

The effect of guided inquiry learning model on students' critical thinking skills in biology learning

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Abstract

The quality of education in preparing students to have critical thinking skills has not been optimal. Guided inquiry stimulates the thinking ability of students. This study analyses the guided inquiry learning model's effect on students' critical thinking skills on the body's defence system material. This research is quasi-experimental. The population in this study were four classes with a sample consisting of two classes, namely XI IPA A as the experimental class and XI IPA B as the control class. The sampling technique used random cluster sampling. Data collection techniques using multiple choice questions. The results showed: that the calculation of the paired sample t-test in the guided inquiry learning model got a significant value (sig) of 0.00, which means that the sig value is smaller than 0.05 ($0.00 < 0.05$). This result shows a probability of less than 0.05, meaning the guided inquiry learning model between the experimental and control classes is not the same. The pre-test and post-test values are more significant than 0.05 ($\text{sig} > 0.05$), so it concluded that the data in this study are homogeneous. There is a significant difference in the use of this learning model that educational institutions should follow up. Teacher qualifications need to be improved in innovating and implementing this learning model to optimize students' critical thinking skills.

Abstrak

Kualitas pendidikan dalam mempersiapkan peserta didik agar memiliki kemampuan berpikir kritis belum optimal. Inkuiri terbimbing merangsang kemampuan berpikir peserta didik. Penelitian ini bertujuan untuk menganalisis pengaruh model pembelajaran inkuiri terbimbing terhadap kemampuan berpikir kritis siswa pada materi sistem pertahanan tubuh. Penelitian ini adalah eksperimen semu. Populasi dalam penelitian ini adalah empat kelas dengan sampel terdiri atas dua kelas yaitu XI IPA A sebagai kelas eksperimen dan XI IPA B sebagai kelas kontrol. Teknik pengambilan sampel menggunakan *cluster random sampling*. Teknik pengumpulan data menggunakan soal pilihan berganda. Hasil penelitian menunjukkan: perhitungan *paired sampel t test* pada model pembelajaran inkuiri terbimbing mendapatkan nilai signifikan (sig) sebesar 0,00 yang artinya nilai sig lebih kecil dari 0,05 ($0,00 < 0,05$). Ini menunjukkan probabilitas kurang dari 0,05 yang berarti model pembelajaran inkuiri terbimbing antara kelas eksperimen dan kelas kontrol tidak sama. Nilai pre-test dan post-test lebih besar dari 0,05 ($\text{sig} > 0,05$) maka dapat disimpulkan bahwa data dalam penelitian ini bersifat homogen. Adanya perbedaan signifikan dengan penggunaan model pembelajaran ini hendaknya ditindaklanjuti oleh lembaga pendidikan. Kualifikasi guru perlu ditingkatkan dalam melakukan inovasi dan implementasi model pembelajaran ini untuk mengoptimalkan kemampuan berpikir kritis peserta didik.

A. Introduction

21st-century educational reform emphasizes learning centred on critical thinking skills and complex cognitive processes (Anggraini & Hudaidah, 2021). Furthermore, in this era of globalization, education has become a priority in every country. Therefore, a country needs to pay attention to the ongoing educational process to improve the quality of education (Dewi, 2019). Critical thinking relates to associating, remembering, and using all the knowledge obtained. This advantage makes students who can think critically to develop the learning process (Fauziyah et al., 2013).

Critical thinking is making rational decisions about something he believes in (Retnowati, 2016). So critical thinking is concluded as an ability to analyze and evaluate information (Siagian, 2015). Critical thinking ability is needed to assist students in obtaining learning techniques according to the subject of learning (Rositawati, 2019). Five aspects are critical thinking: providing explanations, building basic skills, concluding, making further explanations, and managing strategies and tactics (Ennis, 1993).

Critical thinking is a process that involves complex information transformation, including reasoning, imagination, and problem-solving activities (Irdyanti & Sukma, 2018). A person with critical thinking must have a sceptical attitude, be very open, appreciate, respect opinions, respect clarity, look for different views, and have a different attitude if there are opinions that he sees are good (Syafitri et al., 2021).

Good biology learning can be realized by connecting student learning at school with their daily lives, and this will later make students interested in learning biology. However, most students currently rely on theory in biology learning, making it difficult for students to apply it in reality (Ismail et al., 2019).

The guided inquiry model is believed to improve student learning outcomes based on the design and finding of their concepts from the material. In addition, guided inquiry learning can encourage students to be more active and the teacher as a guiding tool. Implementing the guided inquiry learning model includes identifying problems, making hypotheses, designing experiments, conducting experiments, collecting data, extracting conclusions, and communicating results (Sukma et al., 2016).

