

Research Article

The application of discovery learning as an effort to improve mathematical problem solving skills

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ABSTRACT

Research conducted is a type of experimental research that has the following objectives: (1) to know the correlation between the learning achievement of students who use the discovery learning method and the conventional method in the applied math course, (2) to know the level of effectiveness of student outcomes using conventional and discovery learning methods, (3) to know the level of effectiveness of student of learning results by using the discovery learning method and conventional methods. The research conducted has a population of D3 Mechanical Engineering study program students in Semester 2 Academic Year 2022/2023 Harapan Bersama Polytechnic. Samples taken using grade 2A and 2C randomly where the two gradees with the division of grade 2A is the experiment grade and grade 2C is the control grade. The series of processes in the research method consists of preliminary tests, namely validity, reliability, difficulty level, and question differentiation. After being given the learning treatment, then analyzed by statistical tests. The results of the analysis provide an overview the results that in an experimental grade with an average result of 78 and a control grade with average results. Result of 62, then a statistical test is obtained $t_{count} = 6,02$ sedangkan $t_{table} = 2,06$ from the analysis results, it can be concluded that students who get treatment with the discovery learning method get better learning outcomes than the class that does not. do not get discovery learning treatment.

Keywords: application; discovery learning; problem-solving skills;

1. INTRODUCTION

By using discovery learning that utilizes coastal potential as the starting point of mathematics learning, students can recognize, understand, realize, and become a good problem solver so that they can actively participate in all learning activities (Penelitian et al., n.d.; Rofiqoh & Kurniasih, 2016; Suminar & Meilani, 2016; Susilowati & Winanto, 2022). Problem solving is two of the five process standards proposed by the NCTM, in addition to reasoning and evidence, connection, and mathematical representation. Problem solving is the most complex type of learning (Salma & Sumartini, 2022) and is the central focus of the mathematics curriculum (Kahah et al., 2022). These two abilities can develop students' higher order students' mathematical thinking skills such as logical, analytic, systematical, critical, creative, and productivity. A mathematics learning process that provides the opportunity to facilitate the development of these two skills can train students to maximize their thinking potential. Unfortunately, the mathematics learning process at all levels of formal education has not optimally sought the formation of these two abilities. In the current world of education, as we all know, especially during a pandemic, learning process in addition to using online and sophisticated methods must remain fun, and this fun essence is a method that must be innovated, as in the research conducted on students of the Harapan Bersama Polytechnic Mechanical Engineering Study Program in the learning process using the concept of the definition of national education and fun learning methods. Education goals have the essence to form human beings who are virtuous, disciplined, hardworking, and most importantly, devoted to God Almighty (Akhmad & Masriyah, 2014; Anjarwati et al., 2022; Kahah et al., 2022).

In teaching and learning activities, there is often boredom therefore, in the learning process for the students, there must be innovation, then the facilities and pre-facilities owned by universities to support the learning process must also be adequate so that they have a positive correlation with the success of learning (Aprilianingrum & Wardani, 2021; Kaya & Aydin, 2016). The next most important thing is the use of appropriate learning methods and concepts that will be embedded. Lecturers use innovative and fun methods, and are easily accepted by students. The advantages of the discovery learning method include the management of the lecture grade will become more lively and lively so that it will reduce student boredom so that it will increase enthusiasm and interest in learning and achievement. And then from the results of observations and interviews obtained information that the value of applied mathematics courses has not been maximized.

In connection with some of these backgrounds, this research was conducted by making fun learning innovations in the process of teaching matrix material subjects.

In research conducted by Andriani (2020) explains that the use of Android tools is Valid and Practical, then the next research was conducted by Aini et al. (2021) where this research shows that learning with fun can reduce network errors on the device. As well as research conducted by Ardianto (2019) concluded that learning has an influence on the environment with good learning methods. Furthermore, Noviyanto (2020) concluded that the development priorities that have been built have priority and implementation with an integrated system. Then looking at the definition of effectiveness in this study is a good influence on student achievement (Muhammad & Juandi, 2023). The research conducted took subject data with the name Matrix material, where the subject covers/has the scope of a concept that contains the planning and structure of basic computer operations, where in this subject designing hardware components effectively and multipurpose in various needs. (Awan et al., 2020; Purnama, 2012; Sungkar et al., 2019). Discovery learning is a learning method in improving student achievement results with fun learning (Putra & Haqiqi, 2022). The material that will be used as research material is matrix material. So this research is a study that has the aim of obtaining information to find out the correlation between the use of learning innovations Fun learning with student achievement in applied mathematics courses, where these subjects are found in the D3 Mechanical Engineering Study Program of Harapan Bersama Polytechnic. This study has a problem formulation, namely how to implement learning to facilitate student achievement levels, and increase learning motivation with a comfortable and pleasant environment. The purpose of this research is to look at how effective learning with active, creative and fun Learning types is for the mathematics learning process on Matrix material, so that the results of mathematics learning achievement can increase.

