

## COMPARATIVE ANALYSIS OF GENERATIVE ARTIFICIAL INTELLIGENCE: EVALUATING CHATGPT AND DEEPSEEK-R1 IN EDUCATION

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### ABSTRACT

*Generative Artificial Intelligence (AI) chatbots, such as ChatGPT, have increasingly been adopted in educational contexts in recent years. These innovative tools can generate content and address tasks based on naturally articulated queries. They offer personalized learning experiences, provide near-real-time feedback, and foster skill development. By integrating AI technologies into educational institutions, the time-consuming and tedious tasks are achieved automatically, enabling faculty, staff, and administrators to dedicate more time to enhancing student success. Recently, DeepSeek-R1, a novel generative AI chatbot, has gained popularity due to its advanced reasoning capabilities, positioning it as a strong candidate for educational applications alongside ChatGPT. The objective of this paper is to compare the two chatbots' responses to various types of queries. Findings reveal that DeepSeek-R1 demonstrates significant reasoning abilities that are well-suited for educational purposes. The paper first examines the broader applications of AI in education and presents key features of DeepSeek-R1. Subsequently, it reports on a comparative study evaluating the performance of both chatbots. Finally, the paper also reflects on the implications of AI in education, addressing attitudes towards AI adoption and the necessary policy support.*

**KEYWORDS:** *Generative Artificial Intelligence, Chat GPT, Deep Seek, Educational Application, Comparative Study*

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### Article History

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### INTRODUCTION

In recent years, there has been great progress in the research of Large-scale Language Models (LLM) in academia and science and technology, one of which is the generative pre-training transformer (GPT). DeepSeek is a Chinese artificial intelligence (AI) company with the goal of creating Artificial General Intelligence (AGI). DeepSeek focuses on the research and development of the most advanced AI technologies, especially natural language processing (NLP) and deep learning. AI technology allows machines to understand human language, generate text, conduct dialogues, and even solve more complex problems, such as chatbots, text generation, language text translation, sorting out materials (Zhanget *al.*, 2025).

DeepSeek and ChatGPT, which have attracted much attention recently, not only show the powerful ability of generative AI, but also open a new round of global science and technology competition. AI has become the core battlefield for countries to compete (Liu, 2025). Students should master the application and knowledge of AI and become participants rather than bystanders in the era of science and technology. AI technology helps machines perform work that generally

needs intelligence of human to learn, adapt, and process a large amount of data quickly (Saleh, 2025). This function is utilized in educational technologies to assist in enhancing and personalizing students' learning, automate time-consuming and repetitive work. The use of educational technology in schools has gradually become mainstream (Shwetha *et al.*, 2023). AI technology is also used to assist machines in performing tasks that generally require human intelligence, which shows that the application of AI is becoming more and more common in daily life. The combination of AI and education is a natural trend because both students and faculty can benefit from it (Abhishek *et al.*, 2024).

Recently, DeepSeek has cleverly integrated multiple technologies to further improve the efficiency of AI (Gibney, 2025). Its low-cost and open-source model has attracted particular attention, breaking the Western monopoly on AI in the past and having a profound impact on global technological innovation and AI industry. As a reasoning model, the main advantage of DeepSeek-R1 is that it can show its thinking process, making it easier and more accurate for teachers and students to adjust the prompts to obtain a more ideal response than other AI models that do not show the thinking process. DeepSeek excels in technology, mathematics and coding, providing accurate and clear-step suggestions, which are suitable for research and schoolwork (Conroy & Mallapaty, 2025).

This paper investigates the role of DeepSeek-R1 in educational contexts, specifically in comparison to ChatGPT. The paper will examine the broader applications of AI in education, introducing DeepSeek-R1 and detailing its distinctive features. Then, a comparative analysis will be conducted to assess the performance of DeepSeek-R1 and ChatGPT in addressing logical and practical questions. Finally, the paper will explore the implications of integrating AI technologies, such as DeepSeek-R1 and ChatGPT, in educational settings, including prevailing attitudes toward AI adoption and the necessary policy support for effective implementation.

## **APPLICATION OF ARTIFICIAL INTELLIGENCE IN EDUCATION**

The application of AI technology in the field of education is becoming a hot topic. AI technologies can improve efficiency of learning and help learners to better comprehend subject knowledge. In addition, it can help teachers better administer the curriculum and evaluate students' learning (Labadze, Grigolia & Machaidze, 2023).

The application of AI in the education industry can assist in learning and eliminate possible gaps in understanding (Cetinet *et al.*, 2024). Students prepare for the exam through personalization of AI-supported functions. In addition, students learn through peers, communicate and discuss online, and participate in activities of course gamification. When students have visual or hearing disabilities, the AI system can assist in recording lecture content and use text-to-speech technology. If students are busy taking notes and cannot concentrate on listening, AI can simultaneously establish audio records and verbatim manuscripts, which is convenient for students to return to a specific time point and listen to and read the teacher's lecture. Teachers do not have to review the course and provide notes, thus saving time (Wanget *et al.*, 2023).

The AI support system can assist teachers in supervising student activities like customized learning schedules, group work, seminars or hybrid studying experiences. Therefore, it is easier for teachers to check students' progress and have more time to assist in the necessary emotional cognitive learning and behavior management. Teachers can use the AI system to check the grammar, sentence pattern and plagiarism of students' composition in advance. Moreover, AI can help determine whether students understand homework correctly and follow writing tips correctly. Management and staff can use AI to assist in grasping students' attendance, record known or undue absences, and even use AI to notify parents and students of being late. Teachers can decide whether the test paper will be scored automatically according to the test

method. The AI support system can assist instructors to determine the overall understanding of specific subjects based on individual and group assignments and test scores, and use this to plan courses, arrange classroom textbooks, establish personalized learning plans according to personal knowledge gaps, and even change courses to improve learning effectiveness (Cerrattoet *al.*, 2024).

Student education requires the support of the whole ecosystem. Improving the efficiency of contacting parents and faculty members can help improve the learning experience. For all activities such as scheduling, problem feedback, commending students' achievements and announcements, AI-supported communication and video conferencing functions can promote the communication of all stakeholders. AI helps learners better understand subject knowledge and improve learning efficiency. AI technologies provide students with tailor-made learning content and plans according to their personalized requirements and development. Moreover, AI technologies provide teachers with better teaching proposals and curriculum evaluations by considering learning data of students. AI can help teachers better manage the curriculum and evaluate students' learning (Xieet *al.*, 2024).

AI technologies provide teachers with better data analysis and curriculum management tools to help teachers better track students' learning. In addition, AI technologies can evaluate students' homework and exams automatically, decrease the teachers' workload and enhance work efficiency. AI technology can provide students with better interaction and participation experience with, for example, augmented and virtual reality (Antony & Ramnath, 2023). Moreover, AI technologies provide students with better customized support to help them learn subject knowledge.

## EMERGENCE OF DEEPSEEK

Recently, DeepSeek-R1 is a LLM developed by the Chinese company DeepSeek. It has become popular on the Internet. It has ranked first in the application download ranking list in many countries. About \$5.6 million was spent to develop DeepSeek-R1 that is comparable in performance. OpenAI has cost billions of dollars to develop its strongest OpenAI o1 large model. DeepSeek-R1 uses reinforcement learning technology on a large scale in the post-training stage, which greatly improves model reasoning ability with very few annotation data. In mathematics, code, natural language reasoning and other tasks, the performance is comparable to that of the official version of OpenAI o1 (Dreyer, 2025).

Moreover, being subject to the export ban of the United States, DeepSeek-R1 can only use Nvidia H800 chips with low performance, and only 2,000 chips are used. It is designed to comply with the export control measures issued by the United States in 2022. Less than a year after its establishment, DeepSeek launched DeepSeek-R1, an AI large language model, at the same level as ChatGPT, which shocked Silicon Valley in the United States and the stock market value of related companies has evaporated. Investors doubted whether the development of AI applications and services needed more and higher-performance AI chips, resulting in a single-day stock price of Nvidia falling by nearly 17% (Nellis& Freifeld, 2025).

DeepSeek was founded in July 2023 as an innovative technology company. The DeepSeek team is not large, with only about 140 staff members. In May 2024, DeepSeek has released an open source AI model called DeepSeek-V2, which has greatly reduced the cost of AI reasoning and launched a price war for AI large models in China. DeepSeek released the DeepSeek-V3 open source AI model in December 2024, and DeepSeek-R1 in January 2025, which successfully became the international focus (Normile, 2025). When DeepSeek-R1 was released, it would synchronize the weight of the open source model. To promote and encourage the development of the open source community and industrial ecology,

DeepSeek stated that the open source warehouse (including model weight) this time adopts a standardized and relaxed MIT License, which is completely open source. Unlike OpenAI, because DeepSeek-R1 adopts open source design, people can access and develop at will (Alnajafi, 2025).