According to Gusmardin et al. (2019), Inquiry learning usually only occurs when the results of manipulating student activities, creating structures and transforming information in such a

way as to find new information. Nasution's (2018) research shows that guided inquiry learning significantly improves students' critical thinking skills. However, this is not following the research of Sularoso et al. (2015) shows that the Guided Inquiry Model does not affect critical thinking.

In addition, from observations that have been carried out based on interviews with students and biology teachers, when the teacher explains the subject matter related to the previous meeting, the students seem to have difficulty remembering the material that has been explained earlier. In addition, in the learning process, there are evaluation questions that are not following critical thinking. This deficiency creates obstacles for students in developing critical thinking skills. According to Erlianti et al. (2016), guided inquiry learning helps students play an active role in critical thinking, encouraging them to increase their curiosity about the body's defence system material being studied.

Previous research from Sukma et al. (2016) about the effect of guided inquiry has been carried out but is limited to student motivation and learning outcomes. In addition, Nurfauzia (2016) examines the influence of the guided inquiry model on critical thinking in biology learning. Finally, Pitri et al. (2022) also examine the effect of the guided inquiry learning model but use student learning outcomes variables.

Based on the explanation above, it can be seen that there have been many studies on the application of guided inquiry learning models but have not mentioned its impact on students' critical thinking skills optimally. Therefore, this study aimed to analyze the significance of applying the guided inquiry learning model to the critical thinking skills of students of class XI science at the Modern Islamic Boarding School Nurul Hakim Medan on the growing defence system material.

B. Material and Method

This study uses a Quasi-Experimental, involving the control class and the experimental class. The research design is a pretest-posttest control group design. The independent variable applies the Guided Inquiry learning model, and the dependent variable is students' critical thinking. The research was carried out at the Modern Nurul Hakim Tembung Islamic Boarding School in April 2022. The sample used was determined through the Cluster Random Sampling Technique, where from four classes, only two classes were selected to be used as experimental & control classes. The

experimental class XI IPA A consisted of 26 students who received the guided inquiry learning model treatment, and in the control class XI IPA B as many as 26 students received the conventional learning model treatment.

The data collection technique of the test instrument is in the form of multiple choice questions with a total of 25 questions in the form of 5 options with cognitive levels C4 - C6 given to students. The instrument is a critical thinking ability test that follows critical thinking indicators, including providing a simple explanation, building basic skills, making inferences, making further explanations, and setting strategies and techniques. The results of the answers to these questions are said to be effective if the posttest value is greater than the pretest value. The analysis is in the form of normality, homogeneity,

& hypothesis tests. The normality test helps produce normally distributed data based on a normal population. In addition, the normality test can be known through the SPSS 16.00 program for windows. Hypothesis testing is needed to find the difference in the mean of the control & experimental classes based on the t-test using SPSS16.00 for windows.

C. Results and Discussion

The results of the experimental and control class students' critical thinking ability test can be seen in Table 1. The results of hypothesis testing after the t-test show that the influence of the guided inquiry learning model on students' critical thinking abilities is accepted. The summary of hypothesis testing can be seen in Table 2.

Table 1 Result of critical thinking test of experimental and control class students

	Critical Thinking Ability Post-test	
	Experiment class	Control class
N	26	26
Mean	26	60.58
Std. Deviation	10.147	7.393
Minimum	60	45
Maximum	95	75

Table 2 Summary of t-test results

	Paired Differences						t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pair 1 Pre-test Experiment – Post-test Experiment	-20.192	6.242	1.224	-22.713	-17.671	-16.495	25	.000	
Pair 2 Pre-test Control – Post-test Control	-5.192	4.118	.808	-6.856	-3.529	-6.429	25	.000	

Based on the average post-test score (Figure 1), the experimental class students got an average of 75.19. Meanwhile, the control class students obtained a posttest of 60.58. Meanwhile, the critical thinking ability in the experimental class based on the guided inquiry learning model is higher than in the control class using the lecture method. So, guided inquiry is believed to improve students' critical thinking skills.

Then the results of the research and testing of the Paired Sample Test (t-test) to see the effect of the guided inquiry learning model with the critical thinking ability obtained is 0.000 or the sig value is less than 0.05, then H_0 is rejected, and H_a is accepted. Thus the guided inquiry model affects the critical thinking of students' biology learning.

Based on the research above, it is known that the paired simple test (t-test) shows the influence of the guided inquiry learning model on students' critical thinking abilities (Table 2). Where the significant value is 0.000, the result is still below 0.05, so H_0 is rejected. Therefore, at the 95% confidence level, it concluded that the guided inquiry learning model with critical thinking abilities influenced students' biology learning.

