DOI: https://doi.org/10.33487/edumaspul.v8i1

EDUMASPUL JURNAL PENDIDIKAN

*Vol 08 No. 02 (2024) page 3055-3065*

p-ISSN 2548-8201 | e-ISSN 2580-0469

https://ummaspul.e-journal.id/maspuljr/

# Analysis of Natural Science Problem Solving Ability Judging from Self Confidence and Learning with the E-Module Assisted Discovery Learning Model Heat Transfer Materials

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| *Receive: 11/08/2024* | *Accepted: 11/08/2024* | *Published: 01/10/2024* |
|---|---|---|



**Abstrak**

Tujuan dari penelitian ini untuk meningkatkan rasa percaya diri dan kemampuan pemecahan masalah siswa kelas V pada materi perpindahan panas melalui model *discovery learning* berbatuan *e-modul.* Penelitian ini menggunakan jenis penelitian *mixed methods design* dengan desain sekuensial eksplanatori. Teknik analisis data menggunakan analisis kuantitatif, yaitu uji t satu variabel, uji beda, uji N-Gain, dan uji regresi, kemudian dilanjut dengan analisis kualitatif dengan menggunakan wawancara mendalam, angket, tes, dan dokumentasi. Hasil penelitian kuantitatif menunjukkan bahwa: (1) Kemampuan pemecahan masalah siswa lebih dari nilai KKM yaitu 75 dengan hasil nilai $t_{hitung}$ = 3,846 (> 1,706) dan nilai signifikansi 0,015 (< 0,05); (2) Terdapat peningkatan kemampuan pemecahan masalah yaitu sebesar 47,68% setelah pembelajaran dengan model *discovery learning* berbantuan *e-modul* ; (3) Ada pengaruh rasa percaya diri terhadap kemampuan pemecahan masalah siswa sebesar 98,7% sehingga dapat disimpulkan bahwa semakin besar rasa percaya diri siswa maka semakin tinggi kemampuan pemecahan masalahnya. Hal ini diperkuat dari hasil penelitian kualitatif yang menjelaskan bahwa tingkat *Self Confidence* siswa berpengaruh posittif terhadap tingkat kemampuan pemecahan masalah siswa.

**Kata Kunci :** Rasa Ingin Tahu Siswa, Kemampuan Pemecahan Masalah, *Discovery Learning, E-Modul*

**Abstract**

*The purpose of this study is to improve the self-confidence and problem-solving ability of fifth grade students in heat transfer material through the discovery learning model using e-modules. This study uses a mixed methods design with a sequential explanatory design. The data analysis technique uses quantitative analysis, namely the one-variable t-test, difference test, N-Gain test, and regression test, then continued with qualitative analysis using in-depth interviews, questionnaires, tests, and documentation. The results of the quantitative study show that: (1) Students' problem-solving ability is more than the KKM value of 75 with a t-count value of 3.846 (> 1.706) and a significance value of 0.015 (< 0.05); (2) There is an increase in problem-solving ability of 47.68% after learning with the discovery learning model assisted by e-modules; (3) There is an effect of self-confidence on students' problem-solving ability of 98.7% so that it can be concluded that the greater the students' self-confidence, the higher their problem-solving ability. This is reinforced by the results of qualitative research which explains that the level of student Self Confidence has a positive effect on the level of student problem-solving ability.*

**Keywords:** Student Curiosity, Problem-Solving Ability, Discovery Learning, E-Module

## Introduction

Natural Sciences (Science) education has a very important role in forming students' cognitive and problem-solving skills. Problem solving abilities are one of the main aspects of science learning that must be developed to prepare students to face future challenges. Problem solving not only involves knowledge of science concepts but also skills in applying these concepts practically.

Students' self-confidence in the context of science learning greatly influences their ability to solve problems. Confident students tend to be more active in participating, more open to trying new solutions, and have better abilities in facing challenges. Therefore, it is important to assess how self-confidence influences problem solving in science learning.

The Discovery Learning learning model is an effective method for developing problem solving skills. This method emphasizes discovery-based learning, where students are encouraged to explore and discover scientific principles independently.

The integration of e-modules in the learning process can provide the additional support needed to improve student understanding. E-modules as digital learning tools can offer visual and interactive representations that can facilitate students' understanding of the concepts of material.

With this background, this research aims to analyze students' science problem solving abilities in the context of heat transfer material, with a focus on the role of self-confidence and the effectiveness of the Discovery Learning learning model assisted by e-modules. This research uses a quantitative approach to measure the extent to which self-confidence and the use of e-modules influence students' problem-solving abilities, as well as a qualitative approach to gain in-depth insight into students' experiences in learning with this model.

Through this research, it is hoped that a better understanding can be obtained regarding the factors that influence students' problem-solving abilities in science and provide recommendations for more effective learning practices in the future.

## Method

This research uses a mix method design type "The Explanatory Sequential Design". In this type there are sequential research stages, starting from quantitative research and continuing with qualitative research. The priority of collecting and analyzing qualitative data is carried out at an early stage. Building on the results of the analysis in the first stage, the researcher continues to the next stage with quantitative methods to test or generalize based on initial findings. The researcher then interprets how the qualitative research results are built on the initial findings (quantitative data). The main weight in this strategy is in quantitative data.

The experimental design used in this research is Quasi Experimental Design. The sampling technique is Cluster Random Sampling. The selection of 2 class samples was intended to simplify the research process because it was carried out in 1 group, namely the Kartini group.

This research was carried out in Lebakbarang District, Pekalongan Regency, Central Java with the research objects being class V students at SDN Bantarkulon and class V students at SDN Kapundutan. Fifth grade students at SDN Bantarkulon as an experimental class, using the Discovery Learning learning model assisted by e-modules. The number of class V students at SDN Bantarkulon is 11 students. Fifth grade students at Kapundutan Elementary School as the control class, using conventional learning models, namely lectures and questions and answers. The number of students at SDN Kapundutan is 11 students. The research was carried out in five learning meetings. Statistical data will be analyzed with test statistics using IBM SPSS statistics 23 software.

The instrument used in this research is a science problem solving ability test. Before being used as a research instrument, the science problem solving ability test was tested on class V students at SDN Bantarkulon as an experimental class who had previously received heat transfer material. The test results show that the science problem solving ability test used in this research meets the requirements as a research instrument.

The science problem solving ability test is tested twice, namely during the pretest and posttest. The pretest was tested before control class and experimental class students received learning. Meanwhile, the post-test was tested after the control class and experimental class students had learned. The pretest result data is called the student's (initial) science problem solving ability data, the posttest result data is

called the student's science problem solving ability achievement data, while the science problem solving ability achievement data is calculated based on the normalized gain value.

Data was collected through interviews and documentation. To verify the accuracy of the data in this research, data triangulation was used. Instruments are used to measure the variables studied, writing ability tests, questionnaires and learning tools. Qualitative data analysis in this study was used to describe science problem solving abilities in terms of students' self-confidence in heat transfer material based on high, medium and low groups. Qualitative data analysis was carried out using four steps, namely testing data validity, data reduction, data presentation, and drawing conclusions.

## Results and Discussion

### A. Research result

Based on the calculation results, an average of 73.64 was obtained, as many as 54.55% of students who received conventional learning achieved science problem solving abilities below the KKM.

Table 1
Analysis of Control Class Problem Solving Ability

| | |
|---|---|
| Mean | 73,63636364 |
| Standard Error | 2,439346885 |
| Median | 70 |
| Mode | 70 |
| Standard Deviation | 8,09039835 |
| Sample Variance | 65,45454545 |
| Kurtosis | -0,851417824 |
| Skewness | 0,01859772 |
| Range | 25 |
| Minimum | 60 |
| Maximum | 85 |
| Sum | 810 |
| Count | 11 |

Based on the calculation results, an average score of 84.55 was obtained, so from the frequency distribution table above it can be seen that there were 2 students who got scores below the average or 18.18%, while those who got scores above the average there were 9 students or 81.82%. Because the KKM value determined by the school is 75, 18.18% of students who received learning using the e-module assisted discovery learning model achieved science problem solving abilities below the KKM.