2. RESEARCH METHOD

The research method in this study used a research designs as described below indicated in **Table 1**.

Table 1. Research Design

Group	The treatments	Test
A	X1	Y1
B	X2	Y2

Description:

X1 = Teaching with discovery learning

X2 = Teaching without discovery learning

Y1 = Applied Mathematics Course Outcome 2 group A

Y2 = Applied Mathematics Course Outcome 2 group B

However, both groups were given the same material, namely applied mathematics courses, with the same amount of time, and the same teacher. Furthermore, the learning outcomes of the two groups were compared whether they were the same or there was a difference.

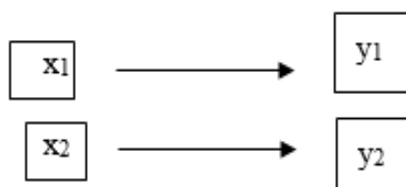
Research Variables

The variables in this study can be based on the research objectives as follows:

X1 = Learning with discovery learning in group A

X2 = Learning without discovery learning in group B

While the response variable is the learning outcomes of applied mathematics courses, in group A (y1) and group B (y2). With a description of the picture as illustrated below.



Description:

X1: Learning Applied Mathematics with discovery learning

X2: Applied Mathematics learning without discovery learning

Y1: Subject results Applied Mathematics group A

Y2: Applied Mathematics subject results group B

Data Collection Methods

This research has several data collections including the following:

a. Documentation Method

That is by searching for data to obtain a list of names of college students who will later be utilized as research samples (Los, n.d.). Then the collection uses teknik documentation which is a technique of collecting data by using documentation, meeting documents, test results, score lists, etc. The type of documentation technique used is the documentation technique of the average initial score of students, such as previous grades and mid-semester exam scores. The way of implementation in the documentation process has the following steps:

- 1) Record the identity of research participants who are part of the study
- 2) Record Student Learning Achievements/Results.

b. Test Method

Our method is a series of tests or exercises that measure the ability of skills and aptitudes of the person or group. The test can have a valid predicate if it is able to assess the desired/obtained data in accordance with the research objectives. Variable indicators use test questions, test questions that are compiled must be able to measure self-understanding and learning behavior, with a trial sample of Harapan Bersama Polytechnic D3 Engineering Study Program students in the 2022/2023 academic year. The next step is to look at the Reliability value which is an index to determine/measure the trustworthiness of a value.

Statistical Test

This research uses the following test statistics,

- a. Normality Test
- b. Homogeneity Test
- c. Test t

The t test has the aims of knowing the hypothesis/final research test, whether H_0 is accepted or rejected. Provided that the two groups are homogeneous, and the following formula can be used:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{(n_1 - 1) + (n_2 - 1)}$$

Description:

- n1 : Total number of subjects in the experimental group/class
- n2 : Total number of subjects in the control group/class
- \bar{X}_1 : The average value in the experimental class/group
- X_2 : The average score in the control class/group
- S12 : Variance value in the experimental group/class
- S22 : Variance value in the control group/class

3. RESULTS AND DISCUSSION

Results

In this study, starting from preparation, research implementation, data collection, analysis and discussion of research results. In the discussion of research preparation, we will discuss the determination of research subjects and the making of test questions. In the implementation of the research will be discussed about the provision of material and the implementation of the test. In the discussion of data collection, matters regarding the results of differentiating power, validity and reliability of questions and the level of difficulty are disclosed. Results regarding data analysis are disclosed regarding prerequisite tests which include normality, homogeneity and hypothesis testing. The discussion of the research results includes Material Provision and Trial Implementation. Then in the calculation of the reliability of the question with the results obtained then compared with the r table with $N = 40$ at the 5% level it turns out to be 0.312, then the result is $0.8876 > 0.31$ or $r_{\text{count}} > r_{\text{table}}$. So it can be concluded that the trial instrument prepared has a high level of reliability and has met the requirements as a data collector.

