the working principles of AI in the physics learning process in front of them, although in-depth understanding needs to be improved.

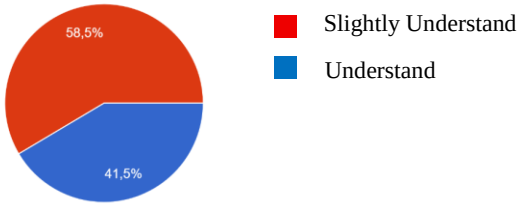


Diagram 4. Students' basic understanding of how AI works.

The basic understanding also supports students' ability to write good questions (prompts) in ChatGPT, 90.2% of students answered Agree and 7.3% answered Strongly Agree, only 2.4% answered Disagree. The data in Diagram 5 showed that almost all students had understood the technique of writing effective questions so that the AI chatbots can respond relevantly and according to the needs of physics learning.

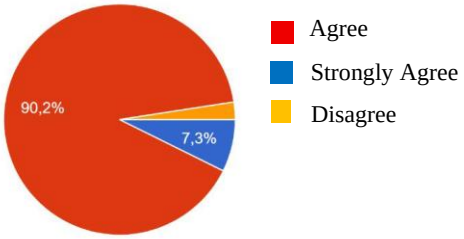


Diagram 5. Students' ability to write prompts in the AI chatbots.

The ability of students' understanding and skills in visualizing images using AI on physics concepts showed a very high percentage. In Diagram 6, students' understanding of the use of AI to create visualizations (images/video), 85.4% of students answered that they understood and only 14.6% answered that they did not understand. This is supported by data in diagram 7 on students' skills in visualizing physics concepts using AI / Chatbots, a total of 85.4% reported being able, while 4.9% reported being very confident, while only 9.8% of students answered that they were less able. This data reinforces that the majority of students already know how to use AI in making visualizations of physics concepts, both in the form of images and videos so that they are more confident in using AI as a visual medium in physics learning.

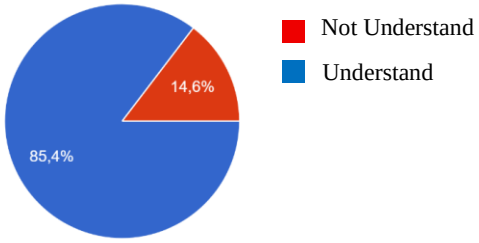


Diagram 6. Student understanding of image visualization using AI.

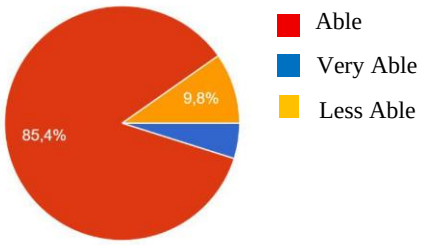


Diagram 7. Students' skills in image visualizations using AI.

Ethical aspects of AI use in education include data privacy and security, transparency in data usage, and fairness in access during the learning process at school, especially in physics subjects. The data in diagram 8 showed that students already understand the ethics of using AI, where 85.4% of students answered Agree and 14.6% answered Strongly Agree. There were no students who answered Disagree or Strongly Disagree. Ethics in the use of AI in education such as privacy and security of student data, transparency of data use, and fairness and equality in AI access are needed with clear and balanced regulations from schools, so that AI technology can be optimally utilized without damaging academic integrity (Kurniahtunnisa et al., 2024). Therefore, the role of teachers becomes very important in teaching ethical use of technology, maintaining data privacy, and encouraging academic honesty (Ikhsan et al., 2025).

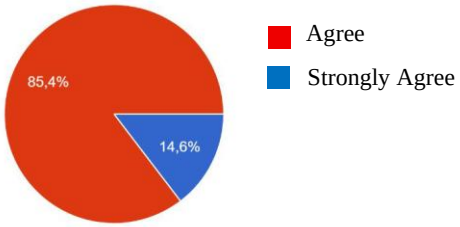


Diagram 8. Knowledge of the Ethical Use of AI in school learning.

This indicates a shift from basic familiarity (pre-test) to more confident application (post-test) that AI-based learning has successfully improved students' ability to utilize technology for learning, both in creating visualizations, interacting with chatbots effectively, and understanding the ethics of its use. These findings demonstrate that integrating AI into physics learning not only enriches the student learning experience but also equips them with essential digital skills for the technological era.

D. Conclusion

The findings of this activity indicate that the use of AI in physics learning at SMAN 6 Central Bengkulu proved to be effective in improving students' concept understanding and skills. Through training on the use of AI-based chatbots and visualizations, students gained knowledge, learned to make the right questions (prompts), visualize physics concepts interactively, and understand the ethics of its use. Based on the pre-test and post-test, it shows that students' interest is very high in participating in the training of this community service activity. There is an increase in students in terms of the ability to understand how AI works, understanding and visualization skills using AI on physics concepts, active discussion, and understanding the ethics of using AI in physics learning. Evaluation results showed that AI in physics learning makes learning more interesting, interactive, and prepares students to face learning challenges in the digital era.

E. Acknowledgment

Our gratitude goes to the Head of SMAN 6 Central Bengkulu and all teachers and staff who have given permission and full support during the implementation of community service. Our thanks also go to the students of grades X and XI of SMAN 6 Central Bengkulu for their enthusiasm and active participation during the learning activities and data collection. In addition, our appreciation also goes to all colleagues, supervisors, and other parties who have provided valuable input and suggestions for the smooth and

successful preparation of this article. Hopefully, this article will be useful in developing technology-based physics learning in the future.

