Proceeding International Conference on Religion, Science and Education (2024) **3**, 337-344

A Literature Review: The Use of Artificial Intelligence (AI) In Mathematics Learning

Mohammad Nurwahid[1], Sofia Ashar[2]
[1]Tadris Mathematic Department, Institut Alif Muhammad Imam Syafi'i Lamongan,
Jl. Raya Mantup Desa Dumpiagung Kembangbahu Lamongan, Indonesia.
[2]STTM AR Fachruddin Bojonegoro,
Jl. Raya PUK, Badug, Sumuragung, Kec. Sumberejo, Kabupaten Bojonegoro, Indonesia.

Corresponding author
[1]mohammadnurwahid96@gmail.com, [2]Sofiaashar@sttmarfachruddin.ac.id

Abstract: Artificial Intelligence (AI) has brought about major changes in education, including in the teaching and learning of mathematics. This article discusses the use of AI in learning mathematics. The research conducted included descriptive research with a qualitative approach. The method used in this research is *Systematic Literature Review* (SLR). This research was conducted by identifying, reviewing related articles and evaluating articles according to the theme and then interpreting them. Model analysis uses the Miles model through three steps, namely data collection, verification, and drawing conclusions. The results of the study show that the use of AI in mathematics learning includes: personalizing learning, making automatic assessments and proofreaders, virtual tutors, and game-based interactive learning.

Keywords: Literature Review, Artificial Intelligence (AI), Mathematics Learning.

Introduction

The development of science and technology (IPTEK) is growing rapidly. Technological advances have had a tremendous impact on humanity. One aspect of the life sector that cannot be separated from the influence of technology is education. Education is a field that is closely related to everyday life. Education is needed to improve human resources and become intelligent and forward-thinking people (Annur et al., 2022). Education is a very important factor in building a civilization of life. Therefore, quality education is needed to develop intelligent and rational human resources. Educational goals are easy to achieve if you have quality education. Therefore, efforts are needed to improve the quality of education, especially through the introduction of a more modern education system (Maufidhoh & Maghfirah, 2023). One of them is the use of Artificial Intelligence (AI) in the world of education.

AI is an application and instructions related to computer programming to do things that from a human perspective are intelligent or can be understood as a study of how to make computers do things that currently can be done better than humans (Tjahyanti et al., 2022). AI is a technology that can be used by humans as a moving assistant like a robot, but its existence is in the form of a virtual display in a computer system. AI can be thought of as the brain of a robot (Pratikno, 2017). AI systems run smartly, perform repetitive tasks efficiently, and think intelligently by learning themselves from existing data and adjusting their performance. The system quickly learns from various data (text, audio, or video), this big data repository allows AI systems to learn from data through various computational methods such as machine-learning, namely machines that have the ability to learn from big data, and update predictions and the action is fast (Jaiswal & Arun, 2021).

ISSN 2829-3355 | EISSN 2828-8467

AI with all its sophistication, has many benefits in the world of education and teaching. AI can collect, analyze and process data efficiently, quickly and accurately. A key aspect of AI is personalization which helps learners to have a personalized learning approach based on their unique abilities, preferences and experiences (Sarai & Shaheed, 2022). In terms of efficiency, AI can help organize schedules, monitor attendance, and design learning programs that suit student needs. AI can also produce more accurate and efficient reports and analysis, making it easier for decision makers to formulate policies related to the education system. On the effectiveness side, AI can help develop more adaptive and personalized learning models (Afrita, 2023). Through the use of AI, learning programs are tailored to the needs and abilities of each student, thereby increasing the effectiveness of learning and student outcomes.

The various benefits that AI provides in the world of education and teaching can be used and applied in mathematics learning. With the help of AI, new approaches to mathematics learning can be realized, changing the way students understand and interact with subject matter. The main contribution of AI in mathematics subjects is the provision of concepts, methods and tools for designing computer-based systems that are flexible and relevant for teaching and learning purposes (Orhani, 2021). In addition, AI can be maximized for the purposes of monitoring students' characteristics, competencies and psychological development (Pratikno, 2017).