Table 2
Analysis of Experimental Class Problem Solving Abilities

| | |
|---|---|
| Mean | 84,54545455 |
| Standard Error | 3,049183606 |
| Median | 85 |
| Mode | 85 |
| Standard Deviation | 10,11299794 |
| Sample Variance | 102,2727273 |
| Kurtosis | 0,423703704 |
| Skewness | -0,647498219 |
| Range | 35 |
| Minimum | 65 |
| Maximum | 100 |
| Sum | 930 |
| Count | 11 |

Based on the statistical measurement table for descriptive analysis, it is known that the average score of 11 students in the control class was 73.64 while the average of 11 students in the experimental class was 84.55. At first glance it can be assumed that the average score for achieving science problem solving abilities for control class and experimental class students is much different. To strengthen this assumption, it is necessary to test the hypothesis.

Based on the calculation results, an average score of 84.55 was obtained, so from the frequency distribution table above it can be seen that there were 2 students who got scores below the average or 18.18%, while those who got scores above the average there were 9 students or 81.82%. Because the KKM value determined by the school is 75, 18.18% of students who received learning using the e-module assisted discovery learning model achieved science problem solving abilities below the KKM.

Table 3
Average analysis of students' problem solving abilities

**One-Sample Test**

| | Test Value = 75 | | | | | |
|---|---|---|---|---|---|---|
| | T | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Hasil Kemampuan Pemecahan Masalah IPA | 2.846 | 26 | .015 | 5.704 | 1.19 | 10.22 |

Based on calculations using the proportion test with a real level of 5%, t_count≥t_tabel↔2.846>1.706 was obtained, while SPSS calculations obtained a Sig value. (2-tailed) = 0.015 < 0.05. So H_0 is rejected, meaning that the average science problem solving ability of students in the class V heat transfer material science subject with the discovery learning model assisted by e-modules exceeds the KKM. This is reinforced based on the results of the test data of 9 students out of 11 students who completed the test, meaning that the percentage of the experimental class was around 81.82% who completed the KKM.

To find out whether there is an increase in the ability to solve science problems on heat transfer material after learning with the discovery learning model assisted by e-modules. The test was carried out with the help of SPSS, namely for the t-test and N-Gain test, the significance level was 5%.

Table 4
T-test for Independent Samples of Control Class Data

Independent Samples Uji-t postest

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Kemampuan Pemecahan Masalah | Equal variances assumed | .224 | .641 | .677 | 20 | .506 | 2.727 | 4.030 | -5.679 | 11.133 |
| | Equal variances not assumed | | | .677 | 19.978 | .506 | 2.727 | 4.030 | -5.679 | 11.134 |

Table 5
T-test for Independent Samples of Experimental Class Data

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| kemampuan pemecahan masalah IPA | Equal variances assumed | .019 | .892 | -2.794 | 20 | .011 | -10.909 | 3.905 | -19.064 | -2.754 |
| | Equal variances not assumed | | | -2.794 | 19.081 | .012 | -10.909 | 3.905 | -19.080 | -2.738 |

Based on the results of the control class posttest t-test, Sig. (2-tailed) = 0.506 > 0.05, so there is no difference in the results of the science problem solving abilities of control class students during the posttest on class V heat transfer material, while the posttest t-test results for the experimental class have Sig. (2-tailed) = 0.01 < 0.05, so there is a difference in the results of the science problem solving abilities of experimental class students during the posttest on class V heat transfer material. So there is an increase in science problem solving abilities in the experimental class after the learning was carried out.

