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COMPARISON OF THE EFFECTIVENESS OF SCIENTIFIC APPROACH AND PROBLEM-SOLVING APPROACH IN PROBLEM-BASED LEARNING IN CLASS IX OF SMP NEGERI 3 PANGSID

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Abstract

The research used is a quasi-experimental study that aims to determine whether there are differences in the effectiveness of the scientific approach and the problem-solving approach in problem-based learning in class IX students of SMP Negeri 3 Pangsid. The population in this study were all grade IX students of SMP Negeri 3 Pangsid, and the sample consisted of two classes, namely class IX.1 and class IX.2, as an experimental class. Based on data collection from learning outcomes, activities and responses of students show that the mathematics learning outcomes of students in the experimental class 1 are in the high category with a mean of 84.38, student activities in learning can be categorized well, while student responses tend to be positive towards this learning. So, it can be concluded that problem-based learning with the scientific approach is quite active. Student mathematics learning outcomes in experimental class 2 are in the high category with a mean of 79.58, student activity in learning is in right criteria, and student responses to this learning are positive. This shows that problem-based learning with a problem-solving approach is quite effective. Hypothesis testing at a significant level $\alpha = 0.05$ with the t-test showed a significant difference in effectiveness, in terms of learning outcomes between students who applied problem-based learning with a scientific approach and students who applied problem-based learning with problem-solving approaches.

Keywords: problem based learning, approach, scientific, problem solving

A. Introduction

Some of the obstacles experienced by teachers in the world of education include the lack of quality of learning carried out by teachers in the school environment. The majority of learning in the classroom focuses on students' ability to memorize information. The child's brain is stimulated only to remember and store various information without paying attention to the information it remembers to link it to the family environment and in everyday life. The effect of

this is that the students generated when they graduate from school are theoretically smart, but they lack implementation. This is not in line with the objectives of a learning process, as Fontana argues that learning is obtained from relatively consistent experience, which is obtained from changes in individual behavior activities in daily life (Suherman, et al., 2003). BPPPK states that the low quality of learning in the classroom refers more to the teacher's learning tools which are not quite right and the learning process is not optimal with the methods, approaches, and evaluations used by teachers that have not moved from traditional patterns (Farman & Yusryanto, 2018).

Implementing in the new curriculum, the Ministry of Education and Culture still applies thoughts that focus on teachers in the learning process and have not applied the learning process that students are active. The expected main goal is still more often a slogan than facts in class. The description of this situation is based on the competition which was participated by representatives of the nation's children at the international level which had not developed for a few years before. Sudjana (2010) states that learning outcomes are talents, skills, and expertise obtained by students from the experience process in a formal and informal environment. To obtain this ability, one of them is to pursue mathematics learning, because mathematics is a structured and systematic science so that the relationship between concepts is clear that allows students to have realistic thinking skills.

Based on the application of the 2013 curriculum, the scientific approach in the process of its implementation becomes learning, which is currently the topic of discussion by educators. This is fundamental to the importance of the material because there are no alumni produced with the knowledge of high-level critical thinking at the level of the abilities of other countries' children. The competencies that are expected to be improved are the increase in the ability of creativity, new knowledge, the ability to analyze problems to form critical thoughts that need to live smartly and learn endlessly. At this stage, the learning conditions can be said to be successful if there is a communicative interaction related to the discussion of the subject matter. In this activity, the teacher encourages guides and evaluates knowledge related to students' thinking (Amri, 2013).

In this activity, all students will get proportionally the same obligations and rights. Students will be guided to be presenters, to be people who will defend the argument theoretically, and can be independent and become people who can be trusted. The stages of the process of learning activities are following the objectives in the realm of learning, namely the affective, cognitive, and psychomotor domains (Hosnan, 2014).

In line with the objectives of national education, a model, approach or method of learning that is appropriate and appropriate to the classroom situation is needed, so that it can involve the active role of all students in learning activities to realize the implementation of quality and quality learning processes (Farman, Chairuddin, & Hali, 2019). Some methods that can be applied by educators to improve the quality of mathematics learning processes and outcomes is by applying problem-based learning through scientific approaches and problem-solving.

Problem-based learning strives to help students become independent, in the learning process, the teacher continually guides students with a system of encouraging students to ask questions, and quality questions will receive rewards from their answers. With the aim of students trying to solve problems against real problems and formulated themselves, students learn to do the task independently.