AI has entered the world of mathematics education and opened up new opportunities to improve the way we learn and teach. Although there are still many things that need to be explored and improved, the use of AI in mathematics learning shows very promising potential to help students overcome obstacles in understanding and mastering material, besides that AI can also help teachers to make learning easier and create interesting innovations in mathematics learning. Therefore, it is important for teachers to know and explore the use and benefits of AI in mathematics learning. So the aim of this research is to explore the potential for using AI in mathematics learning.

Materials and Methods

The research carried out included descriptive research with a qualitative approach. The method used in this research is Systematic Literature Review (SLR). This research was carried out by identifying, reviewing related articles and evaluating articles according to themes and then interpreting them. This research begins by determining a theme that is considered interesting, then formulating a problem related to the theme that has been determined. The next step is to collect articles from national and international journals in the last 10 years that are relevant to the topic of AI in mathematics learning. The literature review carried out was sourced from various databases such as Google Scholar, Garuda Portal and Eric.gov with the search keyword "Artificial Intelligence". After collecting data, data analysis was then carried out using content analysis techniques. The validity of the analysis results is carried out by checking the literature and re-reading the literature.

Results and Discussion

After determining the theme and collecting relevant articles, the researcher reviewed the articles and selected the articles used as data sources in this research. Researchers review the research results Tejawiani et al. (2023), Afrita (2023), Pratikno (2017), Sarai & Shaheed, (2022), Saputra & Serdianus (2023), Tjahyanti et al. (2022), Jaiswal & Arun (2021), Harahap et al. (2022), Rahadiantino (2022). Based on the results of a literature review, researchers offer several uses of AI in mathematics learning as follows:

Using AI to Personalize Learning

In the traditional education system, students are often given uniform learning materials without considering the differences in characteristics and level of understanding of each student. This can be a challenge for students who have different levels of understanding of the learning material. With the help of AI, personalized learning can be implemented by identifying students' individual

needs and providing appropriate learning materials and methods. By personalizing learning, teachers can identify students' needs and provide tailored teaching materials.

One of the advantages of AI in education is its ability to analyze student data in detail. Through data analysis such as learning history, test results, learning styles, and student preferences, AI can identify each student's strengths, weaknesses, and areas that need to be improved (Pratikno, 2017). With this information, the AI system can create a personalized learning profile for each learner. AI can assist in the preparation and delivery of learning materials tailored to student profiles. This can include setting the level of difficulty, type of content, and teaching style that best suits each learner's needs. For example, if a student has an interest in mathematics AI can provide more material and assignments related to that topic.

The application of technology will increase interactivity and personalization in mathematics learning. Mathematics learning software that uses AI can adjust the difficulty level of questions according to students' abilities, thereby increasing learning motivation (Rahadiantino, 2022). Meanwhile according to Suharmawan (2023) utilizing AI using ChatGPT enables personalization of learning by adapting learning materials and methods to individual needs. Students can interact directly with ChatGPT to obtain additional explanations, answer questions, or get instant feedback. This helps students understand the material better and provides relevant guidance according to their level of understanding. According to Tjahyanti et al. (2022) this AI technology allows students or users to get services like a personal assistant. AI will collect data from learning activities that have been carried out by users, and then will provide alternative learning solutions that suit the user's needs. AI will also provide content recommendations, notify the user's study schedule, and various other important functions. AI will learn to optimize the way users learn so that the learning process can be better and more effective. Based on the benefits of AI, AI is very suitable for use in mathematics learning. It will be easier for teachers to design learning and lesson content that suits the level of ability, character and needs of students.