Large Language Model (LLM) is AI technology specially used to understand and generate human language (Liet *et al.*, 2025). It is a super smart "language master" who learns the rules and knowledge of language by reading many text materials (such as books, articles, website content, etc.). The technical core of DeepSeek-R1 is also the LLM, similar to OpenAI's GPT or Google's BERT, but it focuses more on implementing AGI and making AI more versatile and intelligent. AGI is to make AI as smart as human beings, able to understand, learn and complete various complex tasks, not just a single function. AGI can think like a human being and have human self-awareness. AGI is still under development. At present, AI can only complete certain specific tasks, such as text generation, picture generation, sound generation, video generation (Cassano *et al.*, 2024).

Technology can not only process language, but also be applied in more fields in the future, such as medical diagnosis, financial analysis, and educational assistance. DeepSeek allows computers to save more memory, faster computing when processing a large amount of data, and is suitable for handling complex tasks, such as long articles. Several essential techniques of DeepSeek-R1 are introduced below.

When the computer processes long text, it reduces the use of memory and speeds up the processing. Through a technique called Low-Rank Matrix Factorization, the data that needs to be remembered is made smaller, so that the memory requirement is reduced (Sainath *et al.*, 2013). For example, it used to require a lot of memory, but now it can be reduced by 30%. It is suitable for handling long articles or dialogues, such as legal documents or multiple rounds of dialogues.

To make the computer more efficient in handling complex tasks, DeepSeek uses a technology called "Mixture of Expert" (MoE). This allows the computer to work without using all the resources when processing tasks, and only part of it can be started to work (Eliot, 2025). For example, although DeepSeek-R1 model has a total of 671 billion parameters (which can be imagined as its brain capacity), only about 37 billion of them are used each time it processes a task. The advantage of this is that the computer runs faster, and it is also more power-saving and money-saving.

To reduce memory usage and speed up the computing speed when training the model, DeepSeek uses the FP8 hybrid precision training framework, which is more memory-saving than the traditional FP16 and FP32, making training and reasoning faster and more efficient (Morgan, 2025). To achieve communication optimization, when transmitting data between multiple GPUs, a technology called DualPipe is used to make data transmission smoother, reduce waiting time, and improve overall efficiency.

DeepSeek-R1 uses reinforcement learning technology in the later stage of training. Even if there is very little annotation data, it also enhances the reasoning ability of the model a lot (Kerner, 2025). Whether it is calculating mathematics, writing programs, or natural language reasoning, its performance can be as good as the official version of OpenAI's o1.

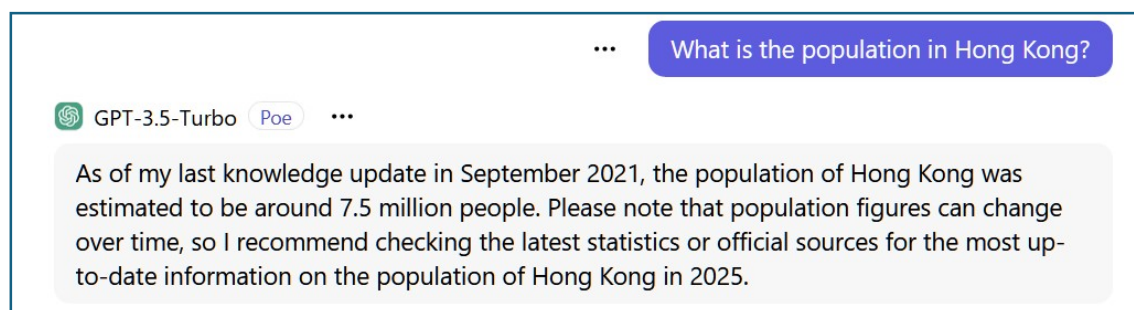
## COMPARATIVE ANALYSIS OF PERFORMANCE

AI chatbots like DeepSeek-R1 and ChatGPT have a profound impact on the field of education. AI chatbots can help students find learning resources that are more suitable for them and promote the realization of personalized learning. When students are learning a concept, AI chatbots can recommend relevant teaching videos, articles and discussions to promote students' independent learning and in-depth understanding (Adeshola & Adepoju, 2023).

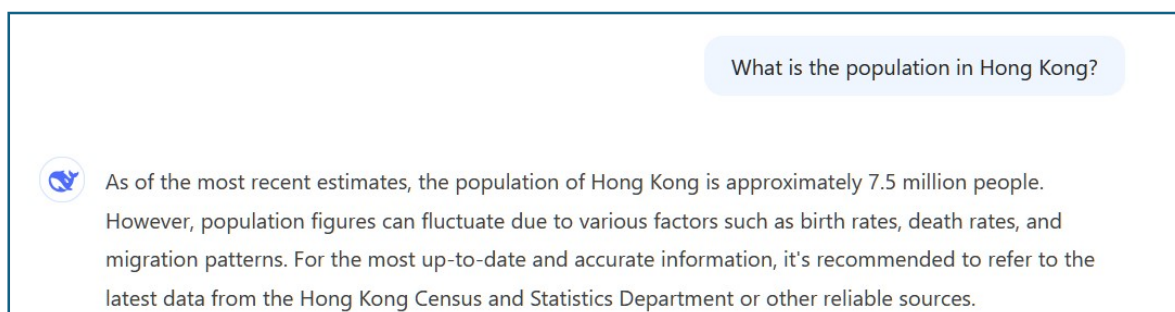
AI chatbots can analyze a huge volume of educational data to help teachers and policymakers understand the allocation and use of educational resources to optimize resource allocation and improve the efficiency and quality of education. Educators can use AI chatbots to analyze the teaching effect and understand the learning profiles of students to adjust their teaching methods. AI chatbots can also help teachers sort out materials, write lesson plans, and enhance the teaching preparation (Olugbade, Edwards & Ojo, 2024).

In recent years, ChatGPT has been used in educational institutions for various purposes mentioned above. DeepSeek-R1 is a relatively new AI chatbot available for teachers and students to use freely. In the subsequent paragraphs, various examples of responses to questions will be examined to facilitate a comparison between these two AI chatbots. DeepSeek-R1 can be accessed through its official website ([www.deepseek.com](http://www.deepseek.com)) while ChatGPT-3.5-Turbo ([www.poe.com](http://www.poe.com)) is utilized for its widespread popularity and free availability.

The accuracy of an answer to a question depends on the content of the training data, especially when the question requests facts that cannot be calculated or determined logically based on the training data. Both ChatGPT and DeepSeek-R1 provide the most updated answer and suggest checking it with other sources of information. In Fig. 1 and Fig. 2, ChatGPT and DeepSeek-R1 inform the population of a city respectively in a similar manner.

