

## Photomath and ChatGPT-4o Applications in Fraction Learning: A Review from the Perspective of Mathematics Education Students

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### ABSTRACT

This study intends to compare the use of two artificial intelligence-based applications, namely Photomath and ChatGPT-4o, in supporting fraction learning for mathematics education students. This study uses a qualitative approach with a phenomenological study design. Data were obtained through in-depth interviews and observations of three active second-semester students from a private university in Gorontalo Province who have used both applications in independent learning activities. The results indicate that Photomath is effective in providing fast and automatic solutions with systematic steps, but it is less in-depth in explaining mathematical concepts and does not present alternative solutions. In contrast, ChatGPT-4o is able to provide in-depth conceptual explanations, invite users to understand the logic behind each stage of the solution, and offer various approaches to solving problems, although the interactive process is slower. These findings indicate that Photomath is more suitable for quick practice, while ChatGPT-4o is ideal for conceptual learning and interactive discussions. This study has implications for the use of AI technology in mathematics learning and serves as a foundation for the development of more adaptive and effective digital-based teaching strategies.

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## 1. INTRODUCTION

The integration of artificial intelligence (AI) in mathematics learning has shown significant potential in improving students' understanding of abstract concepts, such as fractions (Hwang & Tu, 2021). Applications such as Photomath and ChatGPT 4.0 can provide instant solutions and logical explanations, supporting both independent and collaborative learning (Auna & Hamzah, 2024; Ahmad et al., 2025). Several studies have shown that this approach not only accelerates students' learning but also results in a more effective and interactive learning experience (Yusuf et al., 2024; Perifanou & Economides, 2025). ChatGPT, in particular, has been implemented in blended learning models and received positive feedback from students, who consider it a tool that facilitates their understanding of mathematics (Palayukan et al., 2024). Through its

learning customization capabilities, AI can adapt to students' learning pace and style, creating a more personalized and adaptive learning environment (Auna & Hamzah, 2024). This aligns with the characteristics of AI-driven learning, which supports the individual needs of students (Suharyo et al., 2024). This functionality is crucial because the abstract nature of mathematical objects is a contributing factor to students' learning difficulties (Angraeni et al., 2022).

Furthermore, the use of AI in the classroom has increased teaching and learning efficiency by minimizing routine tasks and allowing teachers to focus on deeper interactions with students (Ramadiani et al., 2023). The implementation of AI technology in teaching has received a positive response from teachers and students, demonstrating their readiness to adapt to changes in learning methods in this digital era (Harnawati & Hidayati, 2024). Thus, these benefits open up opportunities to enrich diverse learning experiences in the classroom through the use of technology (Hasnani et al., 2024).

The use of technology, including artificial intelligence (AI) applications, in mathematics education is crucial for improving teaching effectiveness and student understanding of the material (Li, 2025). Mathematics education students must be able to select applications that function not only as calculation tools but also as conceptual reflection tools, supporting better interaction between students and the material. Harnawati and Hidayati demonstrated that students' perceptions of AI technology in learning are very positive, suggesting it can serve as a motivator and aid in understanding complex mathematical concepts (Harnawati & Hidayati, 2024). Furthermore, the use of information and communication technology (ICT) offers new opportunities to create a more inclusive and engaging learning environment. Lase et al. emphasize that teachers' mastery of ICT is crucial for advancing education in the 21st century (Lase et al., 2022). With the appropriate application of this technology, prospective teachers can face the challenges of modern learning (Rasmin et al., 2022). However, critical aspects of technology selection and implementation are needed to ensure alignment with pedagogical objectives (Chisara et al., 2024; Børte & Lillejord, 2024).

Recent studies indicate that the use of artificial intelligence (AI) technology in mathematics education, particularly among mathematics education students, still faces challenges (Hwang & Tu, 2021; Richard et al., 2022; Engelbrecht & Borba, 2024). Although AI tools like Photomath are widely used to locate mathematical solutions, studies show that they are often used only for quick answers, rather than for in-depth understanding of mathematical concepts (Soesanto et al., 2022). Research by Hidayat et al. suggests a strong need to facilitate students' use of AI to better understand mathematics (Hidayat et al., 2022). Quantitative research by Alhazzani demonstrates the untapped potential of ChatGPT in mathematics learning, with many students hesitant to integrate the tool into their learning practices (Alhazzani, 2024). A survey of 331 university students in China also confirms this, with students showing a tendency to use AI to search for information but not to understand the broader context or concepts of the material (Lin & Jiang, 2025).

