Implementation of Guided Inquiry to Improve Students' Thinking Skills in Heat Conduction

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Abstrak

Penelitian ini bertujuan untuk mengembangkan kemampuan berpikir kritis siswa dan mengkaji reaksi mereka terhadap efek pembelajaran inkuiri terbimbing pada konduksi kalor. Pre-experimental design dengan single group pre-test – post-test design merupakan pendekatan penelitian yang digunakan dalam penelitian ini. Partisipan penelitian adalah siswa kelas XI SMA Manbaul Ulum Asshiddiqiyah 2 Batuceper semester genap tahun pelajaran 2020–2021. Pertanyaan ujian esai dan survei respon siswa digunakan sebagai Teknik pengambilan data. Berdasarkan temuan analisis penelitian, kemampuan berpikir kritis siswa kelas XI IPA 2 mengalami peningkatan, dengan skor rata-rata g > 0,67 pada kelompok sedang. Kelas eksperimen dan replikasi meningkat secara signifikan, sesuai dengan hasil uji t berpasangan. Dengan proporsi sebesar 84%, tanggapan siswa terhadap pembelajaran inkuiri terbimbing termasuk dalam kategori sangat baik. Dengan menggunakan strategi pembelajaran inkuiri terbimbing, siswa dapat mengembangkan kemampuan berpikir kritisnya pada materi konduksi kalor. Dengan adanya penelitian ini, sekolah terkait menjadi terinspirasi untuk mencoba model pembelajaran baru dan tidak hanya terpaku pada model pembelajaran konvensional dengan harapan bisa meningkatkan kemampuan berpikir kritis siswa sehingga nantinya para siswa bisa mengatasi masalah yang akan mereka hadapi

Kata kunci: Model pembelajaran inkuiri terbimbing, keterampilan berpikir kritis, dan konduksi kalor.

Abstract

Using a guided inquiry learning approach, this research attempts to improve students' critical-thinking abilities and explain how they reacted to heat conduction. Pre-experimental design with a single group pre-test - post-test design was the research approach employed in this study. Participants in the research were class XI students enrolled in the even semester of the 2020–2021 academic year at SMA Manbaul Ulum Asshiddiqiyah 2 Batuceper. Exam essay questions and surveys of student views were used as the approach. In class XI IPA 2, students' critical thinking abilities improved, according to the study analysis' findings, with an average g> score in the moderate group of 0.67. The examination of the paired t-test shows significant growth in both the experimental class and the replica class. With an 84% percentage, student opinions on guided inquiry learning fell into the very excellent category. The researcher claims that using the guided inquiry learning approach may enhance students' ability to think critically about heat-conducting materials. With this research, the school is inspired to try new learning models and not just stick to conventional learning models in the hope that they can improve students' critical thinking skills so that later students can overcome the problems they will face.

Keywords: *Guided inquiry learning model, critical thinking skills, and heat conduction.*

INTRODUCTION

Education is an important aspect of human existence when combined with other efforts can improve the standard of living and quality of life of a nation. To meet the needs of the educational community, we need a curriculum that can develop with the times. Communication, collaboration, critical thinking and creativity are recognized as "The 4Cs" — essential skills for the 21st century — by the Partnership for 21st Century Skills (P21), a US-based organization. Therefore, the Indonesian curriculum experienced several times modifications, starting with the 1947 curriculum and ending with the 2013 curriculum revision. The 2013 curriculum often uses scientific teaching methods. The scientific method emphasizes student-centered learning, which encourages student involvement while the instructor functions as a facilitator (Fadlillah, 2014).

The ability to think critically is one of the essential qualities of the 21st century. 2019 (Princess & Achmadi). Students will be guided, able to draw conclusions, and able to provide solutions to problems based on the knowledge offered through a critical thinking process (Maulidiyah & Madlazim, 2019).

According to the 2018 PISA (Program for International Student Assessment) findings, Indonesian students average a score of 396 for science, 371 for reading, and 379 for math. From the 79 countries considered, Indonesia is ranked 73rd. (OECD, 2019). The research found that since the release of the PISA results in 2015, the average scores of Indonesian students in science, reading and mathematics have decreased. This shows that the cognitive abilities of Indonesian children are still relatively low.