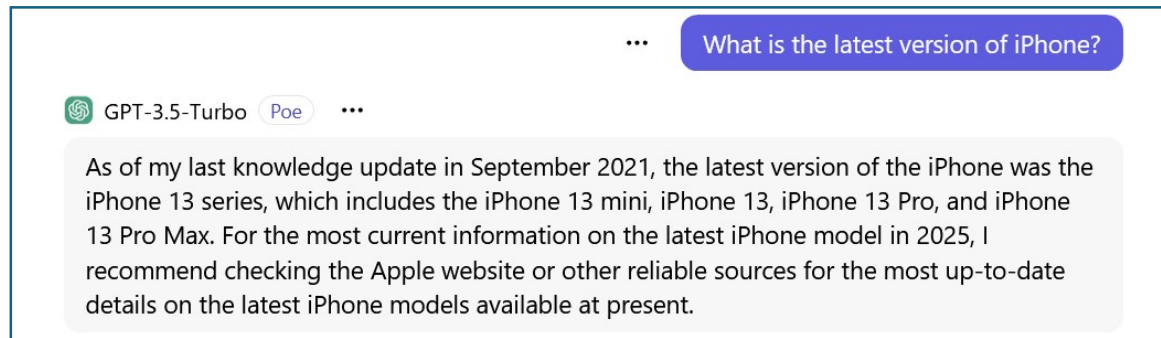


**Figure 1: ChatGPT's Response to the Population of a City.**

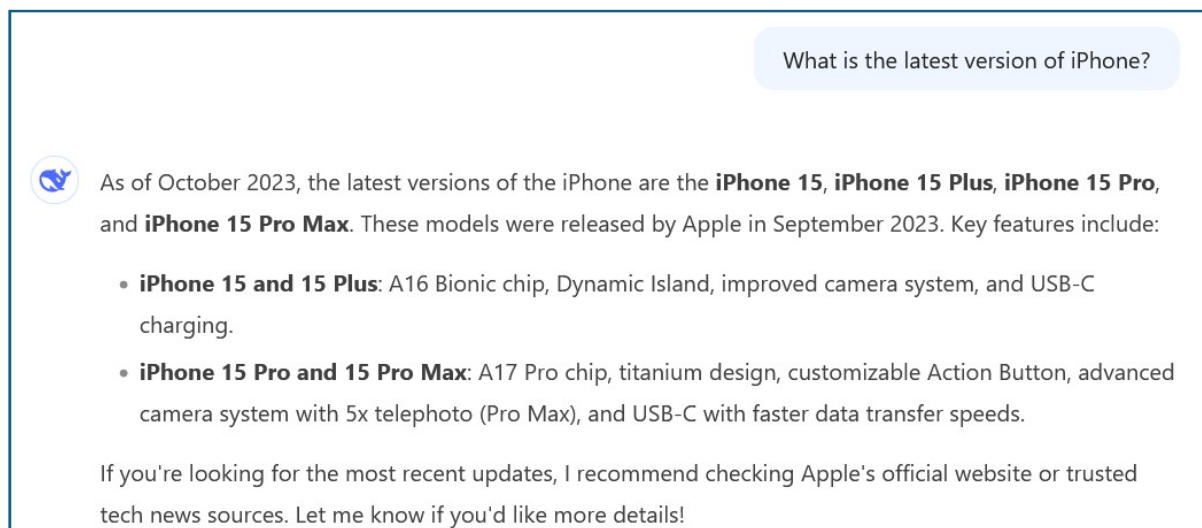


**Figure 2: Deepseek-R1's Response to the Population of a City.**

When ChatGPT and DeepSeek-R1 cannot provide the most updated information about a commercial product (see Fig. 3 and Fig. 4), they also suggest checking the answer with the official information of the company.

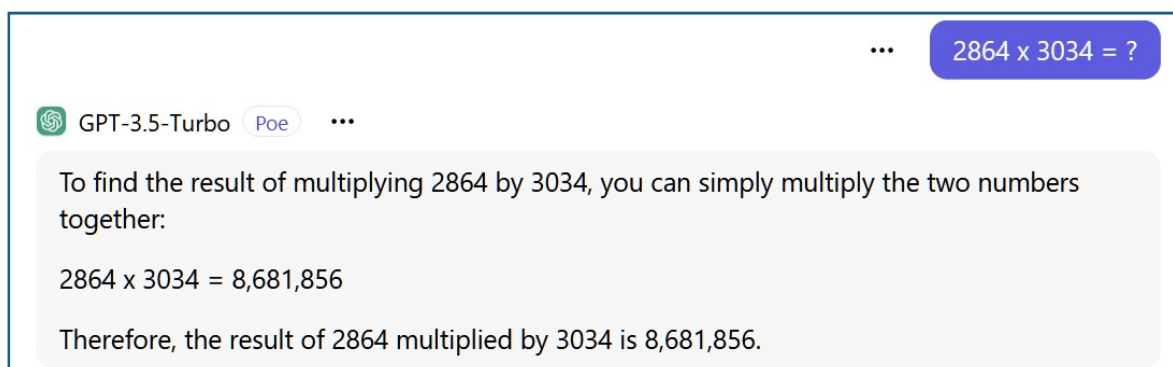


**Figure 3: ChatGPT's Response to an Enquiry on a Commercial Product.**

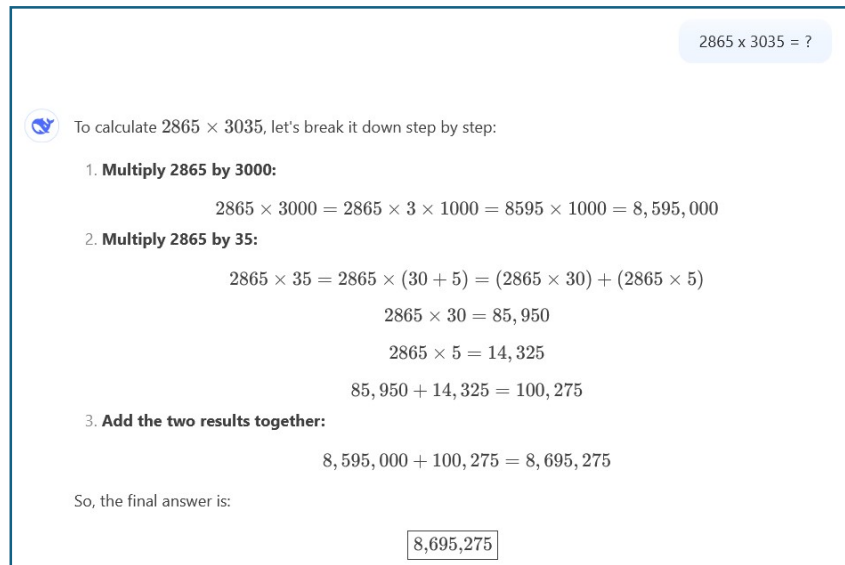


**Figure 4: Deepseek-R1's Response to an Enquiry on a Commercial Product.**

In most cases, the answer is the result of the logical and computational process. It is impossible for the training data to directly cover, for example, all the mathematical calculation results. In Fig. 5, however, ChatGPT cannot correctly calculate the multiplication of two four-digit integers ( $2864 \times 3034$ ) although it is a simple task for a typical computer. In Fig. 6, DeepSeek-R1 can offer a correct answer with an explanation.



**Figure 5: ChatGpt Calculating Multiplication of Two Numbers.**



2865 x 3035 = ?

To calculate  $2865 \times 3035$ , let's break it down step by step:

- 1. Multiply 2865 by 3000:**  

$$2865 \times 3000 = 2865 \times 3 \times 1000 = 8595 \times 1000 = 8,595,000$$
- 2. Multiply 2865 by 35:**  

$$2865 \times 35 = 2865 \times (30 + 5) = (2865 \times 30) + (2865 \times 5)$$

$$2865 \times 30 = 85,950$$

$$2865 \times 5 = 14,325$$

$$85,950 + 14,325 = 100,275$$
- 3. Add the two results together:**  

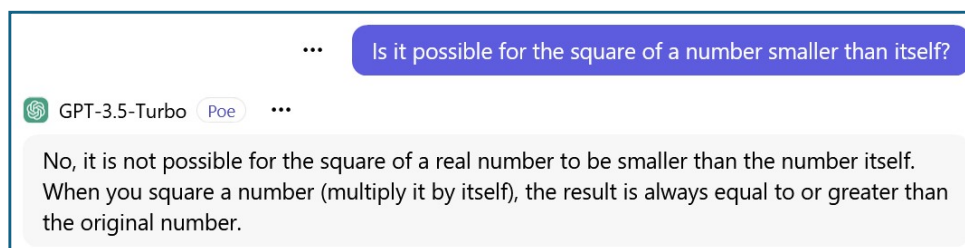
$$8,595,000 + 100,275 = 8,695,275$$

So, the final answer is:

**8,695,275**

**Figure 6: Deepseek-R1 Calculating Multiplication of Two Numbers.**

Besides mathematical expressions, a textual description of a mathematical problem is expected to be processed by AI chatbots. In Fig. 7, ChatGPT answers whether it is possible for the square of a number to be smaller than the number itself. Unfortunately, its answer is wrong. It seems ChatGPT responds based on the intuition. But in Fig. 8, DeepSeek-R1 first converts the textual description into a mathematical expression for evaluation and correctly answers the question.

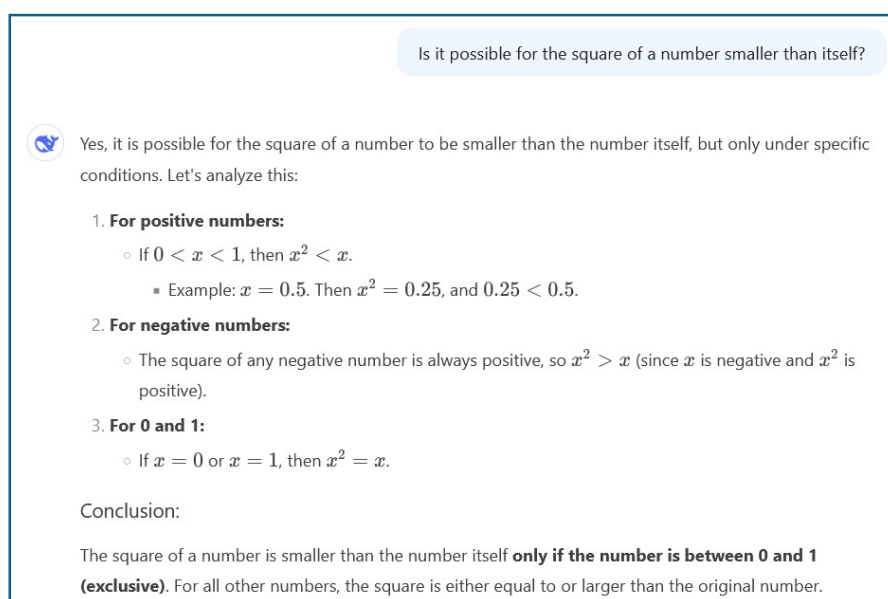


Is it possible for the square of a number smaller than itself?