Apart from using ChatGPT, there are several platforms that teachers can use to personalize mathematics learning, including: 1) ALEKS, ALEKS is an online learning platform that uses AI. This platform can be used to learn math, science and English. ALEKS uses AI to evaluate students' abilities in math, science, and English. After that, ALEKS will provide material and exercises that suit the students' abilities. ALEKS will also provide feedback to students about mistakes made and provide suggestions to improve students' abilities. 2) Dreambox Learning, Dreambox Learning is a mathematics learning platform that uses AI. This platform is specially designed for students from early to intermediate classes. Dreambox Learning uses AI to determine students' learning levels and provides material and exercises that are appropriate to students' learning levels. Dreambox Learning also provides feedback to students about mistakes made and provides suggestions for improving students' abilities. 3) Carnegie Learning, Carnegie Learning is a mathematics learning platform that uses AI. This platform is specially designed for students from early to intermediate classes. Carnegie Learning uses AI to determine students' learning levels and provides material and exercises that are appropriate to students' learning levels. Carnegie Learning also provides feedback to students about mistakes made and provides suggestions for improving students' abilities. 4) Knewton, Knewton is a learning platform that uses AI. This platform is used to study a wide variety of subjects, including math, science, and English. Knewton uses AI to evaluate students' abilities and provide material and exercises that suit students' abilities. Knewton also provides feedback to students about mistakes made and provides suggestions for improving students' abilities. 5) Century Tech, Century Tech is a learning platform that uses AI to provide effective personalized learning. Century Tech allows students to learn in a more interactive and personalized way. This platform can determine students' learning levels and provide material and exercises that are appropriate to students' learning levels. Apart from that, Century Tech also provides feedback to

students about mistakes made and provides suggestions to improve students' abilities.

Using a personalized learning platform with AI has several advantages Jaiswal & Arun, (2021); Suharmawan, (2023), including: 1) Better personalization of learning. By using AI, learning platforms can determine students' learning levels and provide materials and exercises that are appropriate to students' learning levels. This allows students to learn in a more effective and efficient way according to the needs of each student. 2) Increased learning motivation. In conventional learning, students often feel bored with the material presented. However, by using a personalized learning platform with AI, students can learn in a more interactive and personalized way. This can increase students' learning motivation. 3) More effective feedback. In conventional learning, feedback is often late or non-existent. The application of technology will be able to increase interactivity and personalization in mathematics learning. Mathematics learning software that uses artificial intelligence can adjust the difficulty level of questions according to students' abilities, thereby increasing learning motivation (H. Saputra et al., 2023).

Use of AI as an automatic assessment and proofreader

The use of AI as an automatic assessment maker and corrector in mathematics learning is an example of how technology can enrich the learning experience and save time for teachers (Afrita, 2023). AI can be used to create various types of math problems with varying levels of difficulty. Based on the specified curriculum or topic, AI can generate a diverse set of questions to test students' understanding. Once students complete the assessment, their answers can be uploaded to the AI-powered platform. The AI system can then automatically analyze and correct the answers, providing instant feedback to learners about the correctness or error in their answers. According to Tjahyanti et al. (2022) the use of AI in learning can make it easier for teachers to prepare and hold quizzes and tests easily and practically. Teachers no longer need to create questions and correct questions manually. This feature allows teachers to create quizzes and tests easily and practically. Teachers only need to choose the type of subject, level, number of questions, level of difficulty, and several other options. After that, the teacher only needs to share the quiz link with students to take it directly online. One example of applying AI to create automated assessments and corrections is the kejarcita platform (https://kejarcita.id/). This feature allows teachers to create quizzes and tests easily and practically. Teachers can also use the Quizizz platform (https://quizizz.com/?lng=id) this feature can be used by teachers to create varied and interactive assessments, teachers can also set it to correct automatically and students can immediately find out the score they have obtained. There are applications or websites that use AI that teachers can use to create automatic assessments and corrections such as *Google Form, Testmoz, Proprofs, Quizstar, Quia Web, Thatquiz, Tcexam, Edbase, and Virtualx*.

Real-time based learning technology can be used to provide fast and precise feedback for students, this gives students a different learning experience. Of course, real-time based learning makes mathematics learning in class more interesting and effective (H. Saputra et al., 2023). This relatime-based technology can of course be utilized by teachers in evaluating mathematics learning, so that student learning outcomes can be analyzed more quickly, effectively and precisely in real time.

Using AI as a Virtual Tutor for Students

AI virtual tutors in mathematics learning not only provide learning material, but also provide interactive explanations. The AI system can identify areas that are difficult for students to understand and provide further explanations using various media, such as graphics, animation and video. After the explanation is given, students can immediately try the related exercises. AI will provide instant feedback on students' answers, helping them understand mistakes and correcting their understanding. One of the other big advantages is the 24-hour availability of AI virtual tutors. Students are not limited by a certain time schedule or geographical limitations. They can access study help anytime and anywhere,

Suharmawan (2023) argues that AI can carry out conversations, users can start asking various kinds of questions, then AI will answer them like a conversation with a human. Apart from that, AI also provides various kinds of information, users can find various types of information easily through AI technology. You can ask questions and AI will share answers according to the appropriate questions.

One AI-based technology that can be used as a virtual tutor in mathematics learning is ChatGPT. ChatGPT (Generative Pre-training Transformer) is an AI artificial intelligence system that has the function of connecting or interacting in text-based conversations. How to use it is quite easy, students can start by inputting one or several questions and then AI will share the relevant answers. Apart from that, ChatGPT is also equipped with other capabilities, namely being able to correct answers that are less accurate (Suharmawan, 2023). Not only ChatGPT, the PhotoMath application can also be used as a virtual tutor in learning mathematics, because with the help of AI in PhotoMath it can provide answers to the steps in solving math problems.

PhotoMath is an application that uses a smartphone camera to find answers to math questions. This application can solve mathematical problems, because it is easy to use and provides definite results, so students only need to understand the steps to solve it. The PhotoMath application can solve math problems just by pointing the camera directly at the problem. The way this application works is very similar to QR readers, and displays problem solving in just a matter of seconds, so this application really helps save time in working on math problems (Tejawiani et al., 2023). There are other applications that work and function the same as *PhotoMath*, namely *Qanda application, Question AI, Mathway, AutoMath, MalMath, Socratic, Cymath, Microsoft Math Solver, Symbolab,* and *Gauthmath*. With the help of these applications, students will be able to apply and develop solution steps when working on other similar questions and will gain an understanding of the material being studied.

Apart from being a visual virtual tutor, AI can also be used as an audio virtual tutor in mathematics learning. With the help of this audio-based AI, it will be able to help audio-type students or blind students to understand mathematics subject matter. Among the platforms or applications that use audio-based AI technology are *Google Assistant, Euclidean Voice, and Digital Mathematics Learning Companion* (DMLC). According to Putri (2020) The Eclidean Voice application is an application developed with the facility of using voice for both instructions and commands from the application and to run the application. This application also allows users whose targets are visually impaired students to be able to run the entire application using voice commands and tapping assistance as another alternative. The material voiced by Euclidean Voice can also be paused, resumed when paused, or stopped by the user with a voice command so that users can learn Euclid's Geometry material easily. In addition, users who cannot write braille can use this application to repeat material until the user understands the material presented. Further, Users can also check their understanding through the training menu provided. The Euclidean voice application can work optimally and be effectively used as a learning medium for blind students to study advanced mathematics, in this case Euclidean Geometry.

Meanwhile, according to Fatimah et al. (2021) Digital Mathematics Learning Companion (DMLC). DMLC is an application on the Android platform which is intended as an assistant teacher for blind people learning mathematics. The DMLC application is an application on the Android platform that was developed with the facility of using voice for both instructions and commands to run the application. This application also allows users whose targets are blind students to learn independently without the assistance of a special accompanying teacher and run the application as a whole using voice commands and tapping assistance as another alternative. In addition, users who cannot write braille can use this application to repeat material until the user understands the material presented. The DMLC application can work optimally and effectively.