In supporting problem-based learning, several approaches are needed, including a scientific approach and problem-solving. The scientific approach is learning, which in its implementation motivates students to improve their ability to carry out observations or experiments, develop their knowledge and thinking skills so that they can support creative activities in creating new things or creating. While learning problem solving is learning that emphasizes the ability of students in solving problems related to the material to achieve learning objectives. In this study, students are required to make observations to find solutions to the problems given. They analyze and identify problems, develop hypotheses, collect and analyze information, and draw conclusions.

Based on the explanation above, the authors feel the need to investigate to determine the effectiveness of the Scientific Approach and Problem Solving in Problem Based Learning in Geometry Subjects.

B. Literature Review

1. Scientific Approach

The scientific approach means the basic concepts that inspire or form the basis for the formulation of teaching methods by applying scientific characteristics. The scientific learning approach (scientific teaching) is part of the pedagogical approach to the implementation of learning in the classroom, which underlies the application of the scientific method. In general, scientific learning is carried out through some steps:

a. Observe

Observing is the activity of identifying the characteristics of a particular object using its senses carefully, using relevant and adequate facts from the results of observation, using a tool or material as a tool to observe objects in the context of data or information collection and is carried out by using five senses.

b. Ask

Learning activities are asking questions about the information that is not understood from what was observed or questions to get additional information about what was observed. The questioning activity will build active interaction on each element contained in the learning community (Wardoyo, 2013: 58).

c. Reasoning

According to Trianto (2009: 100), in this activity, the teacher helps students in gathering information from various sources, students are asked questions that make them think about a problem and the type of information needed to solve the problem.

d. Try

The activity carried out in gathering information/experiments. Learning activities are conducting experiments, reading sources other than textbooks, observing objects /events/activities, interviewing informants.

e. Networking for all subjects (Presenting)

Learning activities are conveying the results of observations, conclusions based on the results of analysis verbally, in writing, or other media.

2. Problem-Solving

Problem-solving is a series of learning activities that focus on the problem-solving process faced by students scientifically to improve mastery of the material, practice problem-solving skills, and show the relationship between theory and reality (Husna & Burais, 2019). There are five stages as learning strategies through this problem-solving approach, which is as follows.

a. Identify the problem (identify the problem)

Identifying the problem is the initial stage of this strategy. The ability to identify the existence of a problem is an important characteristic to support successful problem solving and make it an opportunity to do something creative.

b. Define the problem (define the problem and set goals)

In this stage, the teacher's activities include helping and guiding students to see things/data/ variables, both those that are already known and those that are not yet known, to search for and filter out various information available, then formulate the problem.

c. Explore solution

Explore (explore) possible solutions and evaluate the possibility of the strategy by the objectives set. In this stage, the teacher's activity is to help and guide students in finding alternative solutions to problem-solving, brainstorming, looking at alternative solutions to problem-solving from various perspectives, and finally choosing an appropriate alternative problem-solving.

d. Act on the strategy

Perform steps to solve the problem by the alternatives that have been selected. In this stage, students are guided step by step in solving problems.

e. Look back and evaluate the effect (review and evaluate the effect)

The fifth step is to look back at the tangible effects of the strategy used and evaluate or study what has been experienced. Seeing and evaluating needs to be done, because after getting results, many forget to look back and learn from solving the problem that has been done.

3. Problem-Based Learning (PBL)

Problem-based learning is based on constructivist theory. This learning begins by presenting real-life problems, and from this problem, students are stimulated to study problems based on their previous knowledge and experience (prior knowledge) so that from previous knowledge, this will form new knowledge and experience. PBL is an effective approach to choose in teaching

proportional reasoning, and this learning uses real problems as a context for students to learn critical thinking, problem-solving skills, and gain knowledge (Hali, 2016).

Duch states that PBL is a problem-based teaching method that is characterized by their real problems as a context for students to learn critical thinking and problem-solving skills, and gain knowledge (Susanti & Rustam, 2018: 35). PBL is a learning method that encourages students to learn how to learn and work together in groups to find solutions to real-world problems. Problem simulations are used to activate students' curiosity before starting to study a subject.

Arends states that there are five main steps or stages in problem-based learning: (1) analyzing and evaluating problem-solving processes, (2) student orientation to problems, (3) organizing students for learning, (4) guiding individual or group inquiry and (5) develops and presents the work (Djidu & Jailani, 2018; Djidu & Retnawati, 2018; Jailani et al., 2018; Mashuri, Djidu, & Ningrum, 2019).

C. Method

The research used is quasi-experimental research (quasi-experimental). The quasi-experimental design has a control group but does not function in controlling external variables (Sugiyono, 2011). The variables studied are the learning approach in problem-based learning which consists of two kinds, namely the scientific approach and the problem-solving approach as independent variables, the effectiveness of learning consists of three aspects, namely: student responses, student activities, and learning outcomes students as the dependent variable. This study used two experimental classes of seven classes IX in SMP Negeri 3 Pangsid in the 2014/2015 academic year odd semester, with an average number of learners of 26 people/class.

Data collection was carried out by providing research instruments in the form of questionnaires, observation sheets, and tests. Descriptive statistics and inferential statistics are used in analyzing data from research results. Inferential statistics are used to test the hypothesis "there are differences in the effect of learning outcomes through scientific approaches and problem-solving in problem-based learning on the subject of geometry in SMP Negeri 3 Pangsid grade IX". To test the hypothesis used a t-test, to facilitate data processing, the computer application program SPSS 20 is used.

D. Findings and Discussion

The results of the analysis for pretest students in the Scientific class obtained data that from 26 students there were 8 students (30.77%) in the low category, 10 students (38.46%) were in the medium category, 8 students (30.77) %) are in the high category and none of the students are in the very low and very high categories. For posttests students in the Scientific class, it was obtained that from 26 students, there were no students in the very low, low, and medium categories. And 14 students (53.85%) are in the high category, and 12 students are in the very high category (46.15%).

The results of the analysis for pretest students in Problem Solving class obtained data that from 26 students there were 1 student (3.85%) in the very low category, 10 students (38.46%) were in the low category, 10 students (38.46%) were in the medium category, 5 students (19.23%) were in the high category and no students were in the very high category. For posttest students in the Problem Solving data class that out of 26 people there are 1 student (3.85%) in the medium category, 16 students (61.54%) are in the high category and 9 students are in the very high category (34.61%) but there were no students in the very low and low categories.

From the observers' observations during the four meetings, in general, the learning process using the Scientific approach took place smoothly. Based on the table of observations described, student activities seemed motivated in observing/recording the learning objectives by the teacher can be known as many as 5 and 3.5. It was proven that they listened carefully to all the material presented by the teacher.

During the learning process, students undertake various other activities besides expressing their opinions/answering the teacher's questions, which shows the initial knowledge they have, namely listening to the explanation steps of the investigation/observation or discussion activities with an average of 3 and 3.5. From the average score obtained by four requests/receives guidance when conducting investigations/observations and discussions to obtain the information needed and requests/receives guidance to present the results of the investigation/observation shows that students respond to the teacher's explanation. In this category, student activities are classified as good. In terms of conducting discussions and formulating the conclusions of investigation/observation, student activities are classified as

good. This is indicated by the average score of activity assessments reaching 4. From the observers' observations during four meetings, in general, the learning process using the problem-solving approach took place smoothly. Based on the table of observations described, student activities seemed motivated in observing/recording the learning objectives by the teacher can be known as many as 5 and 3.5. It was proven that they listened carefully to all the material presented by the teacher.

Based on data processing for the two classes, maximum values, minimum values, mean values, and standard deviations are obtained. It can be seen that the average posttest score in the Scientific Learning class and the Problem-solving class are 84.38 and 79.58, respectively. Meanwhile, the standard deviation for the Scientific Learning class is 6.74, while the standard deviation for the Problem Solving class is 6.97. Based on these data, it is said that the average score of the Scientific class posttest is higher than the average posttest score of the Problem Solving Learning class. This shows that learning in the classroom using the Scientific learning model is better than the Problem-solving learning model.

The truth will be tested based on the similarity test of two averages. Test the normality between the Problem-solving class and the Scientific class. Based on the results of the variance normality test output using the Shapiro-Wilk test, the significant value of the final test (posttest) for Scientific Learning is 0.966, and the Problem-solving class is 0.298. Because the significance value of the two classes is more than 0.05, it can be said that the Problem-solving class and Scientific Learning class are normally distributed.