Furthermore, a study by Li and Noori showed that contextual factors significantly influenced the intention to use AI among mathematics education teachers, indicating that if contextual support were strengthened, AI use could be more optimal for conceptual understanding (Li & Noori, 2024). The potential gap between technological capabilities and their practical use could be due to a lack of training and understanding of how AI can be used effectively in education (Karan & Angadi, 2023).

Statistics related to the use of AI in education indicate that, despite its increasing adoption, its effectiveness in helping students achieve better academic performance still requires further attention. Khazanchi et al. revealed that AI-based tools can significantly improve mathematics outcomes, but proper implementation and teacher support are key to achieving this success (Khazanchi et al., 2024). Thus, efforts are needed to bridge the gap between AI use and a deeper understanding of mathematical concepts so that the benefits of this technology can be more fully realized by students in the classroom (Gürefe et al., 2024; Remoto, 2023).

The lack of research comparing the effectiveness of different AI applications, particularly Photomath and ChatGPT-4o, in fraction learning, creates a gap for further exploration. The use of AI technology in mathematics education shows potential for increasing student engagement and personalized learning (Onesi-Ozigagun et al., 2024; Saxena & Bajotra, 2024). ChatGPT-4o, for example, can stimulate interactive discussions and provide extensive feedback but may not offer the full emotional support of a human instructor (Aditya et al., 2024).

The Photomath application aims to facilitate understanding of mathematical concepts and accelerate problem solving (Romaniuk & Łukasiewicz-Wieleba, 2024). Conceptual understanding is emphasized to avoid misconceptions, particularly regarding fractions (Rapa & Husniati, 2024). The presence of these two tools represents a significant shift in pedagogy but also poses challenges for analyzing material performance, student collaboration, and using learning outcome data to enhance the educational experience (Merzifonluoğlu & Güneş, 2025). Further research involving student perspectives in mathematics education would be invaluable in navigating these opportunities and challenges.

The ability of prospective teachers to utilize information and communication technology is a crucial element that will influence the quality of mathematics instruction in the future (Mensah et al., 2023). Research examining the use of AI applications such as Photomath and ChatGPT-4o in the context of prospective teacher education can demonstrate how these two tools contribute to the development of pedagogical competencies. The Photomath application supports students in solving mathematical problems, while ChatGPT-4o can be used to explain mathematical concepts through support-based conversational interactions. This research is needed to give an understanding of the strategic use of technology in learning (Onesi-Ozigagun et al., 2024) and to assist in the development of relevant educational curricula. It is hoped that the results of this study can serve as guidelines in preparing prospective teachers to face the demands of education in the digital era. Thus, a technology-based approach to

teaching strategies will significantly impact the quality of mathematics education in the future.

This study aims to compare the role of Photomath and ChatGPT-4o in supporting the understanding and mastery of fraction concepts from the perspective of mathematics education students. First, this study identifies how the two applications compare in delivering fractional material using qualitative assessment methods to measure student understanding after using each application. Second, an ease-of-use analysis was conducted through surveys and interviews, exploring user experiences and challenges faced by students when interacting with these applications. Third, this study assesses the pedagogical contribution of each application to the teaching and learning process and considers whether the applications can encourage collaborative discussion and the application of mathematical concepts.

## 2. METHOD

This study uses a qualitative approach with a phenomenological study type, which is intended to examine in depth the perceptions of mathematics education students regarding the use of the Photomath and ChatGPT-4o applications in learning fractions. Both AI applications used are premium versions. The research subjects consisted of 3 active students in the second semester of the Mathematics Education study program at the University of Muhammadiyah Gorontalo who were selected by purposive sampling with the following criteria: (1) having used ChatGPT-4o and Photomath in independent learning activities or lectures, and (2) having taken courses related to fractions or numbers.