Using AI as a Game-Based Interactive Learning Tool

Game-based learning technology applied by teachers can be an alternative to increase students' enthusiasm, interest and interest in learning more positively to understand difficult mathematics. The use of game-based technology as a means of learning mathematics can make students more interested in learning mathematics in a different way compared to conventional methods, students will get a different learning experience. With the different, active and fun game-based learning provided by technology-based learning, it can indirectly increase students' learning motivation (T. Saputra & Serdianus, 2023). Educational games are game-based interactive learning media that have knowledge content in the form of learning materials and quizzes that increase and provide positive stimulation to students' knowledge and learning outcomes with an interesting and fun learning process (Fahlevi & Zanthy, 2021).

*Game-Based Learning*is a learning method that combines games with learning material. This method is very effective in increasing student motivation and learning outcomes. Below are several platforms that teachers can use to create game-based learning. 1) Educandy, Educandy is a Game-Based Learning platform that is used to help students learn in a fun way. This platform provides a variety of games specifically designed to help students learn concepts in various subjects such as mathematics, science, languages, and social sciences. Educandy also provides features that allow teachers to follow student progress and provide appropriate feedback. Educandy uses fun and interactive learning methods, which can increase students' motivation and make them more interested in learning. Some of the games available on Educandy can be used to help students learn skills such as problem solving and critical thinking. 2) Wordwall, Wordwall is an interesting website that can be accessed at any time, by anyone and in any browser for free. Edugame wordwall is designed to make it easier for teachers to create educational game-based learning media without needing to master coding and can adapt the material to be taught. Because edugame wordwall has many templates or types and characteristics of ready-to-use games for game-based interactive learning. Mathematics learning using edugame wordwall can be done during online learning or assigned to students. Because the edugame link can be shared with other online learning media such as WhatsApp, Google Classroom, Facebook, Twitter, and so on. 3) Khan Academy Kids, Khan Academy Kids is a game-based learning application aimed at children. This app provides a wide variety of games and activities designed to help children learn about math, science, language and social sciences. The app also comes with features that allow parents and teachers to follow children's progress and provide appropriate feedback. Khan Academy Kids, which is an example of game-based learning, uses fun and interactive learning methods, which can increase children's motivation and make them more interested in learning. Some of the games available on this application can be used to help children learn skills such as problem solving and critical thinking. 4) Minecraft: Education Edition is a version of the popular game Minecraft designed specifically for education. This example of game-based learning provides a virtual environment that can be used by students and teachers to learn about various subjects such as mathematics, science, social sciences, and languages. Minecraft: Education Edition provides a variety of activities that can be used by students and teachers to help students learn the concepts needed in the subject. For example, students can learn about geometry by creating buildings in games, or learn about ecosystems by creating living gardens. This platform also provides features that allow teachers to follow students' progress and provide appropriate feedback.

By using game applications in learning, it is hoped that it can help increase students' interest and understanding of mathematics lessons. If students don't use this math learning game, students have difficulty understanding mathematics lessons, especially in understanding mathematical formulas and mathematics lessons become increasingly difficult to understand because during online learning students are used to exploring mathematics answers on the internet. So it is important to play mathematics learning games for students to increase their understanding

of mathematical formulas and insight into the importance of mathematics (Antonius Fernando et al., 2023). The application of games as learning media began with the very rapid development of video games and made them an alternative media for learning activities. This educational game needs to be developed and the game should not only be fun but also educational. Seeing the popularity of these games, educators have a good opportunity to use game design components and apply them to learning that is tailored to the curriculum. Games must have an interactive interface design and contain fun elements (Omeen, 2013).