From the calculation results using the t test below:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

with,

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

with known :

$$\bar{X}_1 = 64,08 \quad \bar{X}_2 = 63,25$$

$$S1^2 = 80,76 \quad S2^2 = 90,6875$$

$$n1 = 38 \quad n2 = 40$$

$$S^2 = 84,882$$

$$S = 9,213$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$t = \frac{64,09 - 63,25}{9,213 \sqrt{\frac{1}{38} + \frac{1}{40}}}$$

$$t = \frac{0,84}{9,213 \sqrt{0,0513}}$$

$$t = \frac{0,84}{9,213 \times 0,2265}$$

$$t = 0,403$$

The obtained tcount value is 0.40 then the value of ttable with the limit of the probability of chance (1 - ½) at degrees of freedom = (n + n2 - 2) = 76,0 = 0.05 is 1.98. Because t count > ttable , so it can be concluded that the two gradees / groups do not have a significant difference in average. The t test has the aim of knowing the final result of the research , whether the research H0 is rejected or accepted. Furthermore, because the two gradees/groups are groups when compared are groups that are not homogeneous, the t test uses the following formula:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

This research hypothesis/assumption is as follows :

H0 = This shows that there is no impact on students' study achievement in applied mathematics courses for students who go through the learning process taught by the learning discovery method compared to students who do not go through

the learning discovery learning process.

H_a = This means that there was an influence on student achievement in applied mathematics courses for students who went through the learning process taught by the method of discovery learning compared to students who did not go through discovery learning process.

The test value limits when H_0 is rejected are as follows:

$$t_{count} > t_{table}$$

Based on the attachment, the following values were obtained:

$$t = \frac{15,09}{10,711\sqrt{0,0513}}$$

$$t = \frac{15,09}{10,711 \times 0,2265}$$

$$t = 6,02$$

Discussion

Based on the above calculations, the value of $t = 2.68$ while the value of $t_{count} = 6.02$ with these results obtained calculate t_{table} , Therefore, H_0 was rejected so H_a was accepted and it was concluded that the achievement of/learning results of students who go through the learning process with discovery learning are better than students who do not go through the learning process with discovery learning, or in other terms that the increase in achievement/learning results in the treatment group was much better than the control group. The t test results that have been calculated obtained the results $t_{count} = 6,02$ sedangkan $t_{table} = 2,68$, then $t_{count} > t_{table}$ this means that H_a accepted, that is, there is an influence student achievement in the subject Matrix material on students who go through learning with discovery learning is better than students who do not go through learning with discovery learning.

This shows a meaningful change in students' learning outcomes through the learning process with discovery learning. The following related matters regarding the use of the discovery learning method:

1. The students who are together in this process of learning can develop their abilities such as skills and understandin
2. The use of various stimuli/motivation is about making the learning process become more effective and get closer to the learning objectives, namely improving learning achievement and making learning situations conducive and fun.
3. Lecturers will be more motivated to encourage students to be more skillful in solving their problems, expressing ideas /ideas so as to create effective learning environment conditions.

4. CONCLUSION

According to the research results and statistical analysis of the data in group amounted to 78 while in the control group amounted to 62 after the calculation was obtained $t_{count} = 6,02$, whereas $t_{table} = 2,68$ then from the two data when compared then $t_{count} > t_{table}$ from this combination, there is a positive influence on the ability/learning achievement of students who go through the results of the learning process with the discovery of learning method so that conclusions can be obtained: (a) By looking at the results of students' learning performance, it can also be concluded that the learning performance of students who go through the learning process of discovery learning is significantly better than that of the group with the discovery learning method. of students who did not go through the learning process using discovery learning, (b) Students who are together in this learning process can develop their abilities such as skills and understanding, (c) The use of various stimuli/motivation is meant to ensure that the process of learning is effective and closer to the learning objectives, namely improving learning achievement and making the learning situation conducive and enjoyable, (d) Lecturers will be more motivated to encourage students to be more skillful in solving their problems, expressing their ideas/ideas so as to create effective learning environment conditions.

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AUTHOR'S CONTRIBUTIONS

The authors discussed the research results and contributed from the beginning to the finalization of the manuscript.

CONFLICT OF INTEREST

No conflicts of interest related to this article have been declared by the authors.

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