GPT-3.5-Turbo

No, it is not possible for the square of a real number to be smaller than the number itself. When you square a number (multiply it by itself), the result is always equal to or greater than the original number.

**Figure 7: ChatGpt Responding to a Mathematical Problem in a Textual Description.**



Is it possible for the square of a number smaller than itself?

Yes, it is possible for the square of a number to be smaller than the number itself, but only under specific conditions. Let's analyze this:

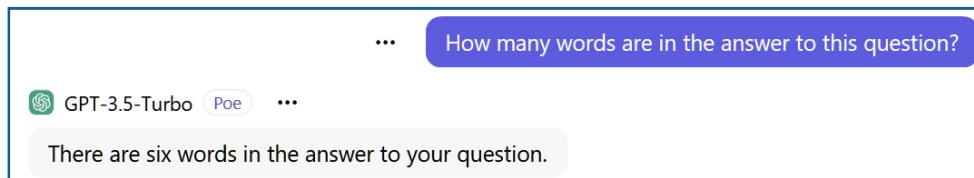
- 1. For positive numbers:**
  - If  $0 < x < 1$ , then  $x^2 < x$ .
    - Example:  $x = 0.5$ . Then  $x^2 = 0.25$ , and  $0.25 < 0.5$ .
- 2. For negative numbers:**
  - The square of any negative number is always positive, so  $x^2 > x$  (since  $x$  is negative and  $x^2$  is positive).
- 3. For 0 and 1:**
  - If  $x = 0$  or  $x = 1$ , then  $x^2 = x$ .

Conclusion:

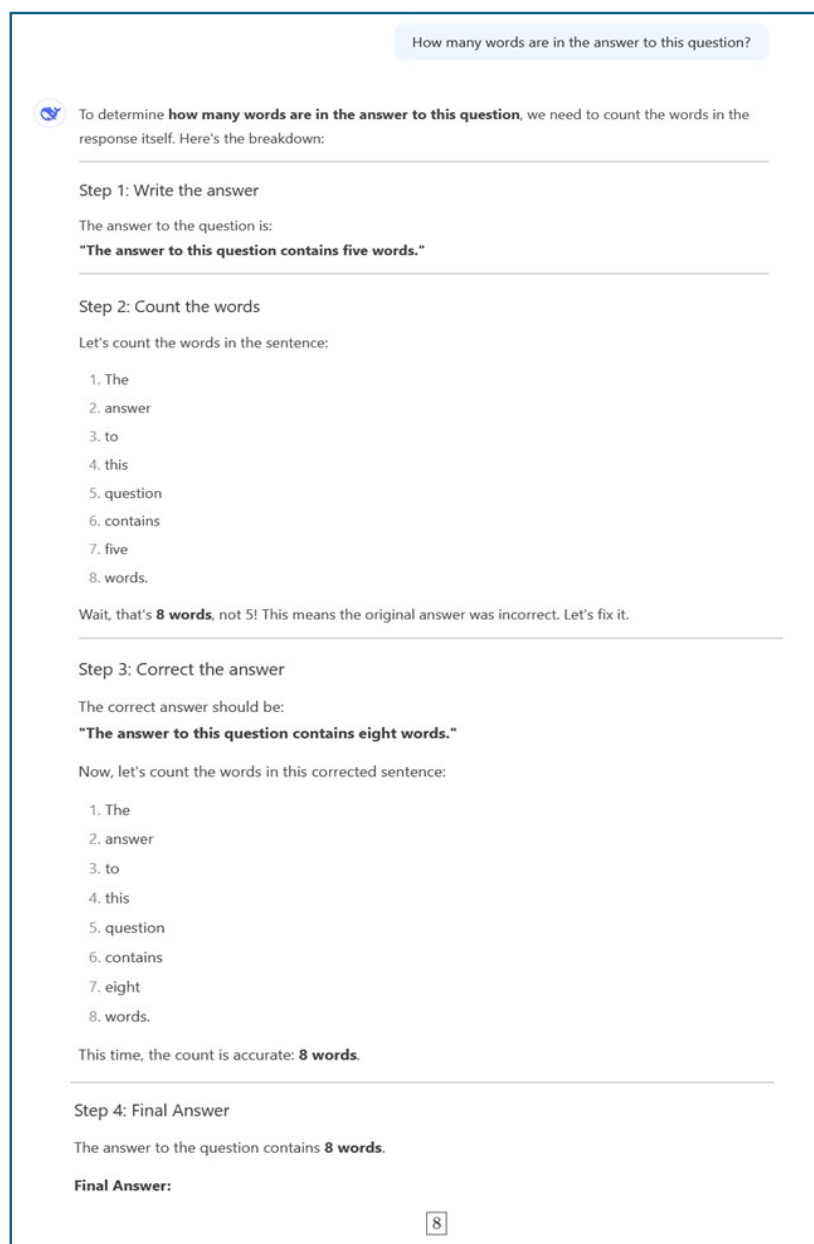
The square of a number is smaller than the number itself **only if the number is between 0 and 1 (exclusive)**. For all other numbers, the square is either equal to or larger than the original number.

**Figure 8: Deepseek-R1 responding to a Mathematical Problem in a Textual Description.**

Counting is a simple mathematical task for a computer. In Fig. 9, ChatGPT responds to a question and counts the words in its response. However, the answer is wrong. It is suggested that there may be an intermediate answer generated in the process and ChatGPT incorrectly counts the number of words of it while the final response is different from the intermediate answer. In Fig. 10, DeepSeek-R1 correctly answers the question. Its reasoning process illustrates that the initial answer is wrong but corrected finally.



**Figure 9: ChatGPT Counting the Number of Words in a Response.**



**Figure 10: Deepseek-R1 Counting the Number of Words in Response.**

Rational analysis is an important ability of AI. It is notable to find out if an AI chatbot can correctly answer questions that require logical reasoning. In Fig. 11, ChatGPT correctly repeats the question in its own words but cannot practically manage the question and produces a wrong answer. In Fig. 12, DeepSeek-R1 responds to the same question. It correctly shows all the reasoning steps as well as the final answer.

...

The wall is 10 meters high. A snail climbs up 2 meters in the daytime. But it slips down 1 meters at night. How many days does it take to reach the top of the wall?

GPT-3.5-Turbo Poe ...

Given that the snail climbs 2 meters during the day but slips down 1 meter at night, it effectively ascends 1 meter per day (2 meters up and 1 meter down).

Let's calculate how many days it would take for the snail to reach the top of the 10-meter wall:

1. On the first day, the snail climbs 2 meters and ends the day at 2 meters.
2. On the second day, it climbs 2 meters again and ends the day at 4 meters.
3. On the third day, it climbs 2 meters more and ends the day at 6 meters.
4. On the fourth day, it climbs 2 meters and ends the day at 8 meters.
5. On the fifth day, it climbs 2 meters and reaches the top of the 10-meter wall.

Therefore, it takes the snail 5 days to reach the top of the 10-meter wall.

**Figure 11: ChatGPT's Response to a Logical Question.**

The wall is 10 meters high. A snail climbs up 2 meters in the daytime. But it slips down 1 meters at night. How many days does it take to reach the top of the wall?

Let's break down the problem step by step to determine how many days it will take for the snail to reach the top of the 10-meter wall.

Key Information:

- **Wall height:** 10 meters.
- **Daily progress:** The snail climbs **2 meters** during the day.
- **Nightly slippage:** The snail slips back **1 meter** at night.
- **Net progress per day:**  $2 - 1 = 1$  meter per day.

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Step 1: Calculate the effective progress.

The snail makes a net progress of **1 meter per day**. However, on the final day, when the snail reaches or surpasses the top of the wall, it will not slip back.

Step 2: Determine the number of days.

1. For the first **8 days**, the snail makes a net progress of **1 meter per day**, reaching **8 meters** by the end of the 8th day.
2. On the **9th day**, the snail climbs **2 meters** during the day, reaching **10 meters** (the top of the wall). At this point, the snail has reached the top and does not slip back.

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Final Answer:

It takes the snail **9 days** to reach the top of the 10-meter wall.

9

**Figure 12: Deepseek-R1's Response to A Logical Question.**

To answer a question, it may be necessary to apply additional information and knowledge not provided by the question. In Fig. 13, ChatGPT attempts a deceitful question and presents logical reasoning. However, it lacks additional knowledge (i.e. a floating object is always above the rising water level) to answer correctly. In Fig. 14, DeepSeek-R1 correctly answers the question because it can apply the necessary knowledge in the final step of reasoning.

...

