Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.12, No.2, 2021

Developing Learning Devices Based on the Discovery Learning Model to Improve the Ability of Creative Thinking and Problem Solving of Junior High School Student Students

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Abstract
This study aims to: 1) to determine the increase in creative thinking skills of students who are taught using learning tools developed using the discovery learning model; 2) to determine the increase in the problem-solving abilities of students who are taught using learning tools developed using the Discovery Learning model; 3) to determine the validity, practicality and effectiveness of learning tools developed using the discovery learning model. The subjects of this study were VIII grade junior high school students of Al-Hikmah Medan in the 2020/2021 academic year. The results showed that: 1) the mathematical creative thinking ability of students using learning tools with the discovery learning model increased in terms of: The average posttest score of the first test was 76.88, increased to 80.94 in the second test and experienced an increase in stage the spread of 88.75 and the N-Gain test I of 0.30 in the medium category increased to 0.33 in the medium category in the second test and at the distribution stage it increased to 0.62 in the moderate category; 2) the mathematical problem solving ability of students using learning tools with the Discovery Learning model increased in terms of: the average posttest score of the first test was 76.88, increased to 81.19 in the second test and experienced an increase in the distribution stage of 84.38 and N-Gain in the first test of 0.31 in the moderate category, increasing to 0.33 in the medium category in the second test and at the distribution stage, increasing to 0.42 in the moderate category; 3) the learning tools developed with the Discovery Learning Model have met the criteria of validity, practicality, and effectiveness
Keywords: discovery learning model-based learning, mathematical creative thinking ability, mathematical problem solving ability, mathematics learning tools
DOI: 10.7176/JEP/12-2-12
Publication date: January 31st 2021

1. Introduction

Education is very much needed in the life of Indonesian society in improving the quality of human resources. An educated society is expected to be able to compete with countries in a world full of competition. Dumciuviene (2015) said, "Future growth of the country will depend on knowledge. In this case more jobs will require a higher education qualification ". This implies that the future growth of a country depends on knowledge. In this case, many jobs will require higher educational qualifications. The same thing was also conveyed by Muhardi (2004) that education has a very valuable and significant contribution in improving the quality of a nation, of course also for the Indonesian nation.

In the world of education, mathematics is one of the subjects that plays an important role in helping develop the potential of students. Studying mathematics can help students to think and study things logically and systematically. This is in accordance with what Wittgenstein expressed that mathematics is a method of logical thinking (in Suriasumantri, 2012)

James (in Hasratuddin, 2015) states that "mathematics is the science of logic regarding form, arrangement, quantity, other related concepts in large numbers which are divided into three areas, namely algebra, analysis, and geometry". In mathematics, the materials taught are basic sciences that are rapidly developing both in terms of content and application. Thus, teaching mathematics in schools is a priority in education.

But in reality, mathematics is considered by most students as something difficult, boring, impractical, abstract and learning requires special abilities that are not suitable for everyone (Ignacio, Nieto and Barona 2006). This is in line with the opinion of Azmidar, Darhim and Dahlan (2017) that mathematics is very difficult, boring, not very practical and has many abstract theorems that are difficult to understand.

One of the abilities that students need to develop is the ability to think creatively. According to Marliani (2015) that: The ability to think creatively is very useful for training divergent abilities in mathematics because the ability to think creatively can be interpreted as the ability to solve math problems with more than one solution and students think fluently, flexibly, do elaboration, and have originality in their answers .

According to Hevy (in Nasution, 2017) states that "creative thinking is very important in the current global era when the complexity of problems from all aspects of life is needed". In creative thinking, there are two basic components needed, namely a balance between logic and intuition. The ability to think creatively has been

developed as a success factor in learning mathematics. In learning mathematics, the creativity of students is needed to solve complex and non-routine problems. Students are expected to be able to come up with new creative ideas in analyzing and solving problems (Kemendibud, 2013).

In fact, in the field it shows that students 'mastery of students' creative thinking skills is still low. This is based on the results of research by Munandar (2012) which states that Indonesian students reach the lowest rank in students' mathematical creative thinking scores. It can also be seen from the results of research conducted by Fardah (2012) which states that students' creative thinking skills are still low. The results showed that students with the ability to think creatively in the high category were 20% of the total number of students, the moderate category was 33.33% and the low category was 46.67%.

Therefore, the ability to think creatively is very important in problem solving activities which are the main activities in mathematics. In life, each individual always faces problems, on a narrow and broad scale, simple or complex. In addition, the ability that students need to improve is the ability to solve problems. According to Lilijedahl, Santos, Malaspina and Bruder (2016), solving mathematical problems is seen as an important aspect of mathematics, teaching mathematics and learning mathematics.