Data collection was carried out through semi-structured in-depth interviews and observation of student activities when using the applications to solve fraction problems. The data analysis technique was carried out descriptively and qualitatively, with the stages of data condensation, data presentation, and drawing conclusions (Miles et al., 2014). Data validity was guaranteed through triangulation of sources and techniques, as well as member checking to ensure the validity of the researcher's interpretation of the subject's perceptions. The following presents a flowchart of the research method used in Figure 1.

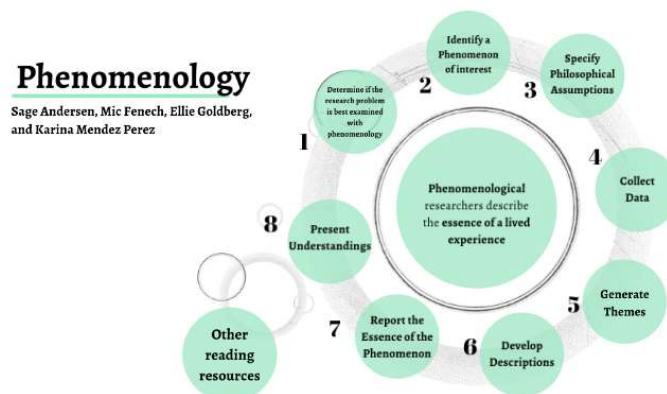




Figure 1. Phenomenological Study Type

The following presents mathematical and technical AI applications of Use used in Table 1.

**Table 1.** Mathematical and Technical AI Applications of Use

Application	Technical Usage
Photomath 	Photomath uses AI image recognition technology to analyze math problems through the camera and then provide step-by-step solutions.
ChatGPT-4o 	ChatGPT-4o is a transformer-based language model that uses deep learning to generate relevant responses based on user input.

3. RESULTS AND DISCUSSION

Results

**Photomath Application in Fraction Learning**

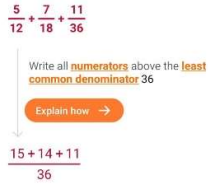
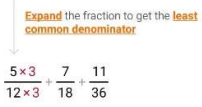
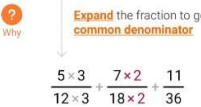

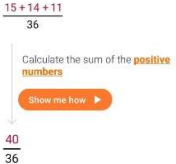
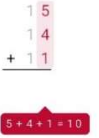
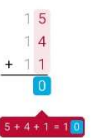
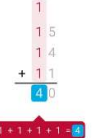
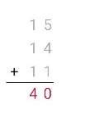
The Photomath app simplifies solving math problems by providing clear, step-by-step solutions. In learning fractions, the app helps students understand basic operations like addition, subtraction, multiplication, and division. Each step is displayed in detail, allowing students to follow the process systematically and deepen their understanding of mathematical concepts. Next, the three subjects were asked to solve fraction problems involving addition using the AI Photomath app. The following presents fraction problems in addition in Figure 2.


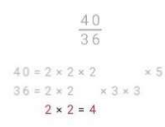

$$\frac{5}{12} + \frac{7}{18} + \frac{11}{36} = \dots$$

**Figure 2.** Fraction Problems in Addition

The following screenshots display the work of three subjects using the Photomath application to solve addition problems involving fractions.

**Table 2.** Steps for Solving Fraction Problems in Addition in the Photomath Application

No.	Completion Stage	Stage Explanation
1.		  
2.		   
3.		

No.	Completion Stage	Stage Explanation
		
4.		Does not provide an explanation of the stages of alternative solutions

The first subject identified the stages of solving fraction problems very systematically. In the first stage, the Photomath app analyzed the problem captured by the camera and mapped the fractions' forms into a format that could be further processed. The second stage involved dividing the numerators and denominators to facilitate addition. In the third stage, the app demonstrated the steps for converting the fractions to a uniform form, simplifying further calculations. Finally, the fourth stage combined the adjusted fractions, resulting in the correct sum of those fractions. However, in the alternative solution stage, the app provided no additional explanation, suggesting that its use was likely limited to finding a quick answer without going over the mathematical concepts involved.