A ship anchored in a port has ladder which hangs over the side. The length of the ladder is 100cm. The distance between each rung is 10cm and the bottom rung touches the water. The tide rises at a rate of 5cm an hour. When will the water reach the fifth rung?

GPT-3.5-Turbo Poe ...

To solve this problem, we need to consider the ladder's length, the distance between each rung, and the rate at which the tide rises.

Given:

- Length of the ladder = 100 cm
- Distance between each rung = 10 cm
- Tide rises at a rate of 5 cm per hour

The ladder has 10 rungs, including the bottom rung that touches the water. The total height covered by the ladder is 100 cm.

When the water reaches the fifth rung, the ladder has been covered up to the 40 cm mark (bottom rung at 0 cm, 4 rungs at 40 cm).

Let's calculate how many hours it will take for the water to reach the fifth rung:

- Initially, the water level is at 0 cm.
- To reach the fifth rung at 40 cm, the water level needs to rise by 40 cm.
- Since the tide rises at a rate of 5 cm per hour, we can calculate the time it takes for the water to rise 40 cm.

$$\text{Time} = \frac{40 \text{ cm}}{5 \text{ cm/hr}} = 8 \text{ hours}$$

Therefore, it will take 8 hours for the water to reach the fifth rung of the ladder.

**Figure 13: ChatGPT's Response to the Question that Requests Additional Knowledge.**

A ship anchored in a port has ladder which hangs over the side. The length of the ladder is 100cm. The distance between each rung is 10cm and the bottom rung touches the water. The tide rises at a rate of 5cm an hour. When will the water reach the fifth rung?

Let's analyze the problem step by step to determine when the water will reach the fifth rung of the ladder.

Key Information:

- **Ladder length:** 100 cm.
- **Distance between rungs:** 10 cm.
- **Bottom rung:** Touches the water initially.
- **Tide rise rate:** 5 cm per hour.
- **Goal:** Find when the water reaches the **fifth rung**.

Step 1: Determine the height of the fifth rung.

The rungs are spaced 10 cm apart, and the bottom rung touches the water initially. The height of each rung is as follows:

- **First rung (bottom):** 0 cm (touches the water initially).
- **Second rung:** 10 cm above the water.
- **Third rung:** 20 cm above the water.
- **Fourth rung:** 30 cm above the water.
- **Fifth rung:** 40 cm above the water.

So, the **fifth rung is 40 cm above the water** initially.

Step 2: Calculate the time for the water to rise 40 cm.

The tide rises at a rate of **5 cm per hour**. To find the time it takes for the water to rise 40 cm, use the formula:

$$\text{Time} = \frac{\text{Height to rise}}{\text{Rate of rise}} = \frac{40 \text{ cm}}{5 \text{ cm/hour}} = 8 \text{ hours.}$$

Step 3: Consider the ship's movement.

As the tide rises, the ship will also float upward, keeping the bottom rung at the water level. This means the **relative position of the ladder and the water does not change**. Therefore, the water will **never reach the fifth rung** because the ladder rises with the water.

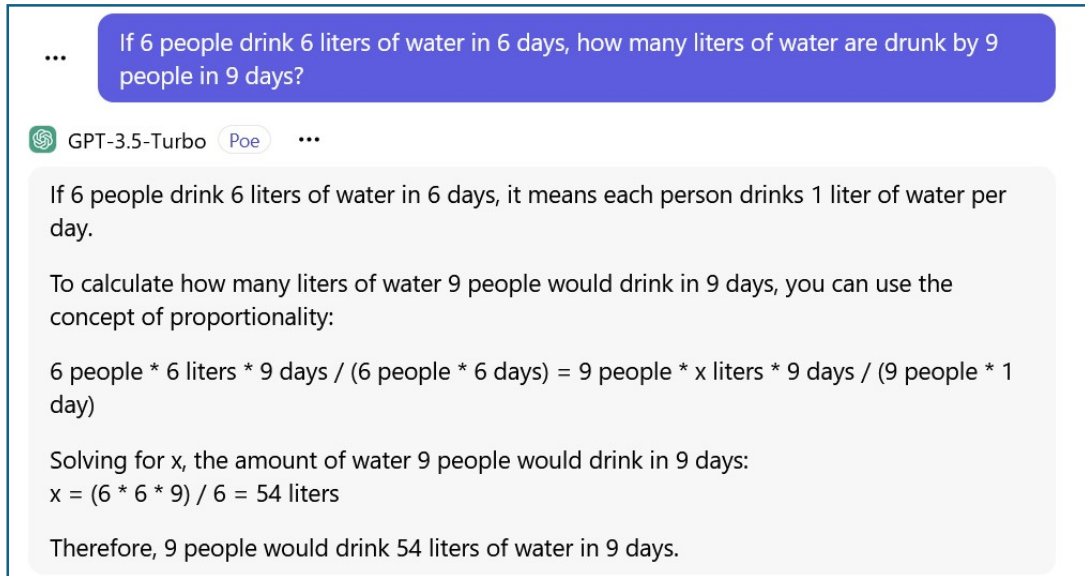
Final Answer:

The water will **never reach the fifth rung** because the ship and ladder float upward with the rising tide.

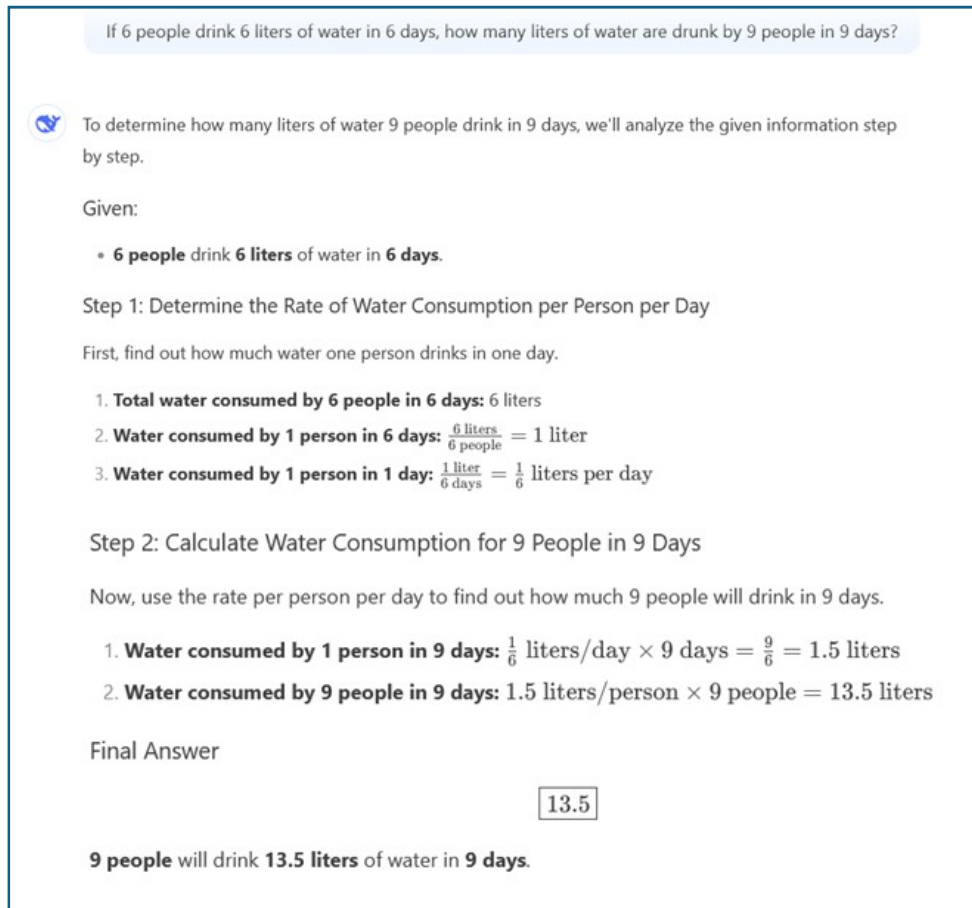
Never

**Figure 14: Deepseek-R1's Response to the Question that Requests Additional Knowledge.**

A question may be incorrectly answered with intuition (i.e., gut feeling). It is necessary to investigate the question mindfully to answer the question. In Fig. 15, ChatGPT attempts a question on ratio calculation, but its first step is intuitionally mistaken and consequently the final answer is wrong. In Fig. 16, DeepSeek-R1 explains each step mindfully and provides the correct final answer.

