Mathematics Using Discovery Learning Model: Improve Creative Thinking on Exponent Function Material

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Abstract : *Learning difficulties can be interpreted as the inability of students to complete tasks from the teacher. In mathematics learning, difficulties in understanding the material have become commonplace, this is because mathematics is considered difficult by students. This study was conducted with the aim of determining the process and influence of creative thinking skills of class X students of SMK Kreatif Bahrul Ulum before and after implementing the discovery learning model. The research method used is pre-experimental design with a one-group post-test design type and using a quantitative approach. The research instruments used were tests and non-tests. The data analysis technique used was a hypothesis test. However, before conducting a hypothesis test, the data obtained was first tested for normality and homogeneity. Based on the calculation of the paired sample t-test, it showed that the t-count value was 19.453 with a significance of 0.000. The significance value showed 0.000 <error level of 0.05, so it can be concluded that Ha is accepted. The acceptance of Ha indicates that there is an increase in the creative thinking skills of class X students of SMK Kreatif Bahrul Ulum Tambakberas before and after implementing the discovery learning model.*

Keywords : *Discovery Learning; Creative Thinking; Exponent Function.*

INTRODUCTION

Formal education in Indonesia starts from elementary education to higher education. One of the studies that is widely studied at every level of education, even in all collections of sciences in higher education is mathematics. The importance of studying mathematics is inseparable from its role in various aspects of life. In addition, after studying mathematics, a person will be accustomed to thinking systematically, critically, scientifically, and can grow his creativity. The importance of learning mathematics is inseparable from its role in various aspects of life. In addition, after learning mathematics lessons, a person becomes accustomed to thinking systematically, critically, and scientifically, and can develop his or her creativity. That mathematics is the science of logic, about form, sequence and concepts related to each other. In order to remember the importance of studying mathematics, it is appropriate for every learner at every level of education to master mathematics lessons (Rahmah, 2018). Mathematics has an important role in education, which can be seen from the provision of mathematics in all levels of education from primary school to university.Considering the importance of mathematics lessons, in learning it is not only to know and understand what is included in mathematics

itself, but more emphasis is placed on students' thinking patterns to solve problems critically, creatively, carefully, thoroughly and logically (Setiawan & Rizki, 2018).

In the educational environment, mathematics is one of the compulsory subjects that has an essential contribution to aspects of life, learning mathematics in this school aims to make learner have the ability to solve problems. Therefore, the learning phase of mathematics is always related to the daily life of the students, according to the real life experiences of the learner. This is done with the aim that learner can decipher the concepts and knowledge through their direct experience of mathematics lessons (Susilawati & Dewi, 2019). From this statement, there are still many learner who have not been able to understand mathematics lessons properly and correctly because there are still learner whose abilities do not meet the average or it can be said that learner have learning difficulties. Learning difficulties can be defined as the inability of students to complete the tasks given by teachers. In learning mathematics, difficulties in understanding the material have become commonplace, this is because mathematics is considered difficult by learner, Bhajan learner think that mathematics is learned for no reason and do not understand the importance of mathematics in life and its relationship with other lessons at the next level (Kurnia et al., 2022).

Learning approach is a perspective in determining learning activities (Nasrulloh & Amin, 2022). The process of learning mathematics in schools should be changed. The concept of mathematics must be built with the understanding of the students themselves. What educators must do is how to encourage students to think, ask questions, solve problems, put forward ideas, discuss ideas and even find something new. Abstract mathematical material makes learner less interested in this lesson, therefore it is important to apply learning models that attract learner to learn more actively and creatively. (Susanto, 2016) states that interest is a factor that significantly affects learning success, because interest contributes greatly to the success of students' learning. (Firdaus, 2019) states that low interest in learning due to the way teachers deliver the material, as well as lack of active participation by learner, can be factors that affect this.

A new atmosphere in learning can be grown by applying a learning model that can move students to be active in the learning process (Nasrulloh et al., 2023). Discovery learning is an active and hands-on learning style developed by Jerome Bruner in the 1960s. Bruner emphasised that learning should be 'doing' or 'learning by doing'. In this method, learners are active participants rather than passive recipients of knowledge. The discovery learning method creates active learning where the material or content is not directly given by the teacher at the beginning of learning. During the learning process, learners are asked to find their own ways to solve problems (Khasinah, 2021). Discovery is done through observation, classification, measurement, prediction, determination and inference. The above processes are called cognitive processes or mental processes that assimilate concepts and principles in the mind. In the discovery learning model, learner are required to play a more active role in finding information. According to (Mukaramah et al., 2020), in the discovery learning model, learner learn to study problems and solutions, find relevant information, develop solution strategies and implement the chosen strategy. Basically, every educator wants the material taught to be accepted as a whole. Educators also need to understand that the characteristics of learner vary, both in terms of interest, potential, intelligence and effort.

