Inquiry Learning Model to Improve Critical Thinking Skills of High School Students

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Abstract

This research aims to discuss students' critical thinking skills in learning mathematics with an inquiry learning model. This type of research is descriptive qualitative research with literature review method. Data were collected through related journals to be reviewed. The results showed that the inquiry learning model is a powerful tool to improve students' critical thinking skills in learning. By emphasizing active learning, collaborative work, and real-world applications, this model gives students the tools they need to develop their critical thinking skills and become more effective learners. The model was able to improve critical thinking skills along with increased problem-solving skills, creativity, engagement, communication skills, and deeper content understanding. By developing critical thinking skills, inquiry-based learning can prepare students for success in academic, professional, and personal environments.

Keywords:

Inquiry Learning Model, Critical Thinking, High School Students.

1. Introduction

1.1. *Background*

Fitriyah et al., (2021) stated that one of the abilities that today's children must have is critical thinking. In line with this opinion (Kurniawati & Ekawanti., 2020) revealed that it is important for students to have critical thinking skills because children who are able to think critically can find solutions to the problems they face. Critical thinking is a reflective way of thinking that is reasonable or based on reason to determine what will be done and believed. Evaluation of critical thinking skills, among others, aims to diagnose students' ability levels, provide feedback on students' thinking courage, and motivate students to develop their critical thinking skills. Errors in solving math problems can be reduced by using critical thinking, so that in the end it produces a solution with the correct conclusion (Kurniawati & Ekawanti., 2020).

Critical thinking skills are important to have so that students are accustomed to thinking reflectively and reasonably. The reason is because to improve the ability to solve problems in everyday life, critical thinking skills are very important (Fitriyah et al., 2021). Students' critical thinking skills must be strengthened to achieve this goal through efficient learning techniques. Kartika & Rakhmawati (2022) suggested that only the problems discussed in class were able to be solved by students. As a result, there is a lack of student involvement and ability to overcome the given problems. In addition, the low critical thinking skills of students are the result of the use of learning models that are less diverse and not in accordance with the needs of students. One of the learning models that can improve students' critical thinking skills is the inquiry model.

The inquiry model places a focus on how students use critical and analytical thinking to solve problems (Putri et al., 2019). In addition, the model of inquiry teaching is student-centered teaching where the teacher leads in the inquiry learning process. In the learning process through inquiry, students are faced with contextual problems that can be seen in their daily lives (Yasin et al., 2019). Based on the background that has been described, this article aims to discuss students' critical thinking skills in learning mathematics through the inquiry model.

1.2. Problem Formulation

1.2.1 How can the application of inquiry learning models effectively improve students' critical thinking skills in learning?

1.2.2 How is the difference in students' critical thinking skills before and after applying the inquiry learning model?

1.3. Research Objective

1.3.1 Knowing how the application of the inquiry learning model can effectively improve students' critical thinking skills in learning?

1.3.2 Knowing the difference in students' critical thinking skills before and after applying the inquiry learning model?

2. Method

This research is a qualitative research using the literature review method. The literature used is in the form of journal articles collected from the Google Scholar database. The time span of articles used in this study published from 2018-2023. The article selection technique used purposive sampling technique based on criteria related to students' critical thinking skills in learning mathematics and inquiry models. The next stage was analyzed to see the relationship between critical thinking skills in learning mathematics through the inquiry model.

3. Discussion

Based on literature studies that have been conducted on research in scientific articles, the results are shown in Table 1 as follows.