The second subject demonstrated a solid understanding of the Photomath app's flow. The first stage, problem detection, was performed efficiently, ensuring that all components of the problem were captured correctly. In the second stage, the app suggested using the lowest common factor (GCF) to equalize the denominators of the fractions involved. The third step, adjusting the fraction form, was performed accurately, demonstrating the app's ability to automatically solve addition problems. While the app provides clear explanations, it lacks further step-by-step explanations of alternative solutions, indicating its limited ability to provide in-depth insight into the various possible approaches.

The third subject used the app, carefully observing each step. In the first step, the app accurately recognized the problem and then began the process of adjusting fractions. The second step demonstrated selecting the correct denominator to equate the dissimilar fractions. In the third step, the app suggested simplifying more complex fractions before proceeding to addition. The fourth step solved the problem correctly and quickly, despite the lack of additional explanations for alternative solutions. This suggests the app's focus on efficiency rather than further exploration of the fundamental principles involved in fraction operations.

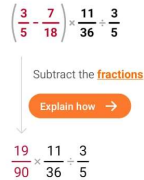
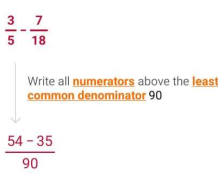


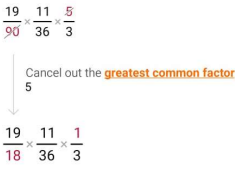
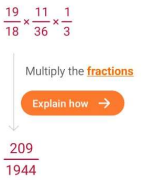
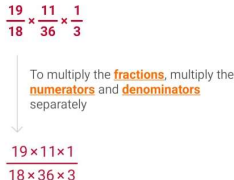
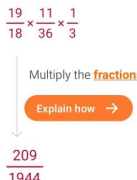

Next, the subject solved fraction problems involving subtraction, multiplication, and division. The following presents fraction problems in subtraction, multiplication, and division in Figure 3.

$$\left(\frac{3}{5} - \frac{7}{18}\right) \times \frac{11}{36} \div \frac{3}{5} = \dots$$

Figure 3. Fraction Problems in Subtraction, Multiplication, and Division

The following screenshots show the three subjects' work in the Photomath application, following the steps for solving fraction problems in subtraction, multiplication, and division.

Table 3. Stages of Solving Fraction Problems in Subtraction, Multiplication, and Division in the Photomath Application

No.	Completion Stage	Stage Explanation
1.		  
2.		Eliminate with greatest common factor 5
3.		 
4.		Does not provide an explanation of the stages of alternative solutions

The first subject demonstrated a systematic understanding of Photomath. The app analyzed fraction problems and divided the numerators and denominators to simplify addition. The structured steps helped students follow the process easily. However, the app did not provide further explanation of alternative solutions for the result 209/1944, indicating limitations in developing a deeper conceptual understanding.

The second subject used Photomath effectively, particularly in using the lowest common factor (GCF) to equate the denominators of fractions. The app suggested the correct steps and solved the problem accurately. However, the app did not explain alternative solutions for the result 0.10751, limiting insight into other methods of solving the problem.



The third subject demonstrated efficient use of the app despite limitations in Indonesian language input. Photomath correctly recognized the problem and provided a quick solution. However, the app did not provide further explanation of alternative solutions, focusing more on efficiency than on developing a more profound understanding of mathematical concepts. All three subjects indicated that while Photomath is effective for quick solutions, it lacks depth in explaining mathematical concepts.

### The ChatGPT-4o Application in Fraction Learning

ChatGPT-4o supports fraction learning with an interactive approach, providing step-by-step explanations and deeper conceptual clarification. The following explains how to use this application to solve fraction problems.