But in fact, the problem solving ability is still low, it can be seen from the research conducted by Marzuki (2012) in his research which also revealed that the initial problem solving abilities of students, from 66 students, 60 students or 90.90% has a very low score and only 6 people or 9.09%, who have sufficient category value. In line with the initial research conducted by Saragih and Habeahan (2014) also shows that in problem solving, it is often found that students only focus on the final answer without understanding whether the answer process is correct or not. So that the answers from students become wrong.

According to Nur (in Sulistyaningsih. 2013) learning tools provide convenience and can assist teachers in preparing and implementing teaching and learning activities in class. So that with the right learning tools it can make it easier for students to learn mathematics.

Meanwhile, Sugiantara (2003) states that there are student textbooks that are used as a dominant learning resource, presenting formulas without providing opportunities for students to build their understanding of the material, and lack of opportunities and means for students to interact and build their own understanding during the learning process.

Furthermore, Mertayasa (2012) states that the math problems presented in student books so far are real world problems that are still difficult to imagine and do not make sense according to the reasoning of students or it can be said that mathematical problems are presented in student books. related to the life of students, makes sense, or at least can not be imagined based on the reasoning of students, so that students have a picture to complete.

Responding to the problems mentioned above, it is necessary to choose a learning model that can change the paradigm of the learning process in the classroom. One of them is by applying the Discovery Learning learning model. Discovery Learning. Discovery Learning. Discovery Learning has the same principles as inquiry and problem solving. There is no principal difference between these three terms. Discovery Learning emphasizes the discovery of previously unknown concepts or principles, problems faced by students, such as problems engineered by teachers.

Development of learning tools through the Discovery Learning model can develop students' creative thinking skills and problem solving skills. The learning tools that will be developed in this study are lesson plans, teacher books, student books and LKPD. In this study, learning tools will be developed through the Discovery Learning model which can activate students 'learning and as a means of increasing students' creative thinking skills and problem solving. Thus the research with the title "Development of Learning Tools Based on the Discovery Learning Model to Improve Creative Thinking Ability and Problem Solving Junior High School Students".

2. Theoritical

Mathematical Creative Thinking Ability

According to Munandar (in Fitriarosah, 2016) states that "creative thinking is a combination of logical thinking and divergent thinking based on intuition in consciousness". Therefore, creative thinking involves logic and intuition together.

Krulik and Rudnick (in Fitriarosah, 2016) stated that "creative thinking is one of the highest levels of a person in thinking, namely starting with recall, basic thinking, critical thinking and creative thinking.). Thinking at a level above memory (recall) is called reasoning.

According to Nasution (2017) that "creative thinking as a person's mental activity through internal factors is manifested to get out of the comfort zone. Creative thinking is the potential of every individual ". Creative thinking can be combined in responding to problems to generate new ideas. Solving a problem with a non-single solution, can be said to be creative thinking if it is feasible, useful, and different from the previous product. So it can be said that creative thinking is one of the higher order thinking skills.

Mathematical Problem Solving Ability

The ability to solve problems is an ability that students must have because they can apply previously acquired

knowledge to new situations. According to Wardhani (in Delyana, 2015: 28) says that "problem solving ability is the ability to apply previously acquired knowledge into new, unknown situations". Previously, students had acquired knowledge from the teacher, so that students who had problem solving abilities were able to apply the right strategies when solving math problems.

Students need to master problem solving abilities because they can find patterns in mathematics, apply rules in mathematics through problem solving activities. According to Suherman (in Masrurotullaily, et al, 2013) that "the ability to solve mathematical problems is one of the abilities that students need to master because through problem solving activities, important aspects of mathematical skills such as applying rules to non-routine problems, finding patterns and so on. -other, can be developed better ".

From the description above, problem solving ability is the ability to apply the steps used by students in solving math problems.

Model Discovery Learning Learning

According to Hosnan (2014) Discovery learning is one of the learning models used in the modern constructivism approach. In discovery learning, students are encouraged to learn on their own, namely through active involvement with concepts and principles. The teacher's job is to encourage students to have experience and conduct experiments by enabling them to discover principles or concepts for themselves.

3. Methods

Research Pattern

This research is categorized into a development research type using the Thiagarajan, Semmel and Semmel learning tools development model, namely the 4-D model (Four D Model). Thus, the product of this research is a learning device that uses a valid, practical and effective Discovery Learning model.

Participants

The subjects of this study were VIII grade students of Al-Hikmah Medan Senior High School in the 2020/2021 academic year.

Data Collection Technique

To measure the validity, practicality and effectiveness of the developed mathematics learning tools, research instruments were compiled and developed. The instruments used in this study include: the validity sheet of the learning device, the validity sheet of the test instrument, the observation sheet for the effectiveness of learning.

Validity and Reliability

This validity is based on the opinions of five experts in the field of mathematics education. Based on the expert's opinion, the average value for the aspects will be determined, in order to obtain the average value for the total aspects. A measuring instrument is said to have high reliability if the instrument provides consistent measurement results. The results of these measurements are relatively similar if the measurements are made on the same subject even though they are carried out by different people and different places. As has been done by Sudjana (2009), it is said to be reliable if the current measurement results show the same results at different times of the same student. In this study, the test items were said to be reliable if they had sufficient reliability at least.

Data Analysis

The data analysis technique used in this research is descriptive analysis. The data obtained were analyzed and directed to answer the question whether the instrument and the learning roles using the Discovery Learning model that was developed met the criteria for validity, practicality and effectiveness. The data obtained from the expert or practical team is analyzed and directed to answer whether the learning instruments and tools using the Discovery Learning model that have been developed meet the validity criteria, while the field test data is used to answer whether the instruments and learning tools using the Discovery Learning model developed meet the criteria. Practicality and effectiveness.

4. Result

Result

This research is development research, so the product of this development research is a learning tool with the Discovery Learning model. The purpose of this development research is to analyze: (1) to increase the creative thinking skills of students who are taught using learning tools developed using the Discovery Learning model; (2) increasing the problem-solving abilities of students who are taught using learning tools developed using the Discovery Learning model; (3) validity, practicality and effectiveness of learning tools developed using the Discovery Learning model.

1) Description of Increased Mathematical Creative Thinking Ability

Based on the data obtained from the posttest results of students' mathematical creative thinking abilities in the first and second tests were analyzed to determine the increase in students' mathematical creative thinking abilities by comparing the students' average scores obtained from the posttest results of mathematical creative thinking abilities. from students I and II. The description of the increase in students' mathematical creative thinking skills in tests I

and II is presented in Table 1.

Table 1. Description of Increasing Students' Mathematical Creative Thinking Ability

Information	Posstest Test I	Posttest Test II
The highest score	93,75	93,75
The Lowest Value	50,00	62,50
Average	76,88	80,94

From Table 1, it shows that the average creative thinking ability of students in the posttest results of test I is 76.88. And the average of students' creative thinking skills in the posttest results of the second test was 80.94. This shows that the increase in the average increase in students' mathematical thinking skills from test I to test II.

2) Description of Improved Mathematical Problem Solving Ability

Based on the data obtained from the posttest results of students' mathematical problem solving abilities in the first and second test were analyzed to determine the increase in students' mathematical problem solving abilities by comparing the students' average scores obtained from the posttest results of mathematical problem solving abilities. from students I and II. The description of the increase in students' mathematical problem solving abilities in test I and II is presented in Table 2.

Table 2. Description of Increased Students' Mathematical Problem Solving Ability

Information	Posstest Test I	Posttest Test II
The highest score	93,75	93,75
The Lowest Value	56,25	62,50
Average	76,88	81,19

From Table 2., it shows that the average mathematical problem solving ability of students on the results of the posttest test I was 76.88. And the average ability of students' mathematical problem solving on the results of the posttest test II amounted to 81.19. This shows that there is an increase in the average ability of students' mathematical problem solving from test I to test II.

Discussion

1) Development of Valid, Practical, and Effective Problem-Based Teaching Materials

Learning tools developed with the Discovery Learning Model have met the criteria of validity, practicality, effectiveness.

2) Increased Mathematical Creative Thinking Ability

The improvement of students' mathematical creative thinking skills in the first test and second test will be seen through the N-Gain of the pretest and posttest results of the mathematical creative thinking ability in the first test and second test. The results of the N-Gain calculation on creative thinking skills can be seen in Table 3.

Tabel 3. Summary of N-Gain Results of Mathematical Creative Thinking Ability

N-Gain	Interpretation	Test I (the number of students)	Test II (the number of students)
g > 0,7	High	0	1
0,3 < g ≤ 0,7	Medium	10	9
g ≤ 0,3	Low	10	10

Based on Table 3. above, it can be seen that in the first test there were no students who got an N-Gain score in the range> 0.7 or experienced an increase in mathematical creative thinking skills with the "High" category, students who experienced an increase in creative thinking skills 10 students with an "moderate" category or an N-Gain score of 0.3 <g ≤ 0.7, and 10 students who experienced an increase in mathematical creative thinking skills in the "Low" category or got an N-Gain score g ≤ 0, 3 as many as 10 students. Then in test 2 it can be seen that students who got an N-Gain score in the range> 0.7 or experienced an increase in mathematical creative thinking skills with the "High" category by 1 student, students who experienced an increase in mathematical creative thinking skills by category "Moderate" or got an N-Gain score of 0.3 <g ≤ 0.7 as many as 9 students and students who experienced an increase in mathematical creative thinking skills in the "Low" category or got an N-Gain score g ≤ 0.3 as many as 10 learners.