F. Author Contribution Statement

All authors made a substantial contribution to the planning, execution, and completion of this study. The initial concept and design of the training program were developed collaboratively. NVA and RM were responsible for the implementation of the training sessions, the administration of the pre-test and post-test, and the assurance of the smooth collection of data during the activities focused on the review of relevant literature and the refinement of the manuscript for publication, which was borne by the team. AP and DHP were responsible for the design of the training content and the coordination of activities with SMAN 6 Central Bengkulu. DJHS and AKJ took documentation during the activities. All authors were involved in the analysis of the data and the interpretation of the findings, as well as the drafting of the article.

References

Afiliyani, M., Maryono, & Firdaus. (2024). Pengembangan Media Pembelajaran Berbasis Artificial Intelligence (AI) "CHATBOT" Melalui Pemahaman ETNOSAINS Pada Pembelajaran Fisika Suhu dan Kalor Untuk Meningkatkan Kemandirian Siswa. *Jurnal Lingkar Pembelajaran Inovatif*, *5*, 39–45. https://ojs.co.id/1/index.php/jlpi/article/view/1415

Alarbi, K., Halaweh, M., Tairab, H., Alsalhi, N. R., Annamalai, N., & Aldarmaki, F. (2024). Making a revolution in physics learning in high schools with ChatGPT: A case study in UAE. *Eurasia Journal of Mathematics, Science and Technology Education*, *20*(9). https://doi.org/10.29333/ejmste/14983

Duy, H. T., Ngoc, C. T., & Hai, N. T. (2024). Building and using chatbots in the process of self-studying physics to improve the quality of learners' knowledge. *International Journal of Education and Practice*, *12*(4), 1165–1185. https://doi.org/10.18488/61.v12i4.3859

Hermila, Bouty, A. A., & Bau, R. T. R. . (2024). Penggunaan Chat GPT Sebagai Sumber Pembelajaran Adaptif Untuk Menanggapi Kebutuhan Individu Siswa. *VOCATECH: Vocational Education and Technology Journal*, *5*(2), 126–135. https://doi.org/10.38038/vocatech.v5i2.170

Ikhsan, I., Artasoma, P., Karliani, E., Sunarno, A., & Raya, U. P. (2025). Etika Dalam Pemanfaatan Kecerdasan Buatan Di Kelas IX SMP. *SCIENCE : Jurnal Inovasi Pendidikan Matematika Dan IPA*, *5*(1), 212–223. https://doi.org/10.51878/science.v5i1.4518

Kotsis, K. T. (2025). From Chalkboard to Chatbot : The Future of Physics Education through Artificial Intelligence Integration. *Journal of Effective Teaching Methods (JETM)*, *3*(2), 74–79.

Kurniahtunnisa, Manuel, M. Y., Aini, M., & Agustina, T. P. (2024). Persepsi dan Sikap Siswa Terhadap Penggunaan Artificial Intelligence. *Scholaria : Jurnal Pendidikan Dan Kebudayaan*, *15*(1), 47–59. https://doi.org/10.24246/j.js.2025.v15.i1.p47-59

Maison, M., Hidayat, M., Kurniawan, D. A., Yolviansyah, F., Sandra, R. O., & Iqbal, M. (2022). How Critical Thinking Skills Influence Misconception in Electric Field Maison*. *International Journal of Educational Methodology*, *8*(2), 377–390. https://creativecommons.org/licenses/by/4.0/

Media, A., Engreini, S., Amini, R., & Alfana, Y. D. (2025). *Effectiveness of Using Artificial Intelligence Chatbox Integrated Case Method on Science Learning Outcomes of Basic Education Students*. *11*(1), 1206–1214. https://doi.org/10.29303/jppipa.v11i1.9815

Noviyanti, W., Ngiu, Z., & Andhani, Y. (2025). Pengaruh Penggunaan CHAT GPT Terhadap Self Efficiacy Siswa. *EDUTECH: Jurnal Inovasi Pendidikan Berbantuan Teknologi*, *5*(2), 231–244. https://jurnalp4i.com/index.php/edutech

Putri, V. D. S., Hartono, Y., & Nurkholipah, S. (2024). Dampak Penggunaan ChatGPT dalam Pembelajaran Sejarah di Tingkat Sekolah Menengah Atas (SMA). *Seminar Nasional …*, *3*(3), 704–708. http://prosiding.unipma.ac.id/index.php/SENASSDRA Dampak

Sudirman, S., Kennedy, D., & Soeharto, S. (2023). The teaching of physics at upper secondary school level: A comparative study between Indonesia and Ireland. *Frontiers in Education*, *8*(March), 1–9. https://doi.org/10.3389/feduc.2023.1118873

Taufik, M. (2024). Computational Physics Education through AI-Assisted Media: Improving Pascal Programming Skills for Sixth-Semester Physics Education Students at PMIPA FKIP UNRAM. *Journal of Classroom Action Research*, *6*(2). https://doi.org/10.29303/jppipa.v6i2.8225

Verawati, N. N. S. P., & Nisrina, N. (2024). The Role of Artificial Intelligence (AI) in Transforming Physics Education: A Narrative Review. *Lensa: Jurnal Kependidikan Fisika*, *12*(2), 212–228. https://doi.org/10.33394/j-lkf.v12i2.13523

Widiasih, Zakirman, Firmansyah, J., Aprianti, R., Nadiyyah, K., & Handayani, R. S. (2025). Peningkatan Kompetensi Guru Fisika SMA Provinsi Banten Melalui Pelatihan Pemanfaatan Artificial intelligence (AI) Dalam Pembelajaran. *KALANDRA : Jurnal Pengabdian Kepada Masyarakat*, *04*(2), 60–76. https://doi.org/10.55266/jurnalkalandra.v4i2.502