**Table 4.** Stages of Solving Fraction Problems with Addition in the ChatGPT-4o Application

No.	Solution Stage	Stage Explanation
1.	Finding the Least Common Multiple (LCM)	<p>Untuk menyelesaikan soal ini, kita harus menjumlahkan pecahan-pecahan yang diberikan, yaitu:</p> $\frac{5}{12} + \frac{7}{18} + \frac{11}{36}$ <p>Langkah pertama adalah mencari KPK (Kelipatan Persekutuan Terkecil) dari penyebut-penyebutnya, yaitu 12, 18, dan 36. Mari kita tentukan KPK-nya:</p> <ul style="list-style-type: none"> <li>Faktor prima dari 12 adalah <math>2^2 \times 3</math></li> <li>Faktor prima dari 18 adalah <math>2 \times 3^2</math></li> <li>Faktor prima dari 36 adalah <math>2^2 \times 3^2</math></li> </ul> <p>KPK dari 12, 18, dan 36 adalah <math>2^2 \times 3^2 = 36</math>.</p> <p>Jadi, kita akan menyamakan penyebut dari semua pecahan menjadi 36.</p>
2.	Converting each fraction	<p>Sekarang, kita konversikan setiap pecahan:</p> <ol style="list-style-type: none"> <li><math>\frac{5}{12}</math> menjadi <math>\frac{5 \times 3}{12 \times 3} = \frac{15}{36}</math></li> <li><math>\frac{7}{18}</math> menjadi <math>\frac{7 \times 2}{18 \times 2} = \frac{14}{36}</math></li> <li><math>\frac{11}{36}</math> sudah memiliki penyebut 36, jadi tetap <math>\frac{11}{36}</math></li> </ol>
3.	Adding fractions with the same numerator	<p>Sekarang kita tinggal menjumlahkan pecahan-pecahan tersebut:</p> $\frac{15}{36} + \frac{14}{36} + \frac{11}{36} = \frac{15 + 14 + 11}{36} = \frac{40}{36}$
4.	Conclusion	<p>Karena <math>\frac{40}{36}</math> bisa disederhanakan, kita bagi pembilang dan penyebutnya dengan 4:</p> $\frac{40}{36} = \frac{10}{9}$ <p>Jadi, hasil dari penjumlahan tersebut adalah <math>\frac{10}{9}</math>, atau bisa juga ditulis sebagai <math>1 \frac{1}{9}</math>.</p> <p><b>Kesimpulan:</b></p> <p>Hasil penjumlahan pecahan tersebut adalah <math>\frac{10}{9}</math> atau <math>1 \frac{1}{9}</math>.</p>

The first subject stated that ChatGPT-4.0 enabled a broader understanding through step-by-step discussions that not only provided straightforward solutions but also encouraged students to grasp the fundamental concepts underlying fraction operations. The process of finding the least common multiple (LCM) in the initial stages was very helpful, especially in understanding a more structured solution rather than simply relying on automatic solutions.



The second subject appreciated ChatGPT-4.0's ability to present various approaches to solving fraction problems. Furthermore, the app provided comprehensive explanations, including converting fractions and guiding students to confirm the agreement between the numerator and denominator. However, despite these in-depth explanations, the subject sometimes felt the process was a little slower than more efficient apps like Photomath.

The third subject found the app very useful for deepening their understanding of mathematical concepts, particularly in adding fractions. ChatGPT-4.0 not only provided the correct solution steps but also connected those steps with easy-to-understand explanations. However, this subject would have liked more variety in the example problems provided to enrich the learning experience. Additionally, a screenshot of the subject's problem-solving using ChatGPT-4.0 on fractions using subtraction, multiplication, and division operations.

Table 5. Stages of Solving Fraction Problems Using Subtraction, Multiplication, and Division Operations in the ChatGPT 4.o Application