Conclusions

The use of artificial intelligence (AI) has changed various aspects of human life, including in the education sector. AI has played a vital role in revolutionizing the way we learn, teach, and manage education systems. With its ability to quickly collect, analyze, and interpret data, AI has opened the door to significant innovation in learning experiences and educational efficiency. Basically, AI is the ability of a machine or computer system to execute tasks that require human intelligence. In the educational context, AI can be applied in various ways, from adaptive learning to more efficient school administration. The use of AI in education brings a number of potential benefits, including personalization of learning, predictive analytics, and increasing educational accessibility. Personalization of learning is one of the most prominent areas in the application of AI in education. By collecting data on learners' preferences, progress, and learning styles, AI systems can design curricula that suit individual needs. This allows each learner to learn at the pace and style that is most effective for them, maximizing understanding and retention of the material. Predictive analytics is also becoming a useful tool in the field of education thanks to AI. By analyzing previous data about student performance, AI can predict possible learning difficulties or even potential dropout. This allows teachers to respond quickly and provide needed help before problems become more serious. Besides that, educational accessibility can be improved through the application of AI. This technology allows distance learning to be more interactive and effective, and can help students with special needs to access material more easily.

However, like any other technology, the use of AI in education also faces challenges and ethical considerations. The collection of students' personal data, concerns about technology adoption harming teachers' jobs, and questions about the extent to which humans and technology should interact in educational settings are some of the many issues that need to be addressed. Thus, the use of AI in education is a growing and promising field. Through a combination of technology, pedagogical innovation, and careful attention to ethical aspects, AI has the potential to change the way we learn and teach, creating a more adaptive, inclusive, and effective educational environment.

Conflict of Interest: There are no conflicts of interest concerning the publication of this article.

References

Afrita, J. (2023). Peran Artificial Intelligence dalam Meningkatkan Efisiensi dan Efektifitas Sistem Pendidikan. *COMSERVA: (Jurnal Penelitian Dan Pengabdian Masyarakat)*, *2*(12), 3181–3187.

Annur, A. F., Sari, R., & Musa, M. M. (2022). Implementation of Environmental Education in Improving The Environmental Ethics of Madrasah Ibtidaiyah Students To Support SDGs 2030. *Jurnal Ilmiah Pendidikan Guru MI*, *12*(2), 99–108. https://doi.org/10.18952/aladzkapgmi.v12i2.7490

Antonius Fernando, Guntoro, G., Loneli Costaner, Devega, M., & Lisnawita, L. (2023). Penerapan Metode Finite State Machine Pada Game Pembelajaran Matematika. *Jurnal Karya Ilmiah Multidisiplin (JURKIM)*, *3*(1), 60–68. https://doi.org/10.31849/jurkim.v3i1.11762

Fahlevi, M. S., & Zanthy, L. S. (2021). ANALISIS KESALAHAN SISWA DALAM MENYELESAIKAN SOAL MATERI BANGUN RUANG BERDASARKAN KRITERIA WATSON DITINJAU DARI PERBEDAAN GENDER SISWA SMP KELAS VIII. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *4*(3), 709–718. https://doi.org/10.22460/jpmi.v4i3.709-718

Fatimah, C., Parinata, D., Efendy, A., & Santika, Y. (2021). Digital Mathematics Learning Companion (Dmlc): Aplikasi Android Guru Pendamping Khusus

Matematika Bagi Penyandang Tunanetra Berbasis Suara. *Jurnal Ilmiah Matematika Realistik*, *2*(1), 40–46. https://doi.org/10.33365/ji-mr.v2i1.1068

Harahap, E. P., Sediyono, E., Hasibuan, Z. A., Rahardja, U., & Hikam, I. N. (2022). Artificial Intelligence in Tourism Environments : A Systematic Literature Review. *2022 IEEE Creative Communication and Innovative Technology, ICCIT 2022*, *17*(3). https://doi.org/10.1109/ICCIT55355.2022.10118589

Jaiswal, A., & Arun, C. J. (2021). Potential of Artificial Intelligence for transformation of the education system in India. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, *17*(1), 142–158.

