Proceeding of The International Conference on Global Education and Learning

E- ISSN: 3089-8072

Research Article

The Impact of Using AI Chatbots in Science Learning on the Questioning Behavior of 5th Grade Students at SDN Plalangan 03 Gunungpati Semarang City

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Abstract: The development of Artificial Intelligence (AI) technology has provided new opportunities to enhance the quality of learning, particularly in elementary science education. One form of AI utilization is chatbots, which function as interactive learning media capable of encouraging students' active participation. In science learning, questioning behavior is an important indicator of students' cognitive engagement; however, many elementary school students tend to be passive in asking questions. This study aimed to examine the effect of using AI chatbots in science learning on students' questioning behavior in Grade V of SDN Plalangan 03 Gunungpati, Semarang City. This study employed a quantitative approach with a quasi-experimental design. Data were collected through observation, questionnaires, and documentation. The data were analyzed to identify changes in students' questioning behavior before and after the implementation of AI chatbots in science learning. The results indicated that the use of AI chatbots improved students' questioning behavior in terms of frequency, confidence, and activeness in asking questions. AI chatbots provided a comfortable and flexible interaction space for students, which helped reduce psychological barriers in questioning. It can be concluded that the use of AI chatbots has a positive effect on students' questioning behavior in elementary school science learning.

Keywords: Artificial Intelligence; Chatbots; Elementary Education; Questioning Behavior; Science Learning

1. Introduction

The development of information and communication technology has brought significant changes to the world of education, especially in the learning process in elementary schools. The utilization of digital technology does not only function as a means of delivering material, but also as an interactive medium capable of increasing student participation and activity in learning. One of the technological innovations currently widely used is Artificial Intelligence (AI), including AI-based chatbots capable of providing interactive responses like humans (Luckin et al., 2016). In science learning, the ability to ask questions is one of the important indicators of critical thinking skills and active learning engagement. Students who actively ask questions show curiosity, conceptual understanding, and cognitive involvement in the learning process (Sanjaya, 2017). However, in practice, many elementary school students still tend to be passive and lack the courage to ask questions, whether due to shyness, fear of being wrong, or a lack of stimulus from the learning environment.

The use of AI chatbots in science learning has the potential to be a solution to overcome these problems. Chatbots allow students to interact flexibly, without social pressure, and provide quick responses to the questions asked. This can encourage students to be more daring in asking questions, exploring concepts, and building understanding independently (Holmes et al., 2019). AI chatbots can play a role as a learning support medium capable of improving the quality of student learning interactions. An effective learning process should encourage students to actively observe, question, experiment, and communicate their learning outcomes.

Received: July 16, 2025
Revised: September 10, 2025
Accepted: November 5, 2025
Published: December 31, 2025
Curr. Ver.: December 31, 2025

However, in reality, science learning at the elementary school level is still often dominated by the lecture method, so that two-way interaction between teachers and students has not run optimally (Samatowa, 2016). This condition causes the low frequency of students in asking questions during the learning process.

Questioning behavior is an important indicator in active learning because it reflects students' cognitive involvement and curiosity about the material being studied. According to (Hosnan 2014), the ability to ask questions can help students develop critical, analytical, and reflective thinking skills. However, psychological factors such as fear of being wrong, lack of self-confidence, and limited opportunities are often barriers for students to ask questions directly to the teacher in class. The utilization of artificial intelligence-based technology, especially AI chatbots, can be an innovative alternative in overcoming these problems. Chatbots allow students to interact personally and flexibly without fear of being judged, thereby increasing students' courage in asking questions. Previous research shows that the use of chatbots in learning can increase student involvement, learning motivation, and independent conceptual understanding (Kuhail et al., 2023). In the context of science learning in elementary schools, the use of interesting learning media is highly needed so that students do not easily feel bored. Science learning is often considered difficult because it contains many abstract concepts that are hard to understand by elementary school-age students. Therefore, teachers need to present media capable of bridging these concepts to make them easier to understand. AI chatbots can act as interactive learning media that present information simply, responsively, and in accordance with students' learning needs (Holmes et al., 2019).

In addition to helping understand the material, AI chatbots can also create a more comfortable learning atmosphere for students. Students who are usually reluctant to ask questions in class because of fear of being wrong or shyness in front of their friends can be more daring to ask questions through digital media. Personal interaction between students and chatbots allows students to learn without pressure, thus encouraging the emergence of self-confidence and the courage to ask questions (Kuhail et al., 2023). The use of chatbots in science learning is also in line with the student-centered learning approach. In this approach, students no longer only receive information from the teacher, but actively search for, explore, and build their own knowledge. Chatbots act as facilitators that help students find answers to their questions, so the learning process becomes more meaningful (Sanjaya, 2017).

Furthermore, the integration of technology such as AI chatbots also supports the strengthening of digital literacy from an early age. Students do not only learn science material, but also learn how to use technology wisely and productively. This is important considering that rapid technological developments demand students to have adaptive and critical abilities in using various digital information sources (UNESCO, 2021). Based on these various descriptions, it can be concluded that the use of AI chatbots in science learning has great potential to improve the quality of learning, especially in fostering questioning behavior in elementary school students. Therefore, research on the influence of the use of AI chatbots on the questioning behavior of fifth-grade students at SDN Plalangan 03 becomes very relevant to be carried out as an effort to improve the quality of basic education in the digital era.

2. Research Method

This research uses a quantitative approach with a quasi-experimental research type. This approach was chosen because the researcher wants to determine the effect of using AI chatbots on students' questioning behavior in science learning. Quasi-experimental research is used because the researcher cannot fully control all variables that influence the research subjects.