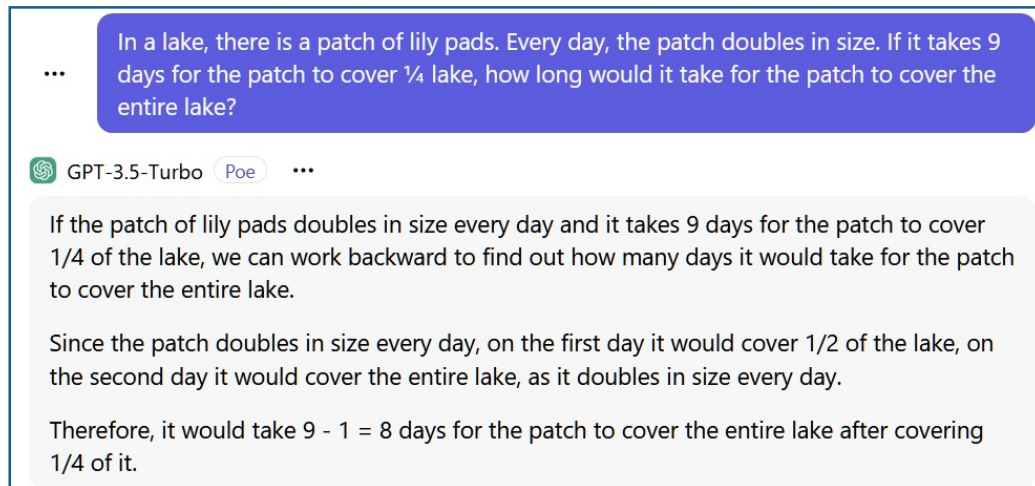


**Figure 15: ChatGPT's Response to a Question that Requires Mindful Reasoning.**

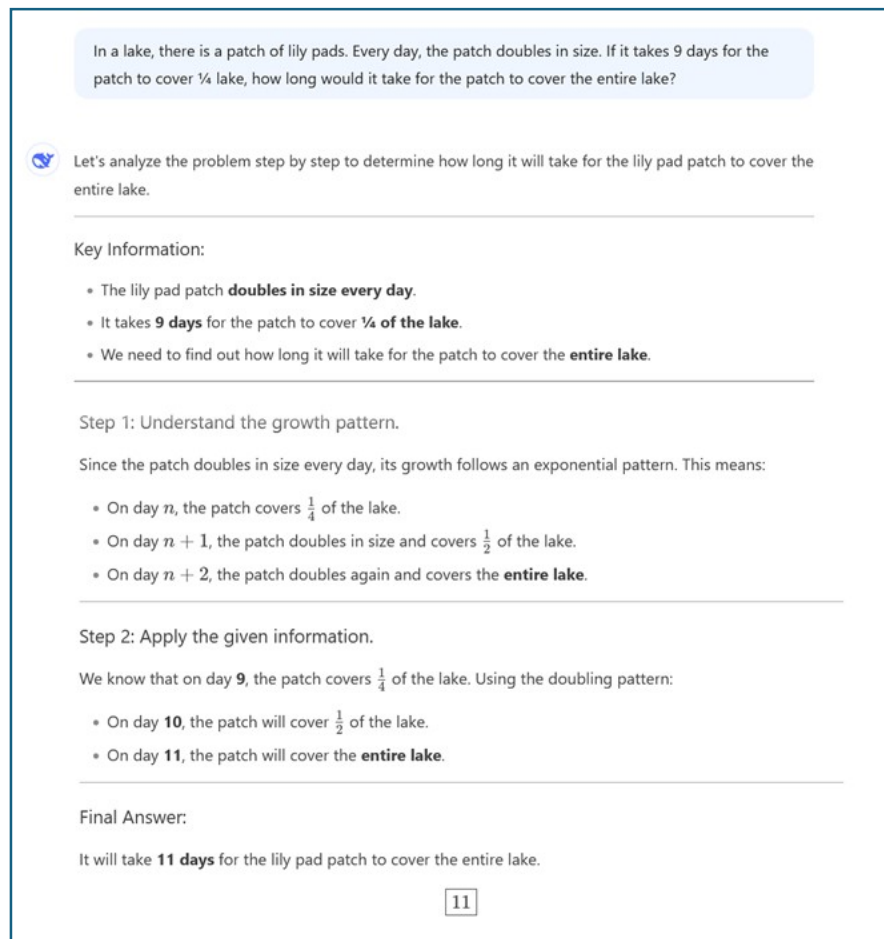


**Figure 16: Deepseek-R1's Response to a Question that Requires Mindful Reasoning.**

Forward or backward reasoning is a common technique to deduce an answer to a logical problem. In Fig. 17, ChatGPT attempts to answer a question that requires the application of forward reasoning. However, it selects a wrong (backward) approach and obtains the wrong answer. In Fig. 18, DeepSeek-R1 attempts the same question and applies the proper technique to answer correctly.

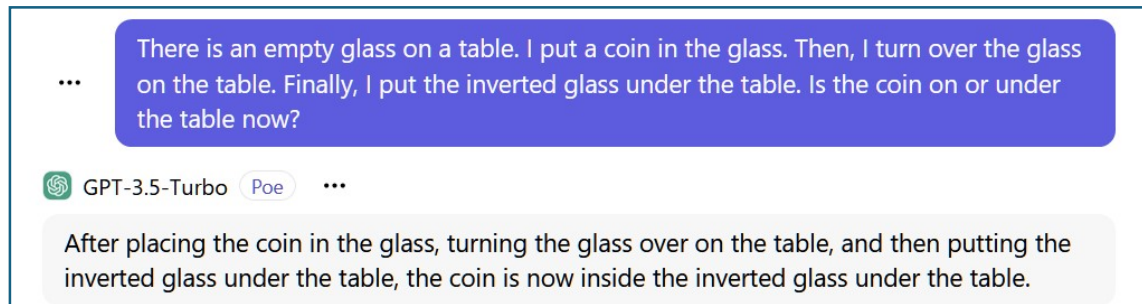


**Figure 17: ChatGPT's Response to the Forward Reasoning Question**

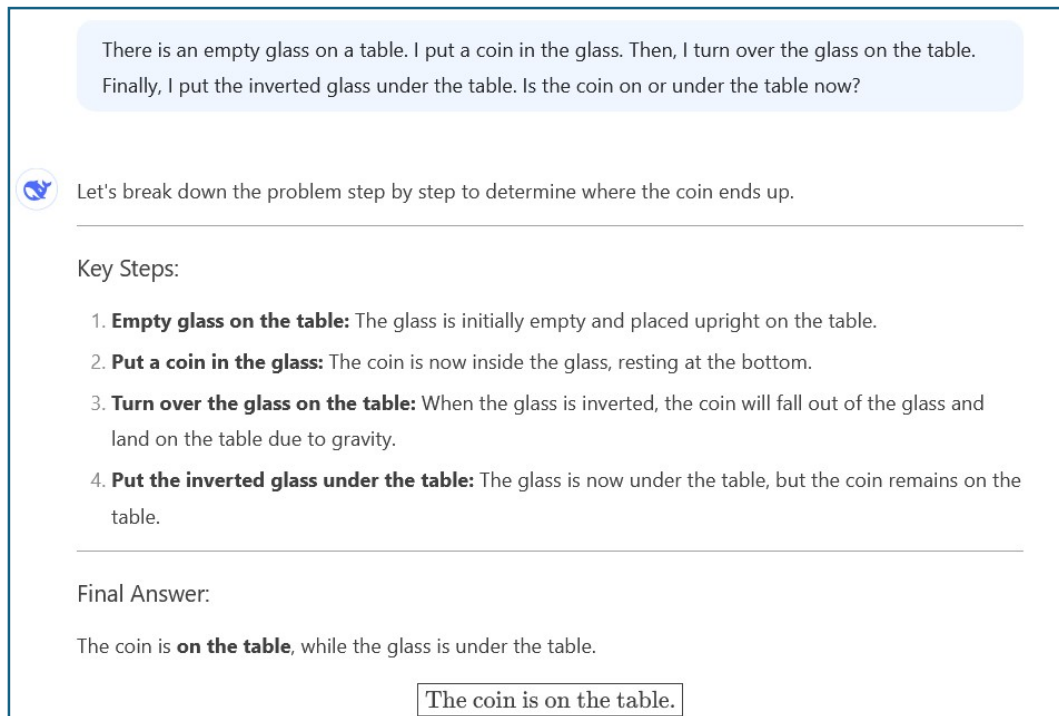


**Figure 18: Deepseek-R1's Response to the Forward Reasoning Question.**

In some situations, common sense (e.g., an object falls because of gravity) may be applied by human beings straightforwardly to solve a problem. In Fig. 19, ChatGPT cannot apply such a kind of common sense to solve the problem and answer incorrectly. In Fig. 20, DeepSeek-R1 attempts the same question and answers correctly with consideration of common sense.