3) Improved Mathematical Problem Solving Ability

The increase in students' mathematical problem solving abilities in the first test will be seen through the N-Gain of the pretest and posttest results of mathematical problem solving abilities in the first test. The results of the N-Gain calculation on creative thinking skills can be seen in Table 4.

Tabel 4. Rangkuman Hasil N-Gain Kemampuan Pemecahan Masalah

N-Gain	Interpretation	Test I (the number of students)	Test II (the number of students)
g > 0,7	High	0	1
0,3 < g ≤ 0,7	Medium	8	12
g ≤ 0,3	Low	12	7

Based on Table 4, it can be seen in the first test that there are no students who have received an N-Gain score in the range> 0.7 or have increased their mathematical problem-solving abilities with the "High" category, students who have increased problem solving abilities mathematically with the "Medium" category or got an N-Gain score of 0.3 <g ≤ 0.7 as many as 8 students and students who experienced an increase in mathematical problem solving abilities with the "Low" category or got an N-Gain score g ≤ 0, 3 as many as 12 students. So, the average N-Gain in the first test was 0.31 in the medium category. Whereas in the second test it can be seen that students who got an N-Gain score in the range> 0.7 or experienced an increase in mathematical problem solving abilities with the "High" category by 1 student, students who experienced an increase in mathematical problem solving abilities with the category "Medium" or got an N-Gain score of 0.3 <g ≤ 0.7 as many as 12 students and students who experienced an increase in mathematical problem solving abilities with the "Low" category or got an N-Gain score g ≤ 0.3 as many as 7 learners. So, the average N-Gain in the first test was 0.33 in the medium category.

5. Conclusion

1. Students' mathematical creative thinking ability using learning tools with the Discovery Learning model increases, in terms of:
   a. The average posttest score in test I was 76.88, increasing to 80.94 in test II and experiencing an increase in the distribution stage by 88.75.
   b. The N-Gain in the first test of 0.30 in the moderate category increased to 0.33 in the medium category in the second test and at the distribution stage increased to 0.62 in the moderate category.
2. Students' mathematical problem solving abilities using learning tools with the Discovery Learning model increase, in terms of:
   a. The average posttest value in test I was 76.88, increasing to 81.19 in test II and experiencing an increase in the distribution stage of 84.38.
   b. The N-Gain of the first test of 0.31 in the moderate category increased to 0.33 in the medium category in the second test and at the distribution stage it increased to 0.42 in the moderate category.
3. Perangkat pembelajaran yang dikembangkan dengan Model *Discovery Learning* telah memenuhi kriteria validitas, ditinjau dari:
   a. RPP validity with a total average of 4.03 with valid criteria
   b. BPG validation with a total average of 4.12 with valid criteria
   c. BS validation with a total average of 4.10 with valid criteria
   d. LKPD validation with a total average of 4.15 with valid criteria
   e. Validation of the creative thinking ability test (pretest and posttest) for 4 essay questions obtained rrx> rtabel with valid criteria
   f. Validation of problem solving ability tests (pretest and posttest) for 4 essay questions obtained rrx> rtabel with valid criteria.
4. The learning tools developed with the Discovery Learning Model have met the criteria of practicality, in terms of:
   a. Expert / practitioner judgment which states that learning tools can be used with little or no revision.
   b. The results of observations of the implementation of learning tools in class in the first test of 85.53% were included in the good category, in the second test it was 91.40% included in the very good category and at the distribution stage of 92.78% included in the very good category.
5. The learning tools developed with the Discovery Learning Model in the first test were not yet effective because they did not meet the effectiveness criteria, namely the classical learning completeness had not yet been achieved but in the second test and the dissemination stage had met the effective criteria, in terms of:
   a. Classical mastery of student learning for creative thinking skills has been achieved in the second test, namely 85% and the dissemination stage, which is 90%, while classical student learning completeness for problem-solving abilities has been achieved in the second test which is 85% and the distribution stage is 85 %.
   b. The achievement of learning objectives has been achieved for each item in the second test and the distribution stage.

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