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AI Chatbots in Mathematics Learning: Analyzing the Effectiveness of ChatGPT in Primary Schools

Kukuh Ariyanto[1], Sutama[2], M. Noor Kholid [3]

Author Affiliations
[123]*University of Muhammadiyah Surakarta, Jl. A. Yani, Pabelan, Kartasura, Sukoharjo, Jawa Tengah 57169*

Author Emails
[1]*q200230072@student.ums.ac.id*
[2]*sut197@ums.ac.id*
[3]*m.kholid@ums.ac.id*

Abstract: This study aims to analyse the effectiveness of using Photomath application in learning mathematics at SDN 01 Sugih Waras Belitang Mulya OKU Timur. The focus of the research includes the impact of the application on students' understanding, teachers' teaching strategies, and challenges and solutions in its implementation. The research method used was descriptive qualitative with data collection techniques through observation, interviews, and documentation involving students, teachers, and principals. The results showed that the use of Photomath helps students in solving mathematics problems faster and understand the solution steps systematically. However, it was found that 40% of students showed dependence on the application without understanding the concepts deeply. Teachers face challenges in balancing the utilisation of technology with traditional learning methods, especially in preventing students from only relying on the app to get answers. In addition, limited access to devices and the internet is a major obstacle in the implementation of Photomath in schools. To optimise the utilisation of Photomath, several strategies have been implemented, such as group discussions, inquiry-based learning approach, as well as self-evaluation of understanding after using the application. Teachers also emphasised the need for additional training so that they are better prepared in integrating technology in learning. This study concludes that although Photomath has the potential.

Keywords: ChatGPT, Artificial Intelligence; Maths learning; Primary School; concept understanding; learning motivation

INTRODUCTION

The development of Artificial Intelligence (AI) technology is growing rapidly and is starting to be applied in various fields, including education. One implementation of AI that is gaining popularity is Natural Language Processing (NLP)-based Chatbots, such as ChatGPT. This technology is able to understand, process, and produce text that resembles human communication, thus providing a more interactive learning experience. In the context of learning in primary schools, especially in the subject of Mathematics, the use of ChatGPT has the potential to improve students' understanding of mathematical concepts and encourage more independent and flexible learning.

The results of research by Manuel et al. (2023) showed that the use of ChatGPT in education can help students understand complex concepts more easily and accelerate the completion of academic tasks [1]. This is in line with research Nasiba (2022) which confirms that AI can simplify Maths learning by providing instant and interactive solutions to difficult problems[2] . Meanwhile, Shabur et al. (2023) highlighted that the use of ChatGPT in learning allows students to learn at any time without fully relying on teachers or traditional textbooks[3].

At SD N 01 Sugih Waras, the implementation of ChatGPT in learning Maths has shown a positive impact on students' learning patterns. With this technology, students can access additional materials, get simpler explanations, and get instant feedback on their answers. In addition, ChatGPT helps to improve students' logical and analytical thinking skills by providing various methods of solving problems and providing alternative strategies in answering questions.

In addition to the benefits offered, the use of ChatGPT in learning Maths also faces some challenges. Melisa et al. (2025) warned that over-reliance on AI may hinder the development of students' critical thinking skills[4]. If students rely too often on ChatGPT to answer questions without trying to understand the concepts independently, they could lose the ability to solve problems by thinking logically. In addition, Ariqo et al. (2025) underlined the importance of verifying the information provided by the AI, as the data used by ChatGPT is not always completely accurate or in line with academic standards[5]. Therefore, the role of teachers in guiding students to use AI wisely is very important.

Aspects of ethics and academic integrity are also a concern in the application of ChatGPT in elementary learning. Bozkurt (2024) highlighted that the use of AI can increase the risk of plagiarism and passive dependence on technology in completing tasks[6]. Therefore, teachers need to teach students about the responsible use of AI, such as by limiting the role of ChatGPT as an aid in understanding concepts, not as an automatic means to get answers without critical thinking.

To ensure effective utilisation of ChatGPT in Maths learning at SD N 01 Sugih Waras, a balanced approach is needed. Teachers can integrate AI in learning by encouraging students to analyse the answers generated by ChatGPT, discussing alternative solutions, and teaching them how to evaluate the accuracy of the information provided by AI. Educational institutions also have a role to play in developing clear policies on the use of this technology in the school environment.

With the right approach, ChatGPT can be a valuable tool in supporting more innovative and effective Maths learning for Primary School students. Early development of digital literacy, implementation of AI-adaptive policies, and integration of technology in learning methods that encourage interaction and critical thinking will ensure that AI is optimally utilised to improve the quality of education.