On March 22, 2021, a test in the form of four questions in the form of an essay was given to students of class XI IPA 2 SMA Manbaul Ulum Asshiddiqiyah 2 Batuceper Tangerang to measure their level of critical thinking about temperature and heat. Based on the results of the preliminary study, out of 20 students, 60% were able to answer C3 questions well, 15% were able to solve C4 questions, and 25% were able to solve C4 questions. was able to solve it with question C5, and none of the students succeeded with C6. The learning method used is still conventional and instructor-centered, according to educators, who state that questions of types C2 and C3 have been widely used so far. According to the instructor, there has never been a practicum in odd semesters. This preliminary study shows that students' critical thinking skills are included in the poor group.

The learning model used can have an impact on student performance in class (Yuli & Asmawati, 2015). One of the best teaching methods for developing critical thinking skills is the guided inquiry learning technique (Yunaini & Setyarsih, 2019).

The guided inquiry learning model, according to Putra (2013), can stop students from remembering techniques because it focuses on helping students get meaning from their environment. With the guided inquiry learning approach, students will be more involved in the learning process because they will focus on themselves and are expected to be able to solve problems through experimentation. Students will receive greater training in problem solving, analysis, and assessment skills — all of which are components of critical thinking — by experimenting.

Researchers Duran and Dokme (2016) found that when students engage in inquiry-based learning, their ability to think critically improves greatly. Fortino (2015) claims that a great way to cultivate critical thinking in twenty-first century students is through inquiry-based learning methods. Furthermore, Yunaini's research (2019) shows that guided inquiry learning, as applied in teaching physics, can improve students' critical thinking skills significantly at the 0.05 level, with an average N-gain in the medium category, and consistent across all three classes.

Based on the background stated above, the research title was chosen "Implementation of Guided Inquiry to Improve Students' Critical Thinking Skills in Heat Conduction".

RESEARCH METHODS

Two classes—the experimental class and the repeat class—were each given the same treatment in the studypre-experimental design by using one group pre-test-post-test design. The following is a description of the research design used:

Table 1. Research Design
One Group Pretest-Posttest Design

Pre-test	**Variabel Bebas**	***Post-test***
O_1	X	O_2

(Sugiyono, 2018)

Information:
O_1 : Mark Pre-test given to students before applying the guided inquiry learning model
X : Learning through guided inquiry learning model
O_2 : Mark Post-test given to students after applying the guided inquiry learning model

Data collection procedures include critical thinking assessment, guided inquiry learning observation sheets, and student response surveys. Critical thinking completeness data was examined using homogeneity test and paired t test and n-gain analysis. Statistical and descriptive analysis were used on the implementation of learning data and student responses.

RESULTS AND DISCUSSION

Five questions describing heat conduction indicated critical thinking were used to test students' critical thinking skills. The average value received by students is shown in the Table 2.

Table 2. Comparison of average values Pre-test and Post- test

Points	Class	
	XI IPA 1	XI IPA 2
Pre-test	38,8	31,8
Post-test	77,9	77,4

The attached table provides evidence of a dramatic increase in students' ability to think critically. Because the average pre- and post-test scores of the two groups were rather low at first, it was evident that the guided inquiry learning model was responsible for the increase.

Researchers used statistical techniques to check whether the two samples came from the same (homogeneous) population with Fisher's exact test (F). Table 3 displays the results of the homogeneity test at a significance level of 0.05, where H_0 shows that the variance of the two sample groups is the same and H_1 indicates that the variances of the two samples are not the same.

Table 3. Homogeneity Test

F-Test Two-Sample for Variances		
	XI IPA 1	*XI IPA 2*
Mean	38,8	31,8
Variance	182,9052632	149,0105263
Observations	20	20
df	19	19
F	1,227465386	
P(F<=f) one-tail	0,329800078	
F Critical one-tail	2,168251601	

From Table 3 it can be seen that the value of F_{count} = 1.23 and the value of F_{table} = 2.17. This means the value of $F_{count} < F_{table}$ until H_0 accepted that the two samples are homogeneous. In addition, the homogeneity of the two samples can also be known from their significance value (P), which if the P value < 0.05 then the variance of the two samples measured is homogeneous. After providing guided inquiry learning as a form of treatment, the researcher conducted a paired t-test to compare students' critical thinking skills before and after the intervention. The results of this paired t test are shown in Tables 4 and 5.