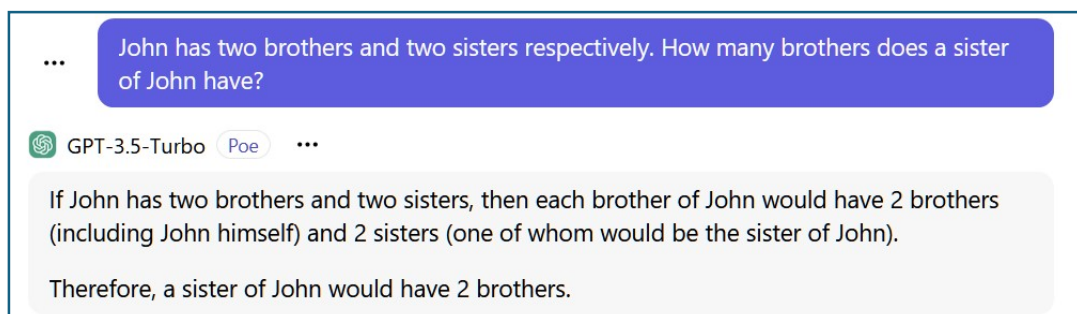


**Figure 19: ChatGPT's Response to the Question that Requires Common Sense**



**Figure 20: Deepseek-R1's Response to the Question that Requires Common Sense.**

To answer the question correctly, it may be necessary to change the perspective to investigate the question. In Fig. 21, ChatGPT attempts a question on simple counting, but it cannot change the thinking perspective and answers incorrectly. The question is: *How many brothers does a sister of John have, given that he has two brothers and sisters respectively?* John should be considered one of the brothers from the perspective of his sisters. Therefore, the answer should be three. In Fig. 22, DeepSeek-R1 can answer and explain correctly.



**Figure 21: ChatGPT's Response to the Question that Requires the Change of Perspective.**

John has two brothers and two sisters respectively. How many brothers does a sister of John have?

Let's analyze the problem step by step to determine how many brothers John's sister has.

**Key Information:**

- John has **two brothers** and **two sisters**.
- We need to find out how many brothers **one of John's sisters** has.

**Step 1: Understand the family structure.**

- John has two brothers and two sisters. This means:
  - Total siblings = John + 2 brothers + 2 sisters = **5 children** in the family.
- From the perspective of one of John's sisters:
  - She has **John** and **two other brothers**.
  - Therefore, she has **3 brothers** in total.

**Step 2: Clarify the question.**

The question asks specifically about the number of brothers that **a sister of John** has. Since John is male, he is included in the count of brothers for his sisters.

**Final Answer:**

A sister of John has **3 brothers**.

3

**Figure 22: Deepseek-R1's Response to the Question that Requires the Change of Perspective.**

**Table 1: Results of Comparative Analysis of Performance of ChatGpt and Deepseek-R1**

Questions	Accuracy of ChatGPT	Accuracy of DeepSeek-R1
10 Fact-based questions (like those in Figs. 1 – 4)	100%	100%
10 Arithmetic questions (like those in Figs. 5 – 6)	20%	100%
10 Mathematical questions (like those Figs. 7 – 10)	30%	90%
10 Logical questions (like those in Fig. 11 – 22)	10%	90%

More questions were used to evaluate the performance of two AI chatbots in a similar manner. Table 1 shows the results.

From the results above, both ChatGPT and DeepSeek-R1 are good at providing fact-based information. Thus, they are helpful in an educational environment. Their ability to process and generate responses based on extensive data allows them to assist students and educators in various ways. Reasoning capabilities of DeepSeek-R1 are superior to those of ChatGPT. DeepSeek-R1 usually shows its logical steps leading to the final answer. This feature is suitable for the learning purpose because students can trace and learn in a stepwise manner and teachers can verify the whole logical process systematically.

## IMPLICATIONS OF ARTIFICIAL INTELLIGENCE CHATBOTS IN EDUCATION

When it comes to AI education, the first thing that many people think of is to learn programming or open courses to let students understand AI. These are not real AI education. The core of AI education is not theory, but how to apply it to change the way of learning and improve learning efficiency (Akçapınar& Sidan, 2024).

One of the greatest advantages of AI Chatbot like ChatGPT and DeepSeek-R1 is that it can achieve a highly personalized learning experience. In traditional classrooms, teachers can often only teach at a unified pace: once students fall behind in a certain link, the subsequent knowledge may not be able to keep up. AI can assist in students' learning process through data analysis, and provide tailor-made exercises and resources for their weak links, so that each student can progress at his own pace.

Teachers can focus on teaching students how to use AI chatbots in class, preside over classroom interactions, and inspire discerning thinking, while some knowledge transfer can be completed online: for example, in language learning, students can first complete the first draft of an article, and then use the suggestions provided by AI chatbots to improve the text. This can not only help students improve their writing ability, but also lets them learn more in interaction with AI. Similarly, in mathematics learning, AI chatbots can help students explore different problem-solving ideas, and even provide more efficient solutions, not just give answers directly (Yetişensoy & Karaduman, 2024).

Whether AI chatbots can bring advantages in learning depends on whether students have mastered the correct usage. If students only use AI chatbots to copy answers, it will hinder their growth. Therefore, another important task of AI education is to train students to walk on both legs: first, how to use AI, and second, learning attitude and ethics. Students need to understand that AI is a tool to help them solve problems and improve their abilities, not a shortcut to being lazy.

The education community should not abandon the use of AI chatbots because it was worried that students would abuse AI tools. On the contrary, it is necessary to guide students to collaborate with AI chatbots correctly and learn to draw knowledge from AI's suggestions. How to make students maintain active learning and clear thinking in the process of using AI is also a topic that educators need to pay attention to.

To achieve the above goals, policy support is crucial. First, it is necessary to strengthen the training of teachers to help them integrate artificial intelligence into teaching. Teachers should not only know how to use AI chatbots by themselves, but also learn to guide students to use AI correctly. This requires teachers to completely change the traditional teaching-based teaching model which is both a challenge and an opportunity to promote educational innovation. At the same time, the education community needs to work closely with science and technology enterprises to update textbooks and teaching methods, such as introducing more AI learning platforms, so that students can contact AI chatbots inside and outside the classroom and learn to use it to solve practical problems.

## CONCLUSIONS

In the era of rapid progress in science and technology, it is more necessary to cultivate students' ability to think carefully. At present, AI is still limited in creativity, but it can be regarded as an auxiliary tool. If students are prohibited from using AI, they will not be able to learn to use AI correctly and effectively, and the role of teachers is to help students establish correct values and let them distinguish right from wrong.

AI can provide various benefits in the education industry, such as helping to make good use of time, greatly improving efficiency, improving the security of schools and data, providing data-oriented insights, and bringing useful tools to improve learning. AI can automate daily work, improve efficiency, and give faculty and staff more time to participate in activities. In addition, AI can automatically send personalized messages of activities and plans. Data analyzed by AI (like students, classroom tests and homework performance) can provide unique insights from teachers and management. AI's insights can be used to improve the curriculum, adjust the personalized learning experience, guide skill

development, and propose new methods to manage and guide students. In addition, according to the opinions put forward by students' progress, the school district can be used as a guide for content development (Kingchang, Chatwattana & Wannapiroon, 2024).

When people use new technology with the right attitude, this can reduce its negative impact and gradually establish an immune system that can adapt to the digital age. Highly repetitive types of work may be replaced, but human experts are still essential. For example, 50 years ago, only experts could use professional cameras to take photos. Nowadays, with the advancement of science and technology, everyone can take photos with mobile phones. Nevertheless, society still needs professional photographers. In addition, the AI model of weather forecasting is also becoming more and more common. By making good use of AI's information collection and integration capabilities, it can provide accurate weather forecasts, help the public prepare for the future, and better cope with the environment and climate change. This is exactly an example of coexistence and collaboration between human beings and AI.

Educators should strengthen the cultivation of students' innovative thinking and creativity. In the AI era, innovative thinking and creativity are students' indispensable abilities. Educators should pay more attention to cultivating children's ability to break through conventional thinking, and encourage them to participate in creative competitions and scientific and technological activities to exercise their innovative ability (Dennis Redeemer Korda & Akolgo, 2024).

To cultivate students' mathematical literacy and understanding of technology, it is very important to cultivate students' interest and understanding of digital technology from an early age. Encourage students to learn programming, algorithms and logical thinking, and pay attention to the development of cutting-edge technology to stimulate students' enthusiasm for technological exploration (Goekcearslan, Tosun & Erdemir, 2024). Teachers should pay attention to protect students' interests and hobbies, and encourage their interdisciplinary learning. AI chatbots like ChatGPT and DeepSeek-R1 integrate multidisciplinary knowledge to encourage students to carry out interdisciplinary learning and break the boundaries between disciplines.