Table 3. 1 Literature study research article

Author (Year)	Publication	Research Type	Subject
Prameswari et al., (2018)	*JPMI (Jurnal Pendidikan Matematika Indonesia)*	Quantitative Experiment	Grade X SMA N 3 Singkawang
Utami et al., (2018)	*Seminar Nasional Pendidikan Fisika 2018*	Research and Development	Grade XI IPA 2 MAN 3 Jember

Azizah e. al., (2019)	*Imajiner: Jurnal Matematika Dan Pendidikan Matematika*	Quasi Experimental	Grade X SMK Nusa Bhakti Semarang
Bharata et al., (2019)	*Jurnal Pendidikan Matematika Universitas Lampung*	Research and Development	Grade X SMA N 16 Bandar Lampung
Sadiyyah et al., (2019)	*Prisma*	Research and Development	Grade VII SMP N 4 Campaka
Warniasih et al., (2019)	*Journal of Honai Math*	Qualitative	Grade VII B SMP N 1 Sentolo
Dores et al., (2020)	*J-PiMat*: *Jurnal Pendidikan Matematika*	Qualitative	Grade VII SMP N 03 Sebungkang
Kurniawati & Ekayanti, (2020)	*PeTeKa (Jurnal Penelitian Tindakan Kelas dan Pengembangan Pembelajaran)*	Qualitative Descriptive	6 Journal
Setiana & Purwoko, (2020)	*Jurnal Riset Pendidikan Matematika*	Qualitative Descriptive	Grade XII SMA N Punung
Charolina et al., (2021)	*Jurnal Penelitian Pembelajaran Matematika Sekolah (JP2MS)*	Quasi Experimental	Grade VIII SMP N 7 Kota Bengkulu
Fitriyah et al., (2021)	*Biormatika: Jurnal Ilmiah Fakultas Keguruan dan Ilmu Pendidikan*	Literature Review	College Student
Hawa et al., (2021)	*ORBITA: Jurnal Kajian, Inovasi Dan Aplikasi Pendidikan Fisika*	Research and Development	Gradi XI MIPA 4 SMA N 1 Gambiran

Safitri et al., (2021)	*Numeracy*	Research and Development	Grade VII SMP Cahaya Harapan
Setiana et al., (2021)	*European Journal of Educational Research*	Quasi Experimental	MIPA student of SMA N in Pacitan
Kartika & Rakhmawati, (2022)	*Jurnal Cendekia : Jurnal Pendidikan Matematika*	Literature Review	Journal (Category: All Grade)
Opticia et al., (2022)	*International Journal of Trends in Mathematics Education Research*	Research and Development	Grade XI SMA Al-Falah Surabaya
Sari & Lutfi, (2023)	*Jurnal Simki Pedagogia*	Qualitative Descriptive	Journal

Articles from Table 1 focus on critical thinking skills that are affected by the inquiry learning model. Some articles were used as sources for a more in-depth theoretical study so that the discussion made becomes more structured and refers to the research objectives.

Based on the literature study that has been conducted, the results obtained if the critical thinking skills of students are still low, especially in learning mathematics. The low critical thinking skills of students are caused by several factors that influence the learning process, which can be from teacher, student, and other supporting factors for learning implementation. The ability to think critically is the basic capital of every person. Therefore, critical thinking skills are very important for students at all levels of education. (Setiana et al., 2021). Students will be better able to solve simple and complex problems if they have critical thinking skills (Setiana & Purwoko, 2020). Students need critical thinking skills, especially in learning mathematics because critical thinking and mathematics go hand in hand.

This is partly due to ineffective learning models. The lecture method is still used in many lessons. Students should be able to create their own ideas as a result of meaningful learning. Therefore, it is difficult for students to develop their critical thinking skills. While critical thinking skills cannot just appear. It needs external stimulation, one of which is the application of an appropriate learning strategy or approach. Learning must be conditioned in such a way that the learning process can help students build their critical thinking skills (Farani et al., 2019). Critical thinking skills have several aspects which are presented in Table 2 below

Table 3. 2 Critical Thinking Indicators

Aspect	**Indicator**

Focus	Students understand the information and problems from the questions given.
Reason	Students are able to provide reasons based on relevant facts and evidence to make conclusions at each step.
Inference	1. Students are able to make conclusions appropriately. 2. Students are able to make the right reasons in supporting the conclusion that have been made.
Situation	Students are able to use information that is appropriate to the problem.
Clarify	1. Students can give further explanations to the conclusions that have been made. 2. Students are able to explain the terms in the problem. 3. Students are able to make examples of problems similar to the problems given problem.
Overview	Students are able to review and correct the problem solving process from beginning to end