Literature Review

The role of AI in Maths Education and Learning in Primary Schools

The development of Artificial Intelligence (AI) technology has brought significant changes in the world of education, including in learning Mathematics at the elementary school level. Natural Language Processing (NLP)-based AI, such as ChatGPT, enables more personalised interactions and helps students understand complex concepts more easily [7]. This technology provides a more interactive learning experience by answering students' questions in real-time, as well as offering alternative solutions in solving maths problems[8].

At SD N 01 Sugih Waras, the use of ChatGPT in Maths learning has been integrated as an aid in understanding basic concepts, such as counting operations, fractions, and geometry. Some studies show that AI can help students develop problem-solving and logical thinking skills by providing different ways of solving problems [9]. Thus, AI not only acts as an aid in understanding the material but also increases students' motivation in learning Mathematics.

Benefits of Using ChatGPT in Maths Learning

One of the main benefits of using ChatGPT in learning Mathematics is its ability to provide simple and systematic explanations. The AI can outline the steps of solving problems in detail, so that students can better understand the concepts being taught [10]. In addition, this technology allows students to learn independently without having to rely entirely on teachers or traditional textbooks, which contributes to increased flexibility in the learning process [11].

Other studies have also shown that AI can help improve students' critical and analytical thinking skills in solving mathematical problems. By providing multiple points of view in solving a problem, AI trains students to explore different strategies and develop a deeper understanding of the material [12]. Thus, ChatGPT plays a role in improving the quality of Mathematics learning through an approach that is more adaptive and responsive to students' needs.

Challenges in ChatGPT Implementation in Primary Schools

Although it offers various benefits, the use of AI in learning Mathematics also faces certain challenges. One of the main concerns is the potential dependence of students on AI in solving problems without trying to understand the concepts independently [13]. This can hinder the development of students' critical and creative thinking skills, which should be one of the main objectives in learning Mathematics in primary school [14].

In addition, the accuracy of the information provided by the AI is also a concern. As ChatGPT is based on data available on the internet, not all answers generated can be confirmed to be correct or in line with academic standards [15]. Therefore, teachers need to play an active role in supervising the use of AI in the classroom and teach students to always verify the answers provided by this technology.

Ethics and Academic Integrity in the Use of AI

The ethical aspect of using ChatGPT is also something that needs to be considered in education. Dempere et al. (2023) emphasised that AI can increase the risk of plagiarism and reduce originality in student work, especially if used irresponsibly[16]. Therefore, it is important for schools to implement clear policies regarding the use of AI in learning as well as provide students with an understanding of the importance of critical and independent thinking in completing academic tasks [17].

To address this challenge, some schools have started to integrate AI into the learning process with a more structured approach. For example, teachers can use ChatGPT as a tool in class discussions, encourage students to analyse the answers AI provides, as well as teach how to evaluate information based on correct academic standards [14]. With this approach, students can utilise AI as a learning tool that supports the development of their critical and analytical thinking skills.

Strategic Recommendations for the Implementation of AI in Mathematics Learning in Primary Schools

To ensure that the utilisation of AI in Mathematics learning can provide optimal benefits without compromising the quality of education, several strategic recommendations are needed. Firstly, educational institutions need to develop clear academic policies regarding the limitations of using AI in the learning process [9]. Second, improving digital literacy for students and teachers is an important step so that AI can be used wisely and in accordance with academic needs [14].

In addition, the integration of AI in learning methods that encourage interaction and critical thinking should be a priority. Teachers can invite students to use ChatGPT as a concept exploration tool, but still provide guidance so that students do not just accept answers without understanding the process [18]. With the right approach, AI can be a valuable tool in supporting more innovative, efficient and quality Maths learning in Primary Schools.

RESEARCH METHODS

In this research, the method used is a qualitative approach with a case study at SD N 01 Sugih Waras. Qualitative research was chosen because it aims to deeply understand how the use of ChatGPT in learning Mathematics affects students' learning process as well as teachers' involvement in the application of this technology in the classroom [19]. Case study as the research design was used to comprehensively explore students' and teachers' experiences in using ChatGPT as a learning tool for Maths in primary schools [20].

Data collection was conducted through direct observation in the classroom, semi-structured interviews with teachers and students, and document analysis in the form of learning notes and student assignments done with the help of ChatGPT. Observations were made to observe how students interacted with the AI in solving Maths problems and to what extent this technology helped them understand the concepts taught. Interviews with teachers aimed to explore their views on the effectiveness and challenges of using ChatGPT in learning, while interviews with students were used to find out their experiences and level of understanding after using AI in learning Mathematics [21].

To increase the validity of the data, this study applied the triangulation technique, which compares the results of observations, interviews, and document analyses to ensure consistency of findings [21]. In addition, the data were analysed thematically by identifying certain patterns in students' and teachers' experiences of using ChatGPT. This step refers to the thematic analysis method developed by Braun & Clarke (2006), where data were coded, grouped by main themes, and analysed in depth to understand the impact of AI technology on Mathematics learning at SD N 01 Sugih Waras[22].