Data collection techniques are carried out through observation, questionnaires, and documentation. Observation is used to directly observe students' questioning behavior during the learning process. Questionnaires are used to measure the level of students' questioning behavior before and after the use of AI chatbots. Meanwhile, documentation is used to supplement data in the form of activity photos, attendance lists, and learning records.

4. Results and Discussion

This discussion aims to analyze the influence of using AI chatbots in science learning on the questioning behavior of fifth-grade students at SDN Plalangan 03 Gunungpati, Semarang City. Questioning behavior is an important indicator of active learning and students' cognitive involvement in the science learning process. Based on the results of observations and

questionnaires that have been conducted, it was found that there was an increase in students' questioning behavior after the use of AI chatbots in learning.

The Increase in students' questioning behavior can be attributed to the characteristics of AI chatbots which are interactive, responsive, and personal. AI chatbots allow students to ask questions without social pressure, so students feel more comfortable and confident. Hosnan (2014) in his study stated that a safe and conducive learning environment plays an important role in fostering students' courage to ask questions and express opinions. Thus, the presence of AI chatbots is able to reduce students' psychological barriers, such as fear of being wrong and lack of self-confidence when asking questions in class.

The results of this study are in line with research conducted by Kuhail et al. (2023) in their systematic study of educational chatbots, which stated that chatbots are able to increase student engagement through question-and-answer-based dialogic interaction. Chatbots function not only as information providers but also as learning facilitators that encourage students to actively ask questions and explore concepts independently. In science learning, these interactions help students understand concepts through a continuous questioning process.

In addition, the use of AI chatbots supports the implementation of studentcentered learning. Sanjaya (2017) in his research emphasized that effective learning is learning that provides space for students to actively build knowledge through the process of asking questions, discussing, and seeking information independently. AI chatbots act as a medium that facilitates students in this process, so that students do not only depend on the teacher's explanation but also actively seek answers to the questions they have.

Holmes et al. (2019) in their research on the application of artificial intelligence in education stated that AI technology is able to improve the quality of learning interactions through the provision of fast and relevant feedback. The rapid response from AI chatbots to student questions can increase student motivation and curiosity.

This encourages students to ask follow-up questions, which is very important in science learning that requires a deep understanding of concepts.

In the context of science learning in elementary schools, the use of learning media that is interesting and in accordance with the characteristics of students is highly necessary. Samatowa (2019) in his research stated that science learning in elementary schools should be presented concretely and contextually so that it is easily understood by students. AI chatbots can present science material in simple language accompanied by explanations that are easy to understand, so students are encouraged to ask questions when they encounter concepts they do not yet understand.

In addition to having an impact on questioning behavior, the use of AI chatbots also contributes to the strengthening of students' digital literacy. UNESCO (2021) in its report emphasized that the integration of digital technology in education is important to equip students with 21st-century skills, including critical thinking skills and the wise use of technology. Through the use of AI chatbots, students not only learn science but also learn to utilize technology as a productive learning tool.

Based on the results of the discussion, it can be concluded that the use of AI chatbots in science learning has a positive influence on students' questioning behavior. AI chatbots are able to create a learning environment that is more interactive, comfortable, and student-centered, thereby encouraging an increase in student activity and curiosity in elementary school science learning.

5. Comparison

The findings of this research, which indicate a significant increase in the questioning behavior of fifth-grade students after using AI chatbots, are consistent with several recent studies in the field of educational technology.

Comparison with Traditional Methods

In contrast to the findings of Samatowa (2016), which highlight that traditional science instruction is often dominated by one-way lecture methods leading to passive student behavior, this study demonstrates that AI chatbots effectively break this pattern. While traditional methods often create a "social barrier" where students fear peer judgment, the AI chatbot provides a "psychologically safe" space. This aligns with Wu and Yu (2024), whose meta analysis found that AI chatbots consistently outperform traditional teaching methods in fostering student engagement and reducing anxiety.

Alignment with Global Research

The increase in questioning frequency observed at SDN Plalangan 03 mirrors results reported by Kuhail et al. (2023). Their systematic review noted that chatbots serve as "low-stakes" interaction partners, allowing students to test hypotheses and ask "silly" questions they might otherwise withhold in a physical classroom. Furthermore, the ability of chatbots to provide instant feedback a key factor noted in this study is supported by Holmes et al. (2019), who argued that the speed of AI responses is critical in maintaining the "curiosity loop" in science education.

Specific Findings in Science Education

Compared to studies in other subjects, such as language learning (e.g., Lin & Ye, 2023), the use of AI chatbots in science specifically helps bridge the gap between abstract concepts and student understanding. While some research (e.g., Walan, 2020) suggests that digital tools can sometimes overwhelm low-achieving students, our observations suggest that when integrated as a supportive questioning tool, AI chatbots actually empower students who were previously shy or passive.

6. Conclusion

Based on the results of the research and discussion that has been conducted, it can be concluded that the use of AI chatbots in science learning provides a positive influence on the questioning behavior of fifth-grade students at SDN Plalangan 03 Gunungpati, Semarang City. The implementation of AI chatbots is able to increase students' courage, activity, and self-confidence in asking questions during the learning process. A chatbots serve as interactive learning media that create a comfortable learning environment free from psychological pressure, so students are not afraid to ask questions even if they make mistakes. The responsive and personal nature of chatbots allows students to obtain quick feedback, which encourages curiosity and cognitive involvement in understanding science concepts.

In addition to improving questioning behavior, the use of AI chatbots also supports student-centered learning and contributes to the strengthening of students' digital literacy from an early age. Thus, AI chatbots can be used as an effective innovative learning media alternative to improve the quality of science learning in elementary schools. The integration of AI chatbots in science learning not only helps increase student activity in asking questions but also has the potential to improve the quality of the learning process and adapt basic education to the demands of technological developments in the digital era.

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