To determine the effect of students' self-confidence on their ability to solve science problems in class V heat transfer material in the experimental class, this was done using prerequisite analysis tests and simple linear regression tests. Testing in this research uses SPSS. The prerequisite tests for analysis, namely the normality test and linearity test, have already been carried out by researchers and the variables are normally distributed and the two variables have a linear relationship.

Table 6
Simple Linear Regression Anova

ANOVA[a]

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 955.682 | 1 | 955.682 | 688.091 | .000[b] |
| | Residual | 12.500 | 9 | 1.389 | | |
| | Total | 968.182 | 10 | | | |

a. Dependent Variable: Kemampuan Pemecahan Masalah
b. Predictors: (Constant), Self Confidence

In the Anova output results, the value Sig = 0.00 <0.05 is obtained, so H0 is rejected. So, it can be concluded that there is a significant influence between students' self-confidence on their ability to solve science problems on heat transfer material with the discovery learning model assisted by e-modules.

Based on data from the independence questionnaire at the pre-meeting, learning from meeting 1 and meeting 5, students in the experimental class experienced an increase. Based on the picture above, in pre-learning students were given a self-confidence questionnaire and produced an average score of 44.22, at the first meeting they got an average score of 56.82 and at the fifth meeting they got an average of 69.77. So it can be concluded that the class the experiment experienced an increase in self-confidence. The research subjects,

namely S-01, S-02, S-04, S-06, S-03, and S-08, also always experienced an increase from the pre-meeting, meeting 1 and last meeting, namely meeting 5. independence, this was clarified in Figure 1 as follows:

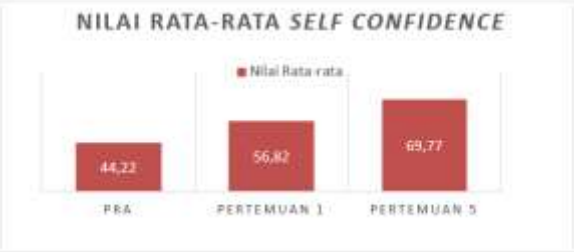


Figure 1
Graph of Average Self Confidence Value

Researchers carried out analysis of students' self-confidence indicators using a 15-item self-confidence questionnaire containing elements of eight self-confidence indicators. The maximum value used is 4 for each question. In indicator 1 there are 3 (three) questions, indicator 2 has 3 (three) questions, indicator 3 has 3 (three) questions and indicator 4 has 3 (three) questions, and indicator 5 has 3 (three) questions. The following are the students' scores on each self-confidence indicator at each meeting which are presented in Figure 2:

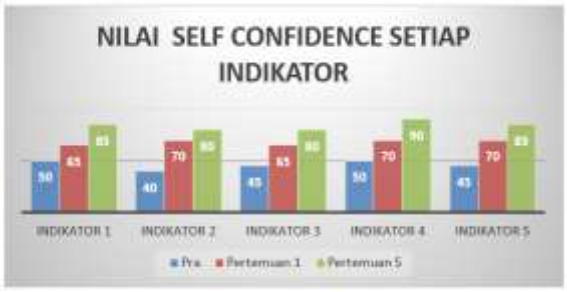


Figure 2
Student Grades Based on Confidence Indicators

Based on Figure 2 above, it can be concluded that in indicator 1, namely at the pre-meeting, the students' average score was 50, at the first meeting 65 and at the final meeting at 85. This concludes that students experienced an increase in indicator 1 at each meeting using the e-assisted discovery learning model. module. This means that students are able to be confident in their own abilities. In indicator 2, the score at the pre-meeting was 40, at the first meeting 70 and at the last meeting 80. It can be concluded that students experienced an increase in indicator 2, namely students were brave in their opinions.

At the pre-meeting, students were able to fulfill indicator 3 at 45, at the first meeting at 65 and at the last meeting at 80. So there was an increase in students' courage in interacting. At the pre-meeting, students were able to fulfill indicator 4 at 50, at the first meeting at 70 and at the last meeting at 85. So there was an increase in students in terms of actualizing as expected. For Indicator 5, the pre-learning meeting was 45, the first meeting was 70 and the last meeting was 85. This means that students are able to develop by accepting criticism and input.