Teachers can take several steps to help students improve their critical thinking skills, especially when learning mathematics, namely: 1) managing the class, 2) using various teaching strategies, 3) fostering positive interactions between teachers and students, and 4) carrying out evaluation/learning activities (Dores et al., 2020). The inquiry learning model is one method that can help students' critical thinking skills, especially in learning mathematics. Students are encouraged to create their own knowledge during the learning process through research and investigation activities. The steps of the inquiry model in learning can be seen in Table 3 below:

Table 3. 3 Steps of Inquiry Model in Learning

Learning Steps	Description
Observing and generalizing question	Students are given a phenomenon or problem to observe and identify, then based on the information obtained they generalize the question to discuss the solution.
Making a hypothesis	The teacher provides opportunities for students to formulate hypotheses and guide them to create relevant questions.
Designing the experiment	The teacher provides opportunities for students to determine the steps of the experiment/problem solving to test the hypothesis.
Conducting an experiment to obtain information	Students test the hypothesis formulated by analyzing the data obtained.
Analyzing data and reports	The teacher gives students the opportunity to convey the results obtained.

3.1. **Application of the Inquiry Learning Model**

Inquiry-based learning is student-centered learning that involves active exploration, questioning, and discovery (Warniasih et al., 2019). Inquiry-Based Learning is an

instructional practice where students are at the center of the learning experience and take ownership of their own learning asking, investigating, and answering questions In this model, students are encouraged to ask questions, investigate, and find answers through direct experience, rather than simply receiving information from the teacher. The inquiry learning model is designed to encourage critical thinking, problem solving, and creativity in students. It begins with a question or problem that students want to explore. Students then gather information, make observations, conduct experiments, and analyze data to develop a deeper understanding of the topic (Opticia et al., 2022). This process is designed to encourage students to make connections between different ideas and concepts, and to develop their own unique perspectives.

Inquiry-based learning falls under the realm of 'inductive' approaches to teaching and learning, an excellent review of which is provided. Inductive teaching and learning approaches begin with a set of observations or data to interpret, or a complex real-world problem, and as students study the data or problem they generate a need for facts, procedures, and guiding principles. Inductive teaching encompasses a range of teaching methods including "inquiry learning" project-based learning, case-based teaching, and discovery learning. Classification of teaching methods taking into account the context for learning and other features, such as the amount of responsibility students take for their learning and the use of group work inductive teaching methods have several characteristics: student-centered approach where the focus of teaching is on student learning rather than communicating a prescribed body of content or knowledge; active learning is about learning by doing may involve, for example, students discussing questions and solving problems, development of independent learning skills where students take more responsibility for their own learning, constructivist theoretical underpinnings that propose that students construct their own meaning of reality; it is students who create knowledge rather than knowledge being imposed or transmitted through direct instruction (Azizah et al., 2019).

One of the main benefits of inquiry-based learning is that it encourages students' sense of ownership and responsibility for their own learning. Students are encouraged to take an active role in the learning process, which helps to increase their engagement and motivation. In addition, because the inquiry model is highly adaptable, it can be used to teach a wide range of subjects, from science and math to history and literature (Hawa et al., 2021). To effectively implement the inquiry learning model, teachers need to provide a supportive environment that encourages student exploration and inquiry. This includes providing access to relevant resources, such as books, videos and websites, as well as developing a classroom culture that values open questions and exploration (Sari & Lutfi, 2023). Teachers should also be willing to step back and let students take the lead in the learning process, providing guidance and support as needed. In conclusion, the inquiry learning model is an effective teaching and learning model that empowers students to play an active role in their own education. By encouraging exploration, questioning and discovery, this model can also help students to develop critical thinking, problem-solving and creativity skills that will serve them well throughout their lives (Warniasih et al., 2019). By creating a supportive environment that values inquiry and exploration, teachers can help their students become confident and independent lifelong learners.