Without separate guidance, students may regard ChatGPT and DeepSeek-R1 as a shortcut to complete homework, which will weaken the learning efficiency. It is urgent to promote AI education, and the key is how to make AI help to improve learning instead of replacing learning. After the introduction of AI chatbots, people's focus has shifted to resource optimization and saving research and development costs. The open source model has further promoted the popularization of AI applications and successfully broke the monopoly of the AI market. Human beings have officially entered the post-artificial intelligence era and must learn to coexist and collaborate with AI, and described that AI will be as simple and easy to use as the Excel test table. In addition, various AI technologies, including chatbots and content generation tools, are being used more frequently to enhance the learning experience, save time for content production, and stimulate creativity.

## REFERENCES

1. Abhishek, N., Devesh, S., Ashoka, M.L., Suraj, N., Acharya, P., & Divyashree, M.S. (2024). Navigating AI and chatbot applications in education and research: A holistic approach. *Quality Education for All*, 1(1), 277–300. <https://doi.org/10.1108/QEA-10-2023-0005>
2. Adeshola, I., & Adepoju, A. P. (2023). The opportunities and challenges of ChatGPT in education. *Interactive Learning Environments*, 1–14. <https://doi.org/10.1080/10494820.2023.2253858>

3. Akçapınar, G., & Sidan, E. (2024). *AI chatbots in programming education: Guiding success or encouraging plagiarism*. *Discover Artificial Intelligence*, 4(1), 87–10. <https://doi.org/10.1007/s44163-024-00203-7>
4. Alnajafi, N. (2025). *DeepSeek and open source AI: What it means for contracts professionals*. *Contract Nerds*. <https://contractnerds.com/deepseek-and-open-source-ai-for-contracts-professionals/>
5. Antony, S., & Ramnath, R. (2023). *A phenomenological exploration of students' perceptions of AI chatbots in higher education*. *IAFOR Journal of Education*, 11(2), 7–38. <https://doi.org/10.22492/ije.11.2.01>
6. Cassano, F., Gouwar, J., Lucchetti, F., Schlesinger, C., Freeman, A., Anderson, C. J., Feldman, M. Q., Greenberg, M., Jangda, A., & Guha, A. (2024). *Knowledge transfer from high-resource to low-resource programming languages for code LLMs*. *Proceedings of ACM on Programming Languages*, 8(OOPSLA2), 677–708. <https://doi.org/10.1145/3689735>
7. Cerratto Pargman, T., Sporrang, E., Farazouli, A., & McGrath, C. (2024). *Beyond the hype: Towards a critical debate about AI chatbots in Swedish higher education*. *Högre Utbildning*, 14(1), 74–81. <https://doi.org/10.23865/hu.v14.6243>
8. Cetin, Y., Tas, O., Alakus, H., & Kaplan, H. ibrahim. (2024). *Examining School Principals' and Teachers' Perceptions of Using ChatGPT in Education*. *Education Process: International Journal*, 13(3), 85–105. <https://doi.org/10.22521/edupij.2024.133.5>
9. Conroy, G., & Mallapaty, S. (2025). *How China created AI model DeepSeek and shocked the world*. *Nature (London)*, 638(8050), 300–301. <https://doi.org/10.1038/d41586-025-00259-0>
10. Dennis Redeemer Korda, Dapaah, E. O., & Akolgo, E. A. (2024). *The role of AI chatbots in education: a review*. *Academy Journal of Science and Engineering*, 18(1), 79–87.
11. Dreyer, J. (2025). *China made waves with Deepseek, but its real ambition is AI-driven industrial innovation*. *Nature (London)*, 638(8051), 609–611. <https://doi.org/10.1038/d41586-025-00460-1>
12. Eliot, L. (2025). *Mixture-of-experts AI reasoning models suddenly taking center stage due to china's deepseek shock-and-awe*. *Forbes*. <https://www.forbes.com/sites/lanceeliot/2025/02/01/mixture-of-experts-ai-reasoning-models-suddenly-taking-center-stage-due-to-chinas-deepseek-shock-and-awe/>
13. Gibney, E. (2025). *China's cheap, open AI model DeepSeek thrills scientists*. *Nature (London)*, 638(8049), 13–14. <https://doi.org/10.1038/d41586-025-00229-6>
14. Goekcearslan, S., Tosun, C., & Erdemir, Z. G. (2024). *Benefits, challenges, and methods of artificial intelligence (AI) chatbots in education: A systematic literature review*. *International Journal of Technology in Education*, 7(1), 19–39. <https://doi.org/10.46328/ijte.600>
15. Kerner, S.M. (2025). *TechTarget. DeepSeek explained: Everything you need to know*. <https://www.techtarget.com/whatis/feature/DeepSeek-explained-Everything-you-need-to-know>
16. Kingchang, T., Chatwattana, P., & Wannapiroon, P. (2024). *Artificial intelligence chatbot platform: AI chatbot platform for educational recommendations in higher education*. *International Journal of Information and Education Technology*, 14(1), 34–41. <https://doi.org/10.18178/ijiet.2024.14.1.2021>

17. Labadze, L., Grigolia, M., & Machaidze, L. (2023). Role of AI chatbots in education: systematic literature review. *International Journal of Educational Technology in Higher Education*, 20(1), 56–17. <https://doi.org/10.1186/s41239-023-00426-1>
18. Li, J., Li, G., Li, Y., & Jin, Z. (2025). Structured chain-of-thought prompting for code generation. *ACM Transactions on Software Engineering and Methodology*, 34(2), 1–23. <https://doi.org/10.1145/3690635>
19. Liu, H. (2025). Global cooperation is crucial for DeepSeek and broader AI research. *Nature (London)*, 639(8055), 577–577. <https://doi.org/10.1038/d41586-025-00822-9>
20. Morgan, T.P. (2025). The Next Platform. How did DeepSeek train its AI model on a lot less – and Crippled – Hardware? <https://www.nextplatform.com/2025/01/27/how-did-deepseek-train-its-ai-model-on-a-lot-less-and-crippled-hardware/>
21. Nellis, S., & Freifeld, K. (2025). Nvidia says DeepSeek advances prove need for more of its chips, Reuters. <https://www.reuters.com/technology/nvidia-says-deepseek-advances-prove-need-more-its-chips-2025-01-27/>
22. Normile, D. (2025). Chinese firm's large language model makes a splash. *Science (American Association for the Advancement of Science)*, 387(6731), 238–238. <https://doi.org/10.1126/science.adv9836>
23. Olugbade, D., Edwards, B. I., & Ojo, O. A. (2024). Facilitating cognitive load management and improved learning outcomes and attitudes in middle school technology and vocational education through AI chatbot. *Journal of Technical Education and Training*, 16(3), 114–131. <https://doi.org/10.30880/jtet.2024.16.03.009>
24. Sainath, T.N., Kingsbury, B., Sindhwani, V., Arisoy, E. & Ramabhadran, B. (2013). Low-rank matrix factorization for deep neural network training with high-dimensional output targets, 2013 IEEE International Conference on Acoustics, Speech and Signal Processing, Vancouver, BC, Canada, 2013, pp. 6655-6659, doi: 10.1109/ICASSP.2013.6638949.
25. Saleh, M. I. (2025). Generative artificial intelligence in hospitality and tourism: Future capabilities, AI prompts and real-world applications. *Journal of Hospitality Marketing & Management*, 1–32. <https://doi.org/10.1080/19368623.2025.2458603>
26. Shwetha G R, Manasa S, Modupalli Suneela, Nisha K M, & Vandana K. (2023). Conversational AI chatbot for education institute. *International Journal of Advanced Research in Science, Communication and Technology*, 245–249. <https://doi.org/10.48175/IJAR SCT-9569>
27. Wang, T., Lund, B. D., Marengo, A., Pagano, A., Mannuru, N. R., Teel, Z. A., & Pange, J. (2023). Exploring the potential impact of artificial intelligence (AI) on international students in higher education: Generative AI, chatbots, analytics, and international student success. *Applied Sciences*, 13(11), 6716-. <https://doi.org/10.3390/app13116716>
28. Xie, Y., Seth, I., Hunter-Smith, D. J., Rozen, W. M., & Seifman, M. A. (2024). Investigating the impact of innovative AI chatbot on post-pandemic medical education and clinical assistance: a comprehensive analysis. *ANZ Journal of Surgery*, 94(1–2), 68–77. <https://doi.org/10.1111/ans.18666>

29. Yetişensoy, O., & Karaduman, H. (2024). *The effect of AI-powered chatbots in social studies education*. *Education and Information Technologies*, 29(13), 17035–17069. <https://doi.org/10.1007/s10639-024-12485-6>
30. Zhang, Z.-X., Wen, Y.-B., Lyu, H.-Q., Liu, C., Zhang, R., Li, X.-Q., Wang, C., Du, Z.-D., Guo, Q., Li, L., Zhou, X.-H., & Chen, Y.-J. (2025). *AI computing systems for large language models training*. *Journal of Computer Science and Technology*, 40(1), 6–41. <https://doi.org/10.1007/s11390-024-4178-1>