In this study it can be concluded that in class V of SDN Bantarkulon in the final assessment (posttest) regarding self-confidence there were 5 students in the good or middle category with a percentage of 45.45% and 6 students in the very good or top category with a percentage of 54.55%.

According to the Ministry of National Education (2010:34), the middle category means students who dare to ask questions and express opinions about events or problems and participate in discussing them. Meanwhile, the top category means that students have met the Self Confidence indicator, meaning that students dare to ask questions during the learning process, express opinions and dare to actualize themselves during learning.

Benjamin S. Bloom in Wulandari (2005) states that initial abilities are very necessary to support students' understanding before being given new knowledge. For this reason, in this study the researcher gave pretest questions to determine initial science problem solving abilities in the control class and experimental class. This is necessary because one of the requirements of explanatory sequential research is that the initial science problem solving abilities of control class and experimental class students must be equivalent, so that it will make subsequent data analysis techniques easier.

The results of the descriptive statistical test of science problem solving abilities (initial) in the control class of 11 students were: maximum science score = 85, minimum score = 55, average = 73 with median = 75, mode = 65, and standard deviation = 9.293. Meanwhile, in the experimental class, the results of descriptive statistical tests on the science problem solving abilities (initial) of 11 students were: maximum science score = 90, minimum score = 55, average

= 70.45 with median = 70, mode = 70, and standard deviation = 9.606.

Based on descriptive statistics, the science problem solving abilities (initial) of students who will receive discovery learning model assisted by e-modules in the experimental class and students who will receive conventional learning are not significantly different at the significance level of α = 0.05. So the requirements for quantitative research in the control class and experimental class have been fulfilled.

The results of this test show that there is an influence of the form of learning on students' (initial) science problem solving abilities. The form of learning used in this research is learning with a discovery learning model assisted by e-modules. Learning with the discovery learning model assisted by e-modules is a step to direct students towards science problem solving abilities (initial) so that students can solve the problems they face. This means that students who study with the discovery learning model assisted by e-modules have been trained in science problem solving abilities.

The achievement of science problem solving abilities in the control class and experimental class can be seen from the post-test results. The post-test to measure the achievement of students' science problem-solving abilities was carried out after each student in the control class and experimental class had learned five meetings. Learning in the control class and experimental class is carried out by the same teacher. The difference lies in the treatment of the two classes.

In the experimental class students receive learning using the discovery learning model assisted by e-modules, while in the control class students receive conventional learning. The forms of questions tested in the post-test are the same as those given in the pre-test.

The post-test data in this study is referred to as the achievement of students' science problem-solving abilities. From the results of hypothesis testing using a two-sample independent one-party t-test, it was concluded that the achievement of science problem solving abilities of students who received learning using the e-module assisted discovery learning model was significantly higher than students who received conventional learning at the level α = 0.05 .

The post-test results showed that students in the control class experienced a change in their average score from 73.18 to 73.63. This means that for students who received conventional learning the increase in the achievement of science problem solving abilities was 0.61%. Meanwhile, students in the experimental class also experienced an increase in their average score from 70.45 to 84.54. This means that students who receive learning using the discovery learning model assisted by the e-module increase in their mathematical problem solving ability is 20%.

Based on the explanation above, it appears that the achievement of science problem solving abilities of students who receive learning using the discovery learning model assisted by e-modules is significantly higher than students who receive conventional learning. Why is that? Achieving science problem solving abilities is an achievement where students appear to be able to solve or find answers to questions in stories, texts and assignments in science learning. Furthermore, indicators in science problem solving abilities include: 1) identifying problems, 2) determining problem solving goals, 3) designing problem solving, 4) implementing problem solving plans, 5) and checking again.