(Khasinah, 2021) outline the discovery learning process. The steps or syntax in the discovery learning model are as follows: 1) simulation (stimulus), 2) problem statement (statement or problem identification), 3) data collection, 4) data processing, 5) verification,

6) generalisation. According to Wulandari (2016), he added the 7th stage, which is evaluation, with per evaluation, where a learner's work is evaluated by other learners using an evaluation rubric created by the teacher. The characteristics of the discovery learning model, according to Hosnan (2014), are as follows: 1) exploring and solving problems to create, connect and generalise knowledge; 2) learner-centred; 3) activities to combine new and existing knowledge. Based on the above description, the researcher took the initiative to conduct research using the discovery learning model to improve the creative thinking of Class X students at SMK Creative Bahrul Ulum on statistical material.

METHOD

The purpose of this study, by applying the Discovery learning Model the researcher tried to find out the creative thinking ability of class X students of SMK Kreatif Bahrul Ulum Tambakberas Jombang. So the right type of research for this study according to Sugiono (2016) is to use the pre-experimental design research type with the one-group pretest-posttest design type which can be described as follows:
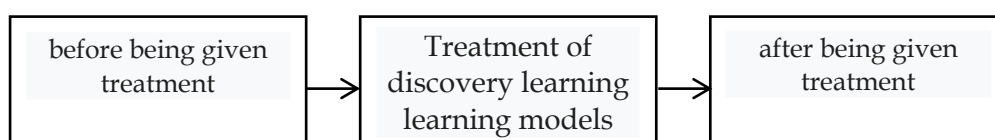

Figure 1. Research Design

The research that will be conducted by this researcher involves independent variables and dependent variables. The independent variable in this study is the discovery learning model, while the dependent variable in this study is the creative ability of class X students of SMK Kreatif Bahrul Ulum, Tambakberas, Jombang. The subjects of this study were 30 students from class 10 of SMK Creative Bahrul Ulum. The instruments used in this study were learning modules, pre-test and post-test. The learning module was prepared for two sessions on the topic of exponents. The learning model used was the Discovery Learning Model. The pretest and posttest instruments contain five descriptive questions with creative thinking indicators. The data obtained from the pretest and post-test results are internal data, so the researcher will compare the pretest and post-test results using statistical tests, with the type of parametric statistics t-test related (paired sample t-test). Based on the two tests above, if the data is normally distributed and the data is homogeneous, then a related t-test (paired sample t-test) can be carried out. The indicators for creative thinking in the pre-test and post-test instruments are presented in the following table:

Table 1. Creative Thinking Pretest and Posttest Instruments

No	Variable	Dimension	Indicator	Research purposes	Question Number
1	Ability to solve exponential function problems	Ability to determine the amount of a thing in the next period	Being able to determine the number of things correctly and accurately	Knowing the improvement of students' creativity in determining the number of things in the next period	1,2 and 3

2	Ability to solve exponential function problems	Ability to work on problems related to the growth of exponential functions	Able to solve problems related to the growth of exponential functions	To know the improvement of students' creativity skills when working on problems related to the growth of exponential functions.	4
3	Ability to solve exponential function problems	Ability to work on problems related to the decay of exponential functions	Able to solve related problems in exponential function decay	To know the improvement of students' creativity in working on problems related to the decay of exponential functions.	5

RESULT AND DISCUSSION

1. Result

The research was conducted on November 11 and 14, 2024 at SMK Kreatif Bahrul Ulum Tambakberas, Jombang with 30 class X students as research subjects. The material tested was the Exponential function with the sub-chapters tested being the definition of Exponents, Properties of Exponents, Definition of Exponents, Exponential Growth, and Exponential Decay. In this study, the learning tools used included a Teaching Module which contained Student Worksheets (LKPD), and an Assessment Rubric, as well as Pretest and Post-test questions containing creative thinking skills, each of which had been validated by two validators.

- The Normality Test

Data can be tested using parametric statistics if the data is normally distributed. The following are the results of the normality test using the IBM SPSS Statistics 26 application. Based on the results of the normality test above, it can be concluded that the data is normally distributed because the Kolmogorov-Smirnov significance value is > 0.05. The data from the normality test results are presented in the following table:

Table 2. the Normality Test

Qustions	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest	.136	30	.162	.912	30	.017
post-test	.164	30	.037	.937	30	.074

- The Homogenity test

Based on the results of the significance test is 0.014, where the significance value is > 0.05. So it can be concluded that the data is homogeneous. The data from the homogenity test results are presented in the following table:

Table 3. the HomogenityTest

Levene Statistic		df1	df2	Sig.
Based on Mean	6.354	1	58	.014
Based on Median	4.481	1	58	.039
Based on Median and with adjusted df	4.481	1	44.737	.040
Based on trimmed mean	6.316	1	58	.015

- Paired Sample t test

The tested data is proven to be homogeneous and normally distributed, then the data can be tested using the Paired Sample t Test or two-sample t-test. The samples in question are the pretest and post-test questions. The data from the paired sample t test results are presented in the Tabel 4.