The Inquiry Learning Model is a powerful tool to improve students' critical thinking skills in learning. It emphasizes active learning and encourages students to question, investigate and analyze information in a structured way. In this essay, I will discuss how the implementation of the Inquiry Learning Model can effectively improve students' critical thinking skills in learning.

First, the Inquiry Learning Model provides students with a learning framework that encourages them to actively engage with the material. Students are encouraged to ask questions, gather information, and analyze data to develop a deeper understanding of the topics covered. By actively engaging with the material, students can develop their critical thinking skills as they learn to evaluate information, draw conclusions, and make decisions (Utami et al., 2018).

Secondly, the Inquiry Learning Model encourages students to work collaboratively. By working in groups, students can share knowledge and ideas with each other, and in the process, develop their critical thinking skills. When students work collaboratively, they can refute each other's ideas, ask questions, and learn from each other. This type of collaborative learning environment is very effective for improving critical thinking skills, as it encourages students to think critically about their own ideas, as well as those of their peers (Prameswari et al., 2018).

Third, the Inquiry Learning Model provides opportunities for students to apply what they have learned in real-world situations. By engaging in real-world problem-solving activities, students can develop their critical thinking skills as they learn to apply what they have learned to practical situations (Charolina et al., 2021). This type of application-based learning is very effective for improving critical thinking skills, as it requires students to think critically about how they can use their knowledge to solve real-world problems.

A standardized and systematic teaching package on inquiry learning model with science literacy has been developed for teaching the topic of Chemical kinetics. The students are very interested and motivated to use the developed learning model which is active activity learning and self-centered, and critical thinking skills are developed. The students have been able to carry out scientific work independently including laboratory activities of planning, implementing, collecting data, processing, analyzing, interpreting results, concluding, and reporting results. The inquiry learning model with science literacy proved effective for developing students' critical thinking. The learning model developed helps students to increase knowledge and understand the chemistry material being studied. Furthermore, the learning model with science literacy brings students involved in problem solving process and improves students' performance in chemistry. The developed learning resources on the inquiry learning model with science literacy have a significant contribution to improving students' critical thinking skills in chemistry and ultimately improving students' thinking skills. achievement. It is expected that courses that require skills can develop and implement the inquiry learning model with science literacy because it has been proven to be able to improve students' critical thinking skills, which contributes to facilitating students' active and critical learning, which in turn improves their learning outcomes.

Inquiry learning with a science context is a learning developed by using a science context as a medium to build and improve students' critical thinking skills (Prameswari et al., 2018). Learning consists of observation, investigation, explanation, conclusion, and communication. This stage provides opportunities for students to conduct investigation activities under the supervision of the teacher. Guided inquiry learning provides opportunities for students to carry out controlled activities with the help of an instructor or teacher. Students ask questions and look at references to find answers or solve a group or individual problem with a scientific approach. Also, inquiry-based learning will develop higher-order thinking skills, communication skills, investigation, and understanding of science facts.

3.2. Differences in Students' Critical Thinking Ability Before and After Implementing the Inquiry Learning Model

Before the inquiry learning model is applied, students' critical thinking skills may still be limited. Traditional teaching methods tend to focus on delivering information to students without providing opportunities for them to apply their critical thinking skills. Students may be required to memorize and recall information from textbooks, but they may not be encouraged to question the information or apply it to real-world problems. As a result, their critical thinking skills may be underdeveloped, and they may struggle to solve problems and make decisions.