Furthermore, based on the results of the simple linear regression analysis, it shows that there is an influence of students' curiosity on problem solving using the discovery learning model assisted by e-modules. The results of this analysis are in accordance with the statement of hypothesis 3, namely that there is an influence of curiosity on problem solving. Based on the research results, it was found that the magnitude of the influence of curiosity on students' ability to solve science problems on heat transfer material was 98.7%, meaning that the remaining 1.3% was influenced by other factors. The higher the student's curiosity, the higher and higher the value of solving science problems on heat transfer material. Based on this, the discovery learning model assisted by e-modules is able to increase students' curiosity and improve problem solving abilities in hot science lessons.

So, to achieve science problem solving abilities, students must identify problems, determine problem solving goals, try to design problem solutions using discovery learning models assisted by e-modules to solve problems whether related to science, other scientific disciplines or in everyday life.

The research results above are also supported by the results of observations during the research. The learning process using the discovery learning model assisted by e-modules brings changes to classroom learning. By practicing a lot of linking concepts in science, students will be more skilled in working on questions.

Based on the results of the analysis, it can be concluded that subjects in the medium category are able to fulfill the indicators in the three steps of science problem solving, namely identifying problems, designing problem solutions, carrying out problem solving but have not met the indicators in the re-checking step.

Based on the results of the analysis, it can be concluded that problem solving abilities at the low category level are only able to fulfill the indicators in one problem solving step, namely identifying problems.

In the discovery learning learning model assisted by e-modules, students are confident and confident in themselves, dare to express opinions and interact, actualize as expected, and are able to develop and accept criticism and input. So it can be concluded that students are enthusiastic during discovery learning assisted by e-modules. Apart from that, the learning atmosphere is fun, students are enthusiastic, and able to solve questions on heat transfer material.

From the results of this qualitative research, three groups were obtained based on the level of science problem solving abilities. Based on the initial test regarding the problem solving abilities of several students, it is known that there are students who are classified as intelligent, who can complete the test in the correct way and with the correct final results, then students with moderate abilities can only complete a few steps with incorrect final results, while students with low academic abilities, they cannot do the test questions at all.

Based on in-depth interviews with the three students, there were 3 (three) groups of students' problem solving abilities, namely high, medium and low academic groups. The high academic group is students who are able to solve problems at all levels of problem solving indicators correctly, namely being able to identify problems, design problem solutions, implement problem solutions, up to the level of looking back. The medium academic group is students who are only able to identify problems and design problem solutions. Meanwhile, the low academic group is students who are only able to identify problems.

From the results of the qualitative research analysis, it is known that the group of students with high science problem solving abilities has a high level of self-confidence, the group of students with moderate science problem solving abilities has a moderate level of self-confidence, and the group of students with low science problem solving abilities has a high level of self-confidence. low self-confidence. Based on this description, it can be seen that students' level of self-confidence influences their science problem solving abilities.

## Conclusion

Based on statistical data analysis, research results and discussion of chapter IV, the conclusion that can be drawn from this research is that students' science problem solving abilities in the Discovery Learning learning model assisted by E-modules achieve classical BTA, namely the proportion of students who achieve learning completion is more than 75%. . The achievement of science problem solving abilities of students who received learning using the discovery learning model assisted by e-modules was significantly higher than students who received conventional learning. Self-Confidence has a positive effect on problem-solving abilities in the experimental class in learning science material for class V Heat Transfer.

Based on research, it can be seen that overall learning carried out using the discovery learning model assisted by e-modules can have a positive and better influence in developing science problem solving abilities and can increase students' self-confidence, especially in science lesson content and heat transfer material in class V elementary school. , especially at the school where the author conducted research.

The material developed in this research is about heat transfer in class V elementary school. Therefore, for further research on science problem-solving abilities and self-confidence, further research needs to be carried out regarding different materials, lessons and levels. The results of this research can be continued and developed in more depth by readers, in order to find the best solutions in science learning so that students' science problem solving abilities continue to improve even better.

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