This impact is because the characteristics of the guided inquiry model can train critical thinking skills. A guided inquiry learning model can encourage students to think actively because students are facilitated to carry out observation, observation, or literature review activities. So that the learning process is more student-centred, the

teacher is only a facilitator in learning (Sularoso et al., 2015).

The learning process is carried out in groups with the help of worksheets to guide activities in achieving learning objectives. So with this knowledge, students conduct group discussions to

discuss what they have found. At the next stage, students are asked to present the results of their discussions and are responded to by other groups. Students as learning subjects so that they have the opportunity to hone their thinking skills.

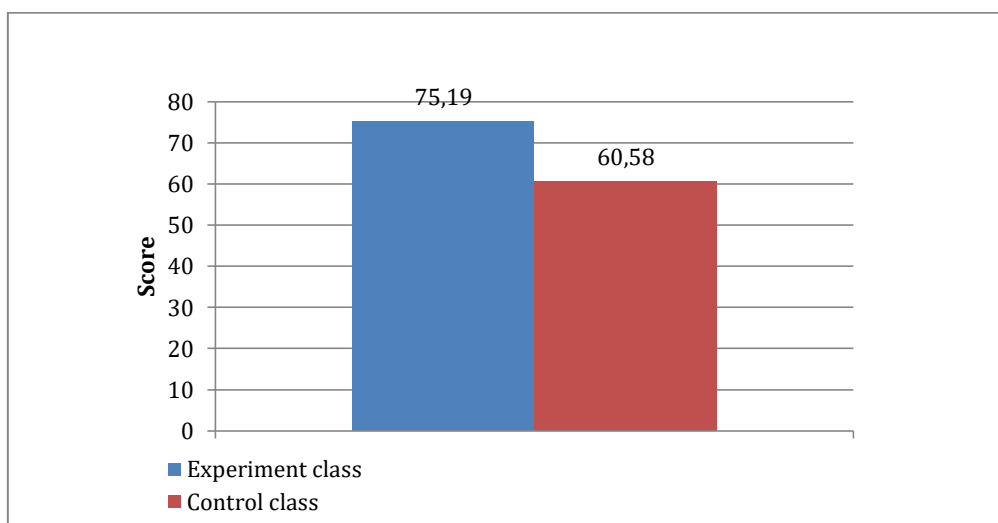


Figure 1 Diagram of the post-test average score of critical thinking experiment class and control class

The guided inquiry learning model can train students in critical thinking by being involved in finding and answering a problem. Students are honed in critical thinking on material that has not been understood through discussions with other students. Sularoso et al. (2015) stated that guided inquiry could increase students' curiosity to find concepts in learning which will stimulate their critical thinking skills. Likewise, Sutarna et al. (2014) state that guided inquiry learning are very oriented toward learning outcomes and the learning process. The goal is to know the effect of critical thinking. Therefore, this learning model can be applied in training critical thinking skills because students analyze various information to find solutions. This statement is in line with Santi et al. (2014), which says guided inquiry learning can make lessons more meaningful in gaining knowledge. This knowledge has the effect of remembering longer and providing in-depth understanding, according to (Sutarna et al., 2014), who said that the advantage of teaching with the guided inquiry model is that it helps students do critical thinking in each learning process because the guided inquiry learning model has stages that can help students understand information through various activities including collecting & analyzing data, which can later help students achieve critical thinking.

In line with the research of Nisa et al. (2018) regarding the effectiveness of the guided inquiry

learning model on the critical thinking skills of high school students, the results show that there is a positive influence from the application of the learning model. Zain & Jumadi (2018) also indicate a significant effect of applying the model to improve the critical thinking skills of high school students. In a similar report from Seranica et al. (2018), the guided inquiry learning model significantly improves students' critical thinking skills.

According to critical thinking indicators, students' critical thinking skills are identified with tests. These indicators include formulating problems, building basic skills, conducting deductions and inductions, and making further explanations in stages. This activity coordinates students to directly see problems from various perspectives and evaluate various intellectual activities. Next, make estimates and make presentations (Hidayat et al., 2016). Critical thinking skills can improve learning outcomes (Astuti et al., 2021). Critical thinking skills can be improved using the guided inquiry learning model (Zain & Jumadi, 2018; Sulistiyawati et al., 2019).

D. Conclusion

There is an influence of the guided inquiry learning model on critical thinking in students. The effect is seen from the results of the t-test, which obtained a significant value (sig) of 0.000 which means that

the sig value is smaller than 0.05 ($0.000 < 0.05$), so that H_0 is rejected and H_a is accepted, which means there is a significant difference between the experimental class and the control class. Educational institutions should follow up on this difference to improve the quality of education. Teacher qualifications also need to be improved in innovating and implementing learning models. The goal is that students' critical thinking skills can be more optimal.

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