No.	Solution Stage	Stage Explanation
1.	Finish the (...) sign first, then find the LCM.	<p><b>Langkah 1: Menyelesaikan <math>\frac{3}{5} - \frac{7}{18}</math></b></p> <p>Untuk mengurangi pecahan ini, kita harus menyamakan penyebutnya. Penyebutnya adalah 5 dan 18. KPK dari 5 dan 18 adalah 90.</p> <p>Sekarang, kita konversikan kedua pecahan tersebut menjadi pecahan dengan penyebut 90:</p> <p>1. <math>\frac{3}{5}</math> menjadi <math>\frac{3 \times 18}{5 \times 18} = \frac{54}{90}</math></p> <p>2. <math>\frac{7}{18}</math> menjadi <math>\frac{7 \times 5}{18 \times 5} = \frac{35}{90}</math></p> <p>Sekarang, kita dapat mengurangi pecahan-pecahan tersebut:</p> $\frac{54}{90} - \frac{35}{90} = \frac{54 - 35}{90} = \frac{19}{90}$ <p>Jadi, hasil dari operasi dalam tanda kurung adalah <math>\frac{19}{90}</math>.</p>
2.	Continue the multiplication operation: $19/90 \times 11/36$ .	<p><b>Langkah 2: Mengalikan dengan <math>\frac{11}{36}</math></b></p> <p>Sekarang kita mengalikan <math>\frac{19}{90}</math> dengan <math>\frac{11}{36}</math>:</p> $\frac{19}{90} \times \frac{11}{36} = \frac{19 \times 11}{90 \times 36} = \frac{209}{3240}$
3.	Continue the division operation: $209/3240 = 3/5$ .	<p><b>Langkah 3: Membagi dengan <math>\frac{3}{5}</math></b></p> <p>Sekarang, kita membagi hasil sebelumnya dengan <math>\frac{3}{5}</math>. Membagi dengan pecahan berarti mengalikan dengan kebalikannya. Jadi kita mengalikan <math>\frac{209}{3240}</math> dengan <math>\frac{5}{3}</math>:</p> $\frac{209}{3240} \times \frac{5}{3} = \frac{209 \times 5}{3240 \times 3} = \frac{1045}{9720}$
4.	Simplify and conclude	<p><b>Langkah 4: Menyederhanakan pecahan</b></p> <p>Kita dapat menyederhanakan <math>\frac{1045}{9720}</math> dengan membagi pembilang dan penyebutnya dengan faktor persekutuan terbesar (FPB) dari 1045 dan 9720, yaitu 5:</p> $\frac{1045}{9720} = \frac{1045 \div 5}{9720 \div 5} = \frac{209}{1944}$ <p>Jadi, hasil dari operasi tersebut adalah <math>\frac{209}{1944}</math>.</p> <p><b>Kesimpulan</b></p> <p>Hasil akhir dari soal ini adalah <math>\frac{209}{1944}</math>.</p>

The first subject stated that using ChatGPT-4o to solve fraction problems was very advantageous in understanding the basic concepts and suggested systematic steps. In the first step, the app asked to complete the () symbol before finding the LCM. Thereafter, ChatGPT-4o continued with multiplication and division operations, providing clear

explanations for each step. In the final step, the app simplified the results and provided a structured conclusion, which made the first subject feel more confident in their understanding. However, the first subject wanted more examples to deepen their understanding of the broader concept.

The second subject appreciated using ChatGPT-4o for its ability to provide in-depth explanations at each step of the solution. In the first step, the app began with finding the LCM and provided a detailed explanation of the process. Next, it performed multiplication and division operations, demonstrating each step clearly and easily. The second subject found the app effective in helping them understand the concept of fractions, although occasionally the process required more detailed prompts compared to more efficient apps like Photomath.

The third subject felt that ChatGPT-4o provided a very useful learning experience in solving fraction problems. The app was able to explain each step in detail, from completing the () sign to finding the LCM, then continuing with the multiplication operation. However, the third step needed additional prompts for the concept of division. The concept of  $3/5$  becoming  $5/3$  was not explained yet. In the final stage, the app provided an explanation of the simplification of the results and conclusions.

### Comparison of Photomath and ChatGPT-4o in Fraction Learning

Criteria	Photomath	ChatGPT-4o
Language Features	Doesn't yet offer Indonesian language support.	Prompts and answer explanations can be in Indonesian.
Problem-Solving Approach	Step-by-step solutions with automatic solutions.	Step-by-step with in-depth explanations.
Learning Focus	Fast and efficient solutions, lacking in depth of concepts.	Provides a broader understanding of concepts.
Ease of Use	Easy to use for quick answers.	Requires longer, but more in-depth interactions.
Student Engagement	I tend to focus on the result without further explanation.	Encourages students to discuss and understand the steps.
Primary Functions	Solve problems with images and automatic analysis.	Provides conceptual and interactive explanations.
Speed of Completion	Faster in providing solutions.	Slower because it provides step-by-step explanations.
Ability to Present Alternatives	Doesn't provide alternative explanations for solutions.	Provides multiple approaches to solving problems.
Limitations	Lacks in-depth explanation of mathematical concepts.	Sometimes it requires more prompts for complex problems.
Advantages	Efficient and practical, good for quick use.	Facilitates deeper understanding and interactive discussions.
Suggested Use	Quick problem solving within the context of assignments.	Deep learning and conceptual understanding for students.