Through this method, the research seeks to provide a holistic picture of the benefits as well as the challenges of using ChatGPT in learning Maths in primary schools. Thus, the results of this study are expected to provide a foundation for the development of more effective AI implementation strategies in basic education, especially in supporting more interactive and adaptive learning of Mathematics.

RESULTS

This study aims to analyse the use of ChatGPT in Mathematics learning at SD N 01 Sugih Waras, focusing on concept understanding, learning effectiveness, and challenges faced by students and teachers. Data were collected through observation, interviews, and document analysis, then analysed using thematic methods.

1. Understanding Maths Concepts with ChatGPT

Based on classroom observations, it was found that the use of ChatGPT significantly improved students' understanding in solving Maths problems. This artificial intelligence is proven to be able to provide simpler explanations and present more diverse examples compared to conventional textbooks, thus helping students understand abstract concepts. This is reflected in the results obtained from formative tests conducted before and after the use of ChatGPT at SD N 01 Sugih Waras in 2025. Before using ChatGPT, only 65% of students understood basic arithmetic operations, but after using this AI assistance, this figure increased to 90%. The most significant improvement was seen in the understanding of

fractions and geometry. Previously, only 45% of students understood fractions, but after using ChatGPT, this figure jumped to 85%. Similarly, in geometry, students' understanding increased from 40% to 80%, indicating that AI assistance was very effective in explaining material that was previously considered difficult by most students.

In addition, understanding of the concepts of multiplication and division also made significant progress, from 50% before the use of ChatGPT to 88% afterwards. Overall, this data shows that the application of AI technology in the learning process, specifically ChatGPT, can be an innovative strategy that accelerates the improvement of the quality of student understanding, especially in subjects that require strong logic and mathematical reasoning.

2. Effectiveness of ChatGPT in Improving Motivation and Learning Independence

The results of interviews with teachers and students show that the integration of ChatGPT in the Maths learning process has had a positive impact on students' learning motivation. Most students feel more enthusiastic and actively involved in learning because the presence of AI allows them to ask questions at any time and get answers instantly, without having to wait for their turn or rely entirely on the presence of the teacher. 70% of students stated that they felt more motivated in learning Maths after using ChatGPT. The presence of this AI provides a more interactive and responsive learning experience, so students feel more emotionally and intellectually engaged. In addition, 65% of students felt more independent because they could learn individually, exploring the material at their own pace and needs without relying too much on explanations from the teacher. This indicates a positive shift towards more student-centred learning.

Another positive influence can be seen from the statements of 80% of students who claimed that it was easier to understand the material after using ChatGPT. The explanations delivered by AI were considered more varied and easy to digest, especially in explaining concepts that were previously considered difficult. However, there were still a small number of students who did not feel a significant impact from the use of this AI. Around 10% of students felt that the use of ChatGPT did not really affect their learning process, while 5% of students experienced difficulties in using this application. These difficulties were generally caused by limited access to adequate devices or a lack of understanding of the technology itself.

Overall, the findings suggest that ChatGPT can be an effective tool in improving students' motivation and understanding in learning Maths. However, to ensure this positive impact can be felt by all students equally, it is important to address access barriers and strengthen digital literacy as part of the technology implementation strategy in education.

3. Challenges and Constraints in ChatGPT Implementation

Research conducted at SD N 01 Sugih Waras shows that although the use of ChatGPT in Mathematics learning has a positive impact on students' conceptual understanding, learning motivation, and learning independence, there are still several obstacles that need to be considered in the implementation process. One important finding is the tendency of students to become dependent on AI. As many as 55% of students admitted to being overly dependent on ChatGPT to solve Math problems without first trying to understand or solve the problems independently. This raises concerns about the decline in students' critical thinking skills and learning initiative if technology is used without proper supervision and guidance from teachers.

In addition, around 30% of students face obstacles in using ChatGPT due to a lack of digital literacy. Some students are not yet accustomed to using digital devices or do not understand how to interact effectively with AI systems, which can hinder their learning process. On the other hand, from the teachers' perspective, 40% stated that the answers provided by ChatGPT sometimes contain errors or biases. This raises concerns because inaccurate information can mislead students if it is not filtered or corrected beforehand. Another challenge that was found is the limited access to devices. About 25% of students do not have adequate devices to access ChatGPT, which causes a gap in the uniform application of this technology across the entire class. Overall, this research emphasises that although ChatGPT is capable of enhancing students' understanding and motivation in Mathematics, its success still heavily depends on the context of its implementation. So that the benefits can be maximally felt without sacrificing important aspects such as independent thinking and equitable access, a balanced learning strategy is needed. Teachers play a crucial role as companions and information filters, as well as facilitators who help students develop digital literacy and critical thinking skills, so that the use of technology can be a complement, not a substitute, in the learning process.

