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THE EFFECTIVENESS OF PROBLEM BASED LEARNING METHODS TO IMPROVE HIGHER LEVEL THINKING SKILLS OF SMP NEGERI 8 SURKARTA

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Keyword

Higher Order Thinking Skills, Problem Based Learning, Effectiveness

Abstract

High level thinking skills in Indonesia are still low, as seen from the results of a survey conducted by the Organization for Economic Cooperation and Development (OECD) using the Program for International Student Assessment (PISA) test in 2018. Education in Indonesia is ranked 74 out of 76 countries. The purpose of this research is to find out whether the problem based learning method is effective in improving students higher order thinking skills. The method used in this research is a quantitative method. The sampling technique was carried out using a purposive sampling technique in which the researcher chose the cases to be included in the sample based on the characteristics of the assessment , so the sampling technique was carried out with certain considerations. In the research, it was found that the problem based learning method was effective in increasing students higher order thinking skills. So it can be concluded that the problem based learning method can be used to improve students higher order thinking skills.

INTRODUCTION

In the 21st century, Indonesia is still far behind other countries, including in terms of education. This can be seen from the results of a survey conducted by the Orgenization for Economic Cooperation and Development (OECD) using the Program for International Students Assessment (PISA) test in 2018, education in Indonesia was ranked 74 out of 76 countries that took the PISA test and Indonesia received a score an average of 379 in 2018. This shows that students' higher-order thinking skills are still low compared to other countries so that the role of the teacher is very important to help students have higher-order thinking skills(Prasetyani et al., 2016). Higher-order thinking ability is a way of thinking that is no longer just memorizing verbally but also interpreting meaning requires an integralistic way of thinking with analysis, syntesis, association to draw conclusions(Winarni et al., 2019). The abilities included in high-level thinking skills are the ability to think critically, the ability to communicate effectively, innovate and solve problems through negotiation and collaboration(Tarihoran, 2019). In supporting students' higher-order thinking skills, learning mathematics is a subject that must be studied because mathematics is an important tool for students in dealing with problems and challenges that exist in personal, work, social and life aspect(Winarso, 2014). So that students are able to think logically and reason, able to analyze, evaluate and be creative in the process of problem solving and decision making. The ability to think at a high level in mathematics is called High Order Mathematical Thinking(HOMT).

High Order Mathematical Thinking (HOMT) is the ability to think at a high level related to mathematical problems. According to Saraswati & Agustika (2020) the ability of students to

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accept and solve problems in math problems is different higher order thinking skills(Saraswati & Agustika, 2020). The development of higher order mathematical thinking is very difficult and takes a long time. It takes a continuous and consistent process to train and familiarize students in higher order thinking. Therefore, the teacher plays an important role in facilitating students in developing their minds. Appropriate learning strategies are needed in the development of higher ordermathematical thinking(Khairiatin, 2017).

Based on the results of research observations conducted from 18 to 24 October 2022 in Mathematics learning in class VIII of SMP Negeri 8 Yogyakarta. The higher level thinking skills in SMP Negeri 8 Yogyakarta based on the results of observations are at a moderate level. The results obtained from distributing the questionnaire were as much as 85,96% of students answered that they had higher order thinking skills which were at a moderate level(Maulina Sela, Nuryadi, 2023)

Based on the observations that have been made, the teacher still uses the lecture learning methode (Convensional method). This method is more teacher centered, one way in nature and makes students passive when the lesson takes place. This is due to the behavior of students who only listen and record the material provided by the teacher. When the teacher finishes delivering the material and the students have taken notes, then the new teacher gives practice questions to students. Because teachers still use conventional methods, students tend to get bored and lazy with learning mathematics which result in students being unable to improve their higher order thinking skills(Kadir et al., 2022).

Based on the results of the questionnaire that was given to class VIII, SMP Negeri 8 Yogyakarta, it was stated that 92,98% of students said that the problem based learning method could improve higher order thinking skills. This is also supported by research that has been carried out by (Setiawan et al., 2012). Based on research that has been carried out by (Setiawan et al., 2012) entitled "Pengembangan Perangkat Pembelajaran Problem Based Learning Untuk Meningkatkan Keterampilan Higher Order Thinking" the result is that problem based learning methods can improve higher order thinking skills(Setiawan et al., 2012). Problem based learning is a learning method that uses problems in the learning process(Wulandari & Surjono, 2013). Therefore the purpose of this research is to find out whether the problem based learning method is effective in improving students higher order thinking skills.

METHOD

The research method used in this study is a quantitative research method because in collecting research data using instruments that are for population and sample research. The implementation of this research is included in the experiment because the researcher makes the condition of a situation or situation in this study is the application of problem based learning methods. The research design used was a pretest posttest control group design. This research was conducