

DEVELOPMENT OF PROBLEM-BASED LEARNING-ASSISTED MATHEMATICS LEARNING TOOLS WITH SCIENTIFIC APPROACHES TO IMPROVE STUDENTS' CREATIVE THINKING SKILLS AND CONFIDENCE

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ABSTRACT

The purpose of this study was to determine the development of problem-based learning (PBL) based mathematics learning tools with a scientific approach to improve students' creative thinking skills and self-confidence (self-confidence) which are valid, practical and effective. Negeri 22 Medan is even semester of the 2019/2020 school year, while the object in this study is a learning device based on a scientific approach, the quadrilateral material was developed. The stages of this research are the stages of this research are the analysis stage, the planning stage (design). The development stage (develop) and the trial stage (validation). The results of this study indicate (1) the validity of the problem-based learning tools with the scientific approach developed including the valid category, with the average score of the experts obtained: RPP (4,565); Book Teacher (4,475); Student Book (4,508); Student Worksheets (4,474); (2) The problem-based learning device with the scientific approach developed is included in the practical category with the assessment of experts, it is found that: in the first trial it was 4.10 (very high / practical) and in the second trial it was 4.3 (very high / practical)); the reliability of the instruments in the first trial was 98.53 (good) and in the second trial it was 98.20 (good). (3) Problem-based learning tools with a scientific approach developed by more than 80% of students gave a positive response to the learning tools developed.

Keywords: Learning Tools Based on Problem Based Learning, Scientific Approach, Creative Thinking Ability, Student Confidence Attitude

INTRODUCTION

Government Regulation Number 81 A of 2013 relating to the implementation of the 2013 curriculum implies that for each education unit conducts learning planning, implementing the learning process, and assessing the learning process to increase the efficiency and effectiveness of competency attainment. Various government efforts to prioritize the development of education are of course aimed at increasing the quality of the human resources of the Indonesian people. It should be realized that in realizing reliable human resources mathematics has a major role. Mathematics is a main subject, even every discipline uses concepts from mathematics. Plato and the Platonists (Ernest, 2004: 25) argue that "Mathematical objects and structures have a real existence that is inseparable from humanity, and therefore, mathematics is a process of finding the relationships that exist behind them". The opinion of the previous description means that mathematics has a connection to all science which has a real existence that cannot be separated from humans.

Apart from curriculum development, other efforts by the Indonesian government to improve student achievement in mathematics are by organizing education and training for mathematics teachers. This is due to the high demands on students mastering mathematics.

The high demands for mastery of students in the field of mathematics are inversely proportional to the achievement achieved. Based on the results of the Trends in Mathematics and Science Study (TIMSS) which was attended by Indonesian VIII grade students in 2011. The assessment conducted by the International Association for the Evaluation of Educational Achievement Study Center Boston College, was attended by 600,000 students from 63 countries. Mathematics, Indonesia is in rank 386 with a score of 386 out of 42 countries whose students were tested. This Indonesian score fell 11 points from the assessment in 2007. In the Mathematics TIMSS class VIII, the first rank was achieved by Korean students (613), followed by Singapore.

The average score is set at 500 points (Saragih, 2016). This description is in accordance with research conducted by Maria M, Zagoto & O, Dakhi (2018) which states that students' learning completeness is still far below average. The cause of the student's difficulty is due to their weakness in understanding basic concepts, properties, operations, and not being skilled in carrying out the procedures and algorithms needed to solve problems. Researchers assess that the low student achievement in Indonesia is due to low creative thinking skills and self-confidence in solving math problems.

The ability to think creatively is one of the factors that affect students' mathematics learning outcomes. Creativity is a complex field of study that can cause various differences of view. The importance of students' creative thinking skills is not in accordance with existing facts. This is reinforced (Sarumaha, 2018; Maria M, Zagoto, 2018): "Based on the results of the PIRLS, TIMSS, and PISA tests, it is known that Indonesian students are not able to answer questions that require higher order thinking skills. This condition has an impact on the low creativity and innovation of students in our country because creativity is the ability to think at the highest level. " This description is in accordance with the research conducted by (Sani, R. A, 2014) which states that students have the assumption that solving math problems is sufficient by following or imitating the work methods described by the teacher in front of the class. Mathematics learning like this, does not provide broad opportunities for students to express ideas and ideas in developing their ability to solve problems in their own way.

In addition to creative thinking, self-confidence is also one of the factors that affect mathematics learning outcomes. Self-confidence is very important to develop. Global competition leads to demands on students to be not only smart in terms of knowledge, but also to have the confidence and courage to face any global challenges, especially junior high school children. Middle school students are generally in the period of puberty. At this time students will experience a lack of self-confidence, because at this time students begin to experience changes physically, thus affecting their self-confidence (Hurlock, 1980).

An alternative that can improve students' creative thinking skills and self-confidence is through developing Problem Based Learning (PBL) tools with a Scientific Approach. The learning process with the Problem Based Learning (PBL) model is a learning model that presents real problems that exist around students to be investigated authentically by students. In accordance with what was stated by Trianto (2012: 90; Rina Novalinda et al, 2020; Agus R, T. et al, 2021), Problem Based Learning (PBL) is a learning model based on many problems that require authentic investigation with real problems (Melda Fajra et al, 2020).

From the description previously described, the author is encouraged to conduct research on "Development of Problem Based Learning Mathematics Learning Tools with Scientific Approaches to Improve Students' Creative Thinking Ability and Confidence Attitudes". Learning mathematics is a process of exploring students' knowledge related to symbols, mathematical problems with old knowledge to find new mathematical concepts. It

can also be said that learning mathematics is a psychological process in the form of one's actions / efforts to reconstruct, understand or master mathematical material.

According to Amabile (Masril, M., Dakhi, O., Nasution, T., Ambiyar, 2020) creative thinking is the key to creativity, especially related to: 1) Thinking differently from others and trying to come up with solutions than usual; 2) The combination of knowledge that is already owned; 3) Never give up in facing difficult problems; 4) Ability to seek new views after leaving the solution effort temporarily (incubation period).

Stenberg (Abdullah Sani, R., 2014: 15) states that "there are three intelligences that are important to produce creativity: 1) synthetic; 2) analytics; and 3) practice ". Furthermore, Stenberg (Abdullah Sani, R., 2014: 15) "Thinking synthetic (creative), namely the ability to develop ideas that are unusual in quality, and according to the task. One aspect of intelligence is the ability to redefine a problem effectively and think deeply. The ability to think deeply is related to the acquisition of knowledge in three forms; a) Selective decomposition, namely distinguishing relevant information, b) Selective combination, namely combining some relevant information in a new way, c) Selective comparison, namely linking new information with old information in a unique / new way ".

From the conclusions of creativity and the description above, the ability to think creatively is a thought process that tends to self-actualize by combining experiences and elements in new or different ways with respect to oneself, nature, and others to realize potential in producing products. The characteristics of mathematical creative thinking skills as stated by Munandar (2009:42), namely: 1) fluency skills; 2) Flexible thinking skills; 3) Original thinking skills / novelty (originality); 4) Elaboration skills. Teachers and the learning methods they apply in the classroom will have a direct effect on students' self-confidence, when students are faced with challenging situations and pleasant feelings, students' self-confidence will increase.

According to Lauster (in Ghufroon & Rini, 2011: 35), the aspects of self-confidence are as follows: Self-confidence, optimistic, objective, responsible, rational and realistic. Based on the opinions of the experts above, the indicators of self-confidence in this study are as follows: 1) confident in their abilities; 2) Acting independently in making decisions; 3) Always optimistic, calm, and never give up; 4) Have sufficient intelligence; 5) Having socialization skills; 6) Always be positive in facing problems; 7) Able to adapt and communicate in various situations; 8) Always be objective, rational and realistic.

Learning by using the Problem Based Learning learning model is student-centered and encourages inquiry and free thinking, the whole teaching and learning process oriented to Problem Based Learning is helping students to become independent. The main role of the teacher in Problem Based Learning is to guide or facilitate, so that students can develop critical thinking skills and be able to solve problems effectively. Problem Based Learning focuses on life problems that are meaningful for students. Because the teacher's job is to help students formulate assignments and not present lesson assignments. The Problem Based Learning model was developed primarily to help students develop thinking skills, problem solving and intellectual skills. The learning process Problem Based Learning is formed from the irregularity and complexity of problems that exist in the real world. This is used as an impetus for students to learn to integrate and organize the information obtained, so that later it can always be remembered and applied to solve problems to be faced.

Learning devices are a set of learning resources arranged in such a way that students and teachers carry out learning activities. According to Trianto (2011: 96) learning tools are devices used in the learning process. Learning tools needed in the learning process. The learning device serves to provide direction for the implementation of learning so that it

becomes directed and efficient. In its implementation, the learning device consists of various components depending on the needs of each person (teacher). However, in this study, the development of learning tools to be developed is limited to student books, lesson plans (RPP), Student Activity Sheets (LAS) and learning ability tests.

METHODS

The type of research to be conducted is development research. This research will use the Thiagarajan 4-D development model and the researcher will develop problem-based learning (PBL) based learning tools with a scientific approach to the rectangular flat shape material. The learning tools to be developed are Student Books (BS), Learning Implementation Plans (RPP) and Student Worksheets (LKS). In addition, researchers also developed a research instrument consisting of a problem-solving ability test and a self-confidence questionnaire.

The subjects in this study were students of class VIII SMP Negeri 22 Medan in the even semester of the 2019/2020 school year, while the object in this study was a learning device based on a scientific approach, developed quadrilateral material.

RESULTS AND DISCUSSION

Results

a. Description of the Effectiveness of Problem Based Learning Tools developed in Trial I.

Problem-based learning tools are said to be effective in terms of (1) classical student learning completeness, namely at least 85% of students who take part in learning are able to achieve a score of 75; (2) student activities meet the predetermined ideal time; and (3) 80% of students responded positively to the component of problem-based learning tools with the developed scientific approach.

In this study, the level of student ability in terms of creative thinking skills using tests of creative thinking abilities that have been developed. Classical completeness of student learning from the results of tests of creative thinking skills, namely students who completed were 15 out of 27 students or (55.56%) and the number of students who did not complete was 12 out of 27 people or (44.44%) who took the creative thinking ability test.

In accordance with the criteria of classical student learning completeness, that is, at least 85% of students who take the mathematical problem solving ability test are able to achieve a score of 75. So, only the posttest results of the ability to think creatively have not fulfilled classical learning completeness. So it can be concluded that, in the trial, the application of problem-based learning tools with the developed scientific approach did not meet the classical completeness criteria.

Overall, the average results of the analysis for each aspect of the student's response were as follows: (1) 96.30% of students said they were happy with the component of the problem-based learning tools developed; (2) 88.15% of students stated that the learning components and activities were still new; (3) 100% of students expressed their interest in learning mathematics in other materials such as the learning being undertaken; (4) 98.15% of students stated that the language in the student books and worksheets was clear; and (5) 90.74% expressed interest in the appearance of the Student Book (BS) and LKS. The average percentage of students' total positive responses to the implementation of the trial is 94.67%.

b. Description of the practicality of problem-based learning tools with the scientific approach developed in Trial II

The average value of the observation of the implementation of learning devices for each meeting in the second trial, it was found that the average of two observers for the implementation of the second trial of the first meeting was 4.20, the second meeting was 4.30 and the third meeting was 4 , 40. Furthermore, the average value of the three meetings is 4.30 which is in the very high category.

c. Description of the Effectiveness of Problem Based Learning Tools with the Scientific Approach developed in Trial II

Problem-based learning tools with a scientific approach are said to be effective in terms of (1) classical student learning completeness, that is, at least 85% of students who take part in learning can achieve a score of 75; (2) student activities meet the predetermined ideal time; and (3) 80% of students responded positively to the component of problem-based learning tools with the developed scientific approach.

The score of students' Creative Thinking Ability (SKBK) in the overall results of the posttest II trial showed that the students who dominated were students with a score of $75 \leq \text{SKBK} < 90$ high category

Classical completeness from the results of the creative thinking ability test in the second trial, namely the number of students who completed was 28 out of 32 students (87.50%) and the number of students who did not complete was only 4 out of 32 students (12.50%). If referred to the criteria of classical student learning completeness, that is, at least 85% of students who take part in learning are able to achieve a score of 75.

d. Description of Increasing Students' Creative Thinking Ability Using Problem Based Learning Tools with the developed Scientific Approach

The results of the analysis of the increase in students' creative thinking skills in trials I and II showed that the average creative thinking ability of students in the posttest results of the first trial was 75.26, increasing to 82.97 in the second trial. This is in accordance with the data analysis on the improvement of students' creative thinking abilities in chapter III, namely the increase in problem solving abilities seen from the average posttest results of trials I and II, thus it is known that there is an increase in the average score of students' creative thinking abilities by 7,709.

e. Description of Increasing Students' Confidence Attitude Using Problem Based Learning Tools with the developed Scientific Approach

The results of the analysis of the increase in student self-confidence in trials I and II showed that the average attitude of students' self-confidence in the results of the first trial questionnaire was 66.44, increasing to 74.61 in the second trial. This is in accordance with the data analysis of the increase in students' self-confidence attitudes in chapter III, namely the increase in students' self-confidence attitudes seen from the average posttest results of trials I and II, thus it is known that there is an increase in the average score of students' self-confidence attitudes of 8 , 17.