DISCUSSION

The results of this study show that the use of ChatGPT in learning Mathematics at SD N 01 Sugih Waras has a positive impact on students' concept understanding, learning motivation, and independence in learning. However, some challenges were also found, such as dependence on AI, lack of digital literacy, and limited access to devices.

1. Improved Understanding of Maths Concepts

The research findings show that after using ChatGPT, the percentage of students' understanding of Maths concepts increased significantly. This is in line with research conducted by Fuchs & Aguilos (2023), who stated that AI in learning can simplify complex concepts through interactive explanations and more varied examples. Polyportis (2023) also asserted that AI is able to provide various methods of solving problems, so that students have more options to understand a concept. In this study, the most significant improvement in concept understanding occurred in fractions and geometry. This is in line with Zakariya's (2025) research, which found that students often have difficulty in understanding abstract concepts in Maths, and AI can help by presenting more visual and adaptive explanations. Thus, ChatGPT proved to be an effective tool in clarifying concepts that are often considered difficult by elementary students.

2. Motivation and Learning Independence

The results of interviews with students showed that the majority of them felt more motivated in learning after using ChatGPT. 70% of students stated that they were more eager to learn Maths because they could ask questions at any time and get answers instantly. This is in accordance with research conducted by Krishnamoorthy et al. (2025), who found that the use of AI in education can increase student engagement by providing a more interesting and interactive learning experience. In addition, 65% of students stated that they became more independent in learning. They no longer depend entirely on the teacher in understanding the material, but can explore various concepts independently with the help of AI. Nikolopoulou (2024) asserts that one of the advantages of AI in learning is its ability to encourage exploration-based learning, where students can learn at their own pace without the pressure of a formal classroom environment.

However, there are around 10% of students who consider that the use of AI does not make a significant difference to their learning. This could be due to individual learning styles that are more suited

to traditional methods, as expressed by Dempere et al. (2023), who stated that the effectiveness of AI in education largely depends on students' preferences and readiness to adapt to new technologies.

3. Challenges in ChatGPT Implementation

Despite the great benefits, this study also found some challenges in the implementation of ChatGPT at SD N 01 Sugih Waras. One of the main obstacles is students' dependence on AI in solving problems without trying to understand the concept first. About 55% of students tended to immediately look for answers on ChatGPT without trying to solve the problems themselves. This finding is in line with Nikolopoulou's research (2024), which warns that overuse of AI can hinder the development of students' critical thinking and problem-solving skills.

In addition, the lack of digital literacy is also a challenge, with around 30% of students having difficulty in using this technology. This is reinforced by Zakariya's (2025) research, which states that not all students have sufficient technological skills to optimally utilise AI in learning. Therefore, additional training is needed to improve students' ability to use educational technology wisely. Another obstacle found in this study was errors or biases in the answers provided by ChatGPT, as noted by 40% of the teachers who participated in the interviews. Teachers stated that although AI can provide quick solutions, not all answers provided are accurate or in line with academic standards. This is supported by the research of Krishnamoorthy et al. (2025), who stated that NLP-based AI still has limitations in understanding the academic context in depth, so it is necessary to verify the information provided.

Finally, limited access to devices is also one of the obstacles, where 25% of students have difficulty using ChatGPT because they do not have adequate devices at home. Dempere et al. (2023) highlighted that the gap in access to technology is still a challenge in the application of AI in education, especially in areas that do not have evenly distributed technology infrastructure.

CONCLUSION

This study shows that the use of ChatGPT in learning Mathematics at SD N 01 Sugih Waras has a positive impact on students' understanding of concepts, increases their motivation to learn, and encourages their independence in solving Mathematics problems. The analysis shows that after using ChatGPT, students' understanding of Mathematics concepts has increased significantly, especially on fractions and geometry. In addition, the majority of students felt more motivated because they could learn independently and get instant feedback. Despite the great benefits, the study also revealed some challenges in the implementation of ChatGPT, such as students' dependence on AI without understanding the concepts deeply, lack of digital literacy that hindered some students from utilising this technology optimally, and limited access to devices among certain students. In addition, teachers noted that the answers provided by ChatGPT are not always accurate or in line with curriculum standards, so verification is needed before use in learning. In order to optimise the benefits of ChatGPT, several strategies can be implemented, such as guiding students in using AI wisely, improving digital literacy for both students and teachers, and developing academic policies governing the use of AI in learning. With a balanced approach, ChatGPT can be an effective tool in supporting more innovative, adaptive and quality learning of Maths at the primary school level. Overall, ChatGPT has great potential to improve the effectiveness of Maths learning, but its use must be combined with teacher guidance and appropriate learning strategies so that it does not replace the role of critical and analytical thinking in students' learning process.

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