In addition, traditional teaching methods may not provide students with opportunities to work collaboratively or engage in discussions. Instead, they may be required to work independently, which limits their exposure to different perspectives and ideas. Without exposure to different perspectives, students may struggle to see things from different angles, and this may limit their ability to critically analyze and evaluate information. In conclusion, before the inquiry learning model is implemented, students' critical thinking skills may still be limited. Traditional teaching methods tend to focus on memorization and recall, without giving students the opportunity to apply their critical thinking skills. Lack of exposure to real-world problems and experiences that require critical thinking may limit students' ability to analyze and evaluate information, make decisions, and solve problems effectively.

The inquiry-based learning model is a teaching model that focuses on engaging students in a process of inquiry, where they explore and investigate questions and problems through independent or group work. This model has been found to have a positive impact on students' critical thinking ability, which is an essential skill for success in academic, professional and personal environments. One of the main differences seen in students' critical thinking ability after the implementation of the inquiry-based learning model is the improvement in problem-solving ability. By engaging in the inquiry process, students learn to identify problems, gather and analyze information, and develop solutions. This process encourages them to think critically and systematically, which leads to an improvement in their problem-solving ability.

Another difference observed was an increase in creativity (Bharata et al., 2019). The inquiry-based learning model promotes a student-centered approach that allows students to think outside the box and develop creative solutions to problems. This encourages them

to be innovative and think creatively, which can have a positive impact on their critical thinking skills. In addition to the improvement of problem-solving skills and creativity, inquiry-based learning is also proven to increase student engagement. As students are actively involved in the learning process, they are more invested in their own learning and are more likely to be motivated and engaged in the classroom. This engagement can lead to an improvement in their critical thinking skills, as they are more interested and engaged with the subject matter (Kartika & Rakhmawati, 2022).

The improvement of communication skills is also a visible difference after the implementation of the inquiry-based learning model. By engaging in the inquiry process, students are required to articulate their ideas and findings to peers and teachers. This communication process can lead to an improvement in their oral and written communication skills which are essential for success in academic, professional and personal settings (Sadiyyah, et. al., 2019). Finally, inquiry-based learning models have been found to promote deeper understanding of content. By engaging in the inquiry process, students are encouraged to explore topics in greater depth, which can lead to a deeper understanding of content. This deeper understanding can have a positive impact on their critical thinking skills, as they are better able to analyze and synthesize information. In conclusion, the implementation of the inquiry-based learning model was found to have a positive impact on students' critical thinking ability. This model promotes increased problem-solving skills, creativity, engagement, communication skills, and deeper understanding of content. By developing critical thinking ability, inquiry-based learning can prepare students for success in academic, professional, and personal environments.

The inquiry-based learning model is a teaching and learning model that focuses on engaging students in a process of inquiry, where they explore and investigate questions and problems through independent or group work. This model has been found to have a positive impact on students' critical thinking skills. This essay will discuss the differences in students' critical thinking skills before and after applying the inquiry learning model.

Before an inquiry-based learning model is implemented, students' critical thinking skills may still be limited. Traditional teaching methods often rely on memorization and passive absorption of information, which can limit students' ability to think critically and solve problems. Students may struggle to analyze information, think creatively, and develop solutions to complex problems. However, after implementing an inquiry-based learning model, students' critical thinking skills can improve significantly. By engaging in the inquiry process, students are encouraged to think critically and systematically, which leads to an improvement in their problem-solving ability. They learn to identify problems, gather and analyze information, and develop solutions. This process encourages them to think creatively and out of the box, which leads to an increase in their creativity (Safitri et al., 2021). In addition, the inquiry-based learning model promotes engagement, which can lead to improved critical thinking skills. Students are actively involved in the learning process, which makes them more invested in their own learning. They are more likely to be motivated and engaged in class, which leads to an increase in their interest in the subject matter and their willingness to engage in critical thinking (Charolina et al., 2021, Fitriyah et al., 2021, Prameswari et al., 2018,).

4. Conclusion

It should be underlined that the inquiry learning model can be implemented if the teacher is able to direct students to explore properly accompanied by adequate facilities and sources of knowledge, so that students are motivated and actively involved in the classroom so that students' critical thinking skills can increase.

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