Test the homogeneity of the two variances between the Problem-solving class and the Scientific Learning class with the Levene test using the SPSS 20.0 for Windows program with a significance level of 0.05. Based on the results of the homogeneity variance test output using the Levene test, the significance value is 0.953. Because the significance value is greater than 0.05, it can be concluded that the students of the Problem-solving class and the Scientific Learning class come from populations where both classes are homogeneous.

Both classes were stated to be normally distributed and homogeneous, then a two-point similarity test was conducted with a two-party t-test through the SPSS 20.0 for Windows program. After processing the data, the t-test results of the final test (post-test) can be seen in the appendix seen sig. (2-tailed) is 0.015. Because 0.015 is smaller than 0.05, H1 is accepted. So it can be concluded that the Posttest scores on students who obtained Scientific learning with students who obtained Problem-solving learning differed significantly.

After obtaining data from the results of research in the field and data processing that has been done, the statistical calculation results are obtained. The initial test data analysis begins by analyzing whether each sample (Scientific learning and Problem-solving) has a low or very high average score based on the existing categories. After doing a descriptive analysis on the initial test, it turns out that for the Scientific learning class is in the medium category while in the learning class Problem solving average score is also in the moderate category.

After learning, students are given a final test to determine the ability of students' mathematics learning achievement. The final test results are analyzed as initial test data using descriptive analysis, but the analysis is then added using inferential analysis to find out which learning is best for students in the class. In a descriptive analysis for the posttest, the average score of students in the Scientific learning class and the Problem-solving class are both in the high category, but the average value in Scientific learning is higher than the problem-solving class. It can be concluded that Scientific learning is better applied to students in the classroom than problem-solving learning. These results are consistent with what was found by Suherman, et al. (2003) that scientific learning supports the improvement of student achievement. Therefore, it is necessary to proceed with the inferential analysis to find out the truth of the conclusion.

First, the normality of the final test data for each class is tested using the Shapiro Wilk test with a significance level of 0.05. The significance value was 0.996 for the Scientific learning class and 0.298 for the problem-solving class. With this, it can be concluded that the two samples come from populations with a normal distribution. Then we do a homogeneity test using the Levene test with a significance level of 0.05. From the Levene test results obtained a significance value of 0.953 for both samples, it can be concluded that both samples come from populations that have the same or homogeneous variance.

The final test data analysis was continued by using the parametric statistical test, namely the independent sample t-test with a significance level of 0.05. Obtained Sig. (2-tailed) is 0.015. Because 0.015 <0.05, H1 is accepted. Thus it can be concluded that Scientific learning is better

than problem-solving learning because it can improve student learning outcomes with an average posttest score in the high category.

The observation of observers on activities can be concluded that every aspect of student activity is going well. Student activities in Scientific learning go well as well as in problem-solving learning. It can be seen from the increase in learning at each meeting. So, it can be said that there are no significant obstacles experienced by researchers during learning.

From the results of data analysis questionnaire sheets, students' responses to Scientific learning and problem solving conducted before and after learning showed a positive response. This can be seen from the analysis of student response data on Scientific learning and problem-solving in addition to mathematics students also generally give positive responses with Scientific learning and problem solving given. It can be seen that students' responses are fun and make them active in class to participate in learning.

E. Conclusion

Based on the results of the research data analysis, some conclusions from the results of this study are: (1) The average posttest score in the Scientific Learning class and the Problem Solving class are 84.38 and 79.58, respectively. Thus, based on these data, it can be seen that the average score of the Scientific class posttest is higher than the average score of the Problem Solving Learning class posttest. (2) The activities of students who are taught by using a scientific approach and problem solving show that every aspect of the activity is in a good category. In general, student activities both in classes taught by using scientific learning and problem-solving learning are in the effective criteria. (3) Student responses to scientific learning and problem solving show positive responses. In general, student responses both in classes taught by using scientific learning and in classes taught using problem-solving learning, and they are active in class to participate in learning. (4) Based on inferential statistical analysis for student learning outcomes in the Scientific learning class and the Problem Solving class, both are in the high category, but the average value in scientific learning is higher than the problem-solving class. It can be concluded that scientific learning is better applied to students in class than problem-solving.

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