Maufidhoh, I., & Maghfirah, I. (2023). IMPLEMENTASI PEMBELAJARAN BERBASIS ARTIFICIAL INTELLIGENCE MELALUI MEDIA PUZZLE MAKER PADA SISWA SEKOLAH DASAR. *ABUYA: Jurnal Pendidikan Dasar*, *1*(1), 29–43.

Omeen, D. (2013). Game " Edukasi Matematika " Menggunakan Metode Path Finding Berbasis Dekstop. *Jurnal Mahasiswa Teknik Informatika*, *3*(1), 411–415.

Orhani, S. (2021). Artificial Intelligence in Teaching and Learning: An Introduction. *Kosovo Educational Research Journal*, *2*(3), 29–38. https://doi.org/10.1080/1355800850220207

Pratikno, A. S. (2017). Implementasi Artificial Intelligence Dalam Memetakan Karakteristik, Kompetensi, dan Perkembangan Psikologi Siswa Sekolah Dasar Melalui Platform Offline. *Proceeding KMP Education Research Conference Keluarga Mahasiswa Pascasarjana (KMP), September 2017*, 18–36. https://scholar.google.co.id/citations?view_op=view_citation&hl=id&user=-FbwaL4AAAAJ&citation_for_view=-FbwaL4AAAAJ:d1gkVwhDpl0C

Putri, L. A. (2020). Euclidean Voice: Aplikasi Pembelajaran Geometri Euclid Berbasis Android Untuk Penyandang Tunanetra. *Jurnal Ilmiah Matematika Realistik*, *1*(2), 23–27. https://doi.org/10.33365/ji-mr.v1i2.597

Rahadiantino, L. (2022). Implementasi Pembelajaran Artificial Intelligence Bagi Siswa Sekolah Dasar di Kota Batu, Malang, Jawa Timur. *Jurnal Inovasi Pendidikan Dan Pembelajaran Sekolah Dasar*, *6*(1). https://doi.org/10.24036/jippsd.v6i1.115857

Saputra, H., Utami, L. F., & Purwanti, R. D. (2023). Era Baru Pembelajaran Matematika: Menyongsong Society 5.0. *Indiktika : Jurnal Inovasi Pendidikan Matematika*, *5*(2), 146–157. https://doi.org/10.31851/indiktika.v5i2.11155

Saputra, T., & Serdianus. (2023). Peran Artificial Intelligence ChatGPT dalam Perencanaan Pembelajaran di Era Revolusi Industri 4.0. *MASOKAN: Jurnal Ilmu Sosial Dan Pendidikan*, *3*(1), 1–18.

Sarai, N. K., & Shaheed, J. S. M. (2022). ARTIFICIAL INTELLIGENCE IN EDUCATION. *The Indian Journal of Technical Education*, *45*(3), 1–23.

Suharmawan, W. (2023). PEMANFAATAN CHAT GPT DALAM DUNIA PENDIDIKAN. *Education Journal : Journal Education Research and Development*, *7*(2), 158–166.

Tejawiani, I., Sucahyo, N., & Sopian, A. (2023). PERAN ARTIFICIAL INTELLIGENCE TERHADAP PENINGKATAN KREATIVITAS SISWA DENGAN MENERAPKAN PROYEK PENGUATAN PROFIL PELAJAR PANCASILA. *JMM (Jurnal Masyarakat Mandiri)*, *7*(4), 3578–3592.

Tjahyanti, L. P. A. S., Saputra, P. S., & Gitakarma, M. S. (2022). Peran Artificial Intelligence (AI) Untuk Mendukung Pembelajaran Di Masa Pandemi Covid-19. *Jurnal Komputerdan Teknologi Sains(KOMTEKS)*, *1*(1), 1–7.