## **Discussion**

### ***The Photomath Application in Fraction Learning***

The Photomath application has become an essential tool in mathematics learning, particularly in understanding fractions. Its primary function is to provide step-by-step solutions to various mathematical problems. In fraction learning, this application simplifies students' understanding of basic operations such as addition, subtraction, multiplication, and division. Through automatic image detection and analysis, Photomath allows students to clearly follow each stage of the calculation. Each solution step is presented in detail, allowing students not only to see the final answer but also to understand the underlying process. The results of this study are supported by Tejawiani et al. (2023), who showed that students' understanding of integral concepts when solving problems using the Photomath application significantly improved. This improvement was evident in aspects of process-based knowledge, relevance, and student satisfaction with the Community Service Program activities.

However, although this application offers efficiency and convenience, it has limitations in developing a deeper understanding of mathematical concepts. As found by Ranisyah et al. (2025), students stated that the application was still ineffective because it lacked audio and video features that could assist them in understanding the material. Furthermore, the solution steps provided are considered insufficiently detailed (Ranisyah et al., 2025). Photomath focuses more on quick solutions, which risks neglecting explanations of broader mathematical theories or principles. This is evident in several cases, where the app does not provide alternative solutions or a more in-depth explanation of the steps used. For example, in the addition of fractions, although the app shows the correct conversion of the denominator and numerator, it does not provide further discussion of concepts such as simplifying fractions or the role of the lowest common factor (GCF) in problem solving. This limitation suggests that Photomath is more effective as a tool for practicing problems and reinforcing basic concepts but less suitable for learning that prioritizes a deeper understanding of theories or principles. As found by Aminullah & Irwansyah (2024), the use of technology is still limited to visualization and does not fully encourage active interaction between students and the material.

The use of Photomath in learning also tends to accelerate the problem-solving process, which is beneficial for students who need quick solutions for assignments or exams. This app is particularly useful in contexts where tasks require fast and efficient results. However, learning emphasizes concept exploration and in-depth understanding; a discussion-based approach or more in-depth explanations, such as those offered by other applications, such as ChatGPT-4o, better support the learning process comprehensively.

### ***The ChatGPT-4o Application in Fraction Learning***

The ChatGPT-4o application makes a significant contribution to fraction learning through an immersive, interactive approach. Research (Arisanti et al., 2024) also clarifies that ChatGPT could solve mathematical problems involving complex

calculations. Unlike applications that focus solely on quick problem solving, ChatGPT-4o encourages users to understand each step of the solution by providing clear and detailed explanations. In fraction learning, this application not only provides direct answers but also guides students to understand the basic concepts involved in fraction operations, such as addition, subtraction, multiplication, and division.

When solving fraction problems, ChatGPT-4o proposes more systematic steps, starting with finding the least common multiple (LCM) and continuing with more complex fraction conversions. Each step of the solution is explained in detail, allowing students to follow the calculation process and understand the rationale behind each step. This plays a crucial role in developing a deeper conceptual understanding, beyond simply obtaining the correct result. Students can learn not only how to solve problems but also why and how each step is performed. Consistent with Buton et al. (2025), although the type of GPT used is not specified, GPT AI indicates that it can not only improve individual understanding but also has the potential to promote equity in learning outcomes. The findings also suggest that the application of artificial intelligence in mathematics education is a promising innovative solution for improving the quality of the learning process (Buton et al., 2025).