Table 4. Paired T test in class XI IPA 1

t-Test: Paired Two Sample for Means		
	Pretest	Post Test
Mean	38,8	77,9
Variance	182,90526	41,88421
Observations	20	20
Pearson Correlation	0,3328927	
Hypothesized Mean Difference	0	
df	19	
t Stat	-13,55077	
P(T<=t) one-tail	1,621E-11	
t Critical one-tail	1,7291328	
P(T<=t) two-tail	3,241E-11	
t Critical two-tail	2,0930241	

Table 5. Paired T test in class XI IPA 2

t-Test: Paired Two Sample for Means		
	Pretest	*Post Test*
Mean	31,8	77,4
Variance	149,0105	68,67368
Observations	20	20
Pearson Correlation	0,608527	
Hypothesized Mean Difference	0	
df	19	
t Stat	-20,9704	
P(T<=t) one-tail	6,72E-15	
t Critical one-tail	1,729133	
P(T<=t) two-tail	1,34E-14	
t Critical two-tail	2,093024	

Table 4 shows that the value of T_{count} = - 13.55 so $|T_{count}|$ = 13,55 is greater than T_{table} whose value is 1.73. This shows that the scores before and after applying the guided inquiry learning technique to students of class XI IPA 1 differ significantly.

In Table 5, it can be seen that the value of T_{count} =-20.97 so $|T_{count}|$ = 20,97 is greater than T_{table} whose value is 1.73. This shows that there is a significant difference in class XI IPA 2 students between the scores before and after the guided inquiry learning model is applied.

It was concluded that the guided inquiry learning model had a positive impact on students' critical thinking skills in heat conduction material as evidenced by an increase in the valuepost-test students (Tables 4 and 5). The researcher conducted an n gain analysis to compare students' critical thinking skills before and after implementing guided inquiry learning, and the findings are summarized in the Table 6.

Table 6. The results of n-gain calculations

Class	Category	Amount of Students	n-gain score	Percentage
XI IPA 1	Low	1	0,20	5 %
	Medium	13	0,60	65 %
	High	6	0,75	30 %
XI IPA 2	Low	0	-	-
	Medium	14	0,62	70 %
	High	6	0,78	30 %

Table 6 shows that approximately identical n-gain values were achieved in both groups, with the majority falling into the moderate category. Even so, this shows an increase in students' critical thinking skills. In addition, the results of this research also was supported by the results of research conducted by E.K Nisa et al (2018)

which concluded that the inquiry model effective to improve the critical thinking skills of students

The increment is utilized to carry out a science-based request, which has the potential to advance students' conceptual understanding (Maknun,2020). Because each student has a different thinking capacity, there are differences in n-gain values. This is in accordance with the message conveyed by Arrends (2012) that because everyone's cognitive capacity is different, even though teaching materials are made by the same instructor, each student will still get different results.

Guided inquiry learning, trains students to discover facts, data to be analyzed, provide ideas or arguments against the data obtained, explore information from various sources, answer questions or make conclusions, and communicate the results of their observations to stimulate their critical thinking skills. This means that guided inquiry learning trains and develops students' critical thinking skills. A set of critical thinking competencies that students need to possess are the skills of analyzing, synthesizing, making connections between information, and argumentation (Rosen & Maryam, 2014)

Researchers seek students' opinions about the guided inquiry learning model. Ten questions from the questionnaire were used to gather information about the guided inquiry learning model. Students then respond to the statement with the following four choices: strongly agree, agree, disagree, and strongly disagree. After collecting the responses, a Likert scale analysis was performed, resulting in a final score of 84%. This shows that learning with the guided inquiry model is included in effective learning for heat conduction lessons.

The propensity of creating basic considering abilities within the learning given by the teacher is anticipated to be advantageous for students and make it simple for them to determine solutions to the issues they confront. It is utilized as fundamental or mental capital, which is exceptionally vital for everybody and appears one's level of maturity (Maknun,2020).

CONCLUSION

Based on the research findings, it can be concluded that guided inquiry learning techniques at SMA Manbaul Ulum Asshiddiqiyah 2 Batuceper can help students improve their critical thinking skills. This was shown well in the XI IPA 2 experimental class as well as replication class XI IPA 1 where the growing n-gain value is included in the medium group. In addition, based on student responses to the questionnaire associated with guided inquiry learning that has been implemented, it can be said that the guided inquiry learning model is an effective learning model and is in the very good category. With this research, the school is inspired to try new learning models and not just stick to conventional learning models in the hope that they can improve students' critical thinking skills so that later students can overcome the problems they will face.

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