Table 4. Paired Sample t Test

		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	Df	Sig. (2-tailed)
Pair 1	pretest post-test	15.267	4.299	0.785	- 16.872	-13.662	-19.453	29	0.000

2. Discussion

The research conducted aims to determine the creative thinking ability of students after implementing the discovery learning model. The creative thinking ability studied includes 3 indicators, namely (1) being able to determine the number of a period properly and correctly (2) being able to solve mathematical problems related to the growth of exponential functions in everyday life (3) being able to work on mathematical problems related to the decay of exponential functions in everyday life. The following is an example of a student answering one of the questions on the posttest:

Figure 1. the Example of Student Answers

In this answer, students can answer question number 4, namely the question regarding the population growth rate using the exponential function formula. The creative thinking ability of students can be known through the test results that are tested. The

researcher gave pretest questions to determine the creative thinking ability of students before implementing the model discovery learning and post-test questions to determine students' creative thinking abilities after implementing the discovery learning model.

Before being given pre-test questions on the exponential function material, students had been taught the material by teachers at SMK Kreatif Bahrul Ulum Tambakberas, but the learning method used by the teacher was a conventional method. Contextual problems of pretest questions, students are asked to use their abilities to determine the number of a period properly and correctly from the question. In this indicator, what is assessed in the student's work is how students can determine properly and correctly about the population in a certain period, or the mass of an item at a certain time from the question. The pretest results show that the creative thinking ability of class X students of SMK Kreatif Bahrul Ulum Tambakberas is still low. In indicator 1 studied, the pretest results showed that 57% of students were able to use their abilities to determine the number of a period properly and correctly, while the post-test results showed that 71% of students were able to use their abilities to determine the number of a period properly and correctly.

Based on the data obtained, the pretest results on question number 1 showed that 58% of students met this indicator, while in the post-test question the percentage of students increased to 73%. Question number 2 which contains level 2 of creative thinking skills showed an increase before and after implementing the discovery learning model. Where the pretest results showed 51% of students who were able to meet indicator 1, while in the post-test results it increased to 72%. At level 3, namely question number 3, there was also an increase before and after implementing discovery learning. Namely the pretest results showed that 63% of students were able to meet indicator 1 while in the post-test it increased to 71% of students were able to determine the remaining population of the question. The average number of students who were able to determine the number of items, population, mass, etc. in a certain period or time properly and correctly was 57%, while in the post-test results 72% of students were able to work on the questions.

In indicator 2, namely being able to solve mathematical problems related to the growth of exponential functions in everyday life. Some students cannot solve problems about the growth of exponential functions in everyday life. Based on the data above, 54% of students were able to choose and work on questions related to the growth of exponential functions in everyday life in pretest question number 4. In the post-test questions there was an increase to 72%. Then in indicator 3, namely the ability to work on questions related to the decay of exponential functions in everyday life. Some students were unable to solve problems related to the decline in car selling prices from year to year. 59% of students were able to work on questions related to the decay of exponential functions in everyday life on pretest question number 5. While on post-test questions there was an increase to 76%.

Learning activities carried out in accordance with the teaching module that has been validated by experts, and accompanied by learning media in the form of Student Worksheets (LKPD). The instruments used by researchers include teaching modules, Student Worksheets (LKPD), and creative thinking ability test questions. Based on the research results and discussion, what can be concluded is that there is a significant difference in the creative thinking abilities of class X students at Bahrul Ulum Tambakberas Creative Vocational School before and after implementing the discovery learning model. This is in line with research that has been carried out by Rahayu et al., (2019) the research results state that the application of the discovery learning model can increase student activity and learning outcomes in thematic learning. During the learning

process, researchers found various obstacles. These obstacles include: (1) time constraints, in the discovery learning learning process it takes quite a long time while the allocation of learning time applied by the school institution is limited (2) lack of inadequate facilities at school such as projectors, (3) there are several students who are noisy or fight over themselves during the learning process.

CONCLUSION

Based on the results of the study and discussion, what can be taken is that there is a significant difference in the creative thinking ability of class X students of SMK Kreatif Bahrul Ulum Tambakberas before and after implementing the discovery learning model. This is shown in the Paired t Test where the significant value produced is 0.000, a value smaller than the error rate used, which is 0.05, so Ha: there is a difference in the creative thinking ability of students before and after implementing the discovery learning model is accepted. This difference can be seen from the average test results creative thinking ability which shows a higher average post-test value than the pretest value. So it can be concluded that the discovery learning model has an effect on improving the creative thinking ability of class X students of SMK Kreatif Bahrul Ulum Tambakberas.

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