Discussion

1. Validity of Problem Based Learning Tools with the Developed Scientific Approach.

Based on the results of the validation of problem-based learning tools with the scientific approach developed, it was found that the components in the Learning Implementation Plan (RPP) were declared valid in good categories. Furthermore, the validation results of the Teacher Book (BG), Student Book (BS), Student Worksheets (LKS) as well as tests of creative thinking skills and self-confidence attitude questionnaires are also valid with good and understandable categories. This shows that problem-based learning tools with a scientific approach developed both lesson plans, teacher books, student books, worksheets and test instruments have met the valid criteria.

2. The Practicality of Problem Based Learning Tools with the Developed Scientific Approach

The results of the assessment of the practicality of the first learning device were obtained from the expert / practitioner's assessment which stated that the learning tools developed could be used with little or no revision. Based on the results of expert assessments, the components of learning tools developed in the form of Learning Implementation Plans (RPP), Student Books (BS), Student Worksheets (LKS), tests of creative thinking skills and self-confidence attitude questionnaires are practical / can be used with minor revisions.

3. Effectiveness of Problem Based Learning Tools with the developed Scientific Approach

Based on the results of trials I and II, problem-based learning tools with the scientific approach developed have met the effective category in terms of: (1) classical student learning completeness; (2) student activities within the specified ideal time tolerance limits; (3) and the students gave a positive response to the component of problem-based learning tools with the developed scientific approach

4. Increased Creative Thinking Ability Using Problem-Based Learning Tools with a Developed Scientific Approach.

Based on the results of the posttest analysis, students' creative thinking abilities in trials I and II showed that students' creative thinking abilities increased. This increase in creative thinking skills can be seen from the average posttest results of students' creative thinking abilities. The increase in students' creative thinking skills is also seen in every indicator of creative thinking abilities, namely an increase in indicators of fluency (fluency), flexibility (flexibility), elaboration (clarity) and originality (authenticity). This shows that the use of problem-based learning tools with a developed scientific approach has an impact on increasing students' creative thinking abilities

5. Increasing the Attitude of Student Confidence Using Problem Based Learning Tools with a Developed Scientific Approach

Based on the results of the posttest analysis, students' self-confidence attitudes in trials I and II showed that the students' self-confidence attitude increased. This increase in self-confidence can be seen from the average questionnaire results obtained by students' self-confidence attitudes. The increase in students' self-confidence was also seen in each indicator of self-confidence, namely an increase in indicators (1) being confident in their abilities, (2) acting independently in making decisions, (3) always being optimistic, being calm, and never giving up, (4) have sufficient intelligence, (5) have the ability to socialize, (6) always have a positive attitude in dealing with problems, (7) Able to adapt

and communicate in various situations, and (8) always think objectively, rationally and realistically. This shows that the use of problem-based learning tools developed has an impact on increasing students' self-confidence attitudes

CONCLUSION

1. Validity Problem-based learning tools with the scientific approach developed are categorized as valid, with the average score of the experts obtained: (1) Learning Tool Plan (RPP) of 4.565; (2) Teacher Books (BG) of 4,475; (3) Student Book (BS) of 4,508; (4) Student Worksheets (LKS) of 4,474; and limited trial results obtained (5) Problem Solving Ability Test (TKPM) is said to be valid for each item with a reliability value of 0.82 (very high); and (6) The Mathematical Disposition Questionnaire is said to be valid for each questionnaire item with a reliability of 0.872 (very high).
2. Problem-based learning tools with a scientific approach developed are included in the practical category with the assessment of experts, it is found that: (1) the device can be used with minor revisions and observations; (2) the results of observations of the implementation of learning tools in the class obtained an average value, namely in the first trial of 4.10 (very high / practical) and in the second trial of 4.3 (very high / practical) and (3) reliability the instrument instrument in the first trial was 98.53 (good) and the second trial was 98.20 (good).
3. The problem-based learning tools with the scientific approach developed are each in the effective category with the following indicators: (1) students' classical completeness in the first trial was 55.56% and in the second trial it was 87.50%; (2) The achievement of the percentage of ideal time for student activities is in achieving the ideal time for student activities with a time tolerance of 5%; and (3) more than 80% of students gave positive responses to the learning tools developed.

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