One of ChatGPT-4o's key strengths lies in its ability to offer multiple approaches to problem-solving. This provides students with the opportunity to explore different ways of solving fraction problems, a practice that may not always be apparent in other, more efficiency-focused applications. In this study, students reported that although the process using ChatGPT-4o was slower than using Photomath, they felt more confident in their understanding. This application allows for more profound learning, which extends beyond the result to exploring the fundamental mathematical principles underlying each operation. Although this study contradicts previous findings suggesting that ChatGPT, even without a premium version, is sufficient for lectures (Mariyadi et al., 2024), it specifically complements the mathematics learning content related to fractions.

However, ChatGPT-4o also has drawbacks, particularly in terms of problem-solving speed. While it provides more in-depth explanations, the interactive process takes longer than apps that focus solely on quick results. Some students also noted that while the explanations provided are very advantageous, the app sometimes requires more prompts to handle more complex problems or when basic concepts need further clarification. Thus, while ChatGPT-4o is not as efficient as Photomath in terms of speed, it excels in terms of in-depth conceptual understanding. For students seeking a more comprehensive understanding of fraction operations, ChatGPT-4o is an excellent choice, as it allows for discussion-based learning and a broader understanding of mathematical theory.

### ***Comparison of Photomath and ChatGPT-4o in Fraction Learning***

A comparison between the Photomath and ChatGPT-4o applications in fraction learning shows significant differences in their approaches and effectiveness in supporting student understanding of the material. Photomath focuses more on efficiency and speed in problem solving. This application allows students to quickly obtain

solutions through automated steps presented in a clear and structured manner. While very useful for solving problems that require instant solutions, Photomath tends to lack a deep understanding of the mathematical concepts involved in each step. According to Permana Dewi & Handayani (2022), Photomath does not have all the formulas connected within the application, and many formulas cannot be solved by the application. In the context of fraction learning, this application is effective for students who need quick results but may not be ideal for those who want to delve deeper into the theory behind mathematical operations.

On the other hand, ChatGPT-4o offers a more interactive and in-depth approach. This application not only provides solutions but also explains each step in detail, allowing students to understand the reasoning behind each decision made during the problem-solving process. In learning fractions, ChatGPT-4o proposes various problem-solving approaches, such as finding the least common multiple (LCM) and converting fractions, which support a more comprehensive understanding of the concepts. Although this interactive process leads to longer completion times, students report feeling more confident in their understanding because each step is explained in-depth. This finding is supported by Tyaningsih et al. (2024), who found that students are more accustomed to using ChatGPT to solve problems than they are to using other applications.

However, ChatGPT-4o also has several shortcomings. One is the need for more prompts to handle more complex problems or when further clarification of certain concepts is needed. This observation is confirmed by research (La Ode Lisbar et al., 2024), which found that ChatGPT's reliability in performing complex numerical calculations is questionable. The slower processing time also presents a challenge for students seeking quick solutions. While Photomath is more efficient at providing answers quickly, ChatGPT-4o excels in deep learning, which is more suitable for students seeking conceptual understanding.

The main difference lies in the intended use of each application. Photomath is highly effective in situations that require speed and efficiency, such as exams or assignments focused on the result. Meanwhile, ChatGPT-4o is more ideal for learning that prioritizes a deeper understanding and mastery of mathematical concepts. Both applications have different roles in the context of mathematics learning, and the choice between them should be based on the student's specific learning needs.

#### **4. CONCLUSION**

The Photomath and ChatGPT-4o applications each have their own characteristics and advantages in learning fractions for mathematics education students. Photomath excels in efficiency and rapid problem-solving through automated, step-by-step solutions but lacks conceptual depth and does not present diverse solution alternatives. In contrast, ChatGPT-4o offers an interactive approach that allows for deeper conceptual understanding with detailed explanations at each step, although it requires more time and interaction.

Therefore, it is recommended that educators and students utilize Photomath for quick practice or assignment completion, while ChatGPT-4o is more appropriate for in-depth learning and conceptual discussions. Future research is expected to involve a larger number

of subjects, utilize a mixed-methods approach, and examine the effectiveness of both applications in improving students' learning outcomes and critical thinking skills longitudinally to strengthen empirical evidence on the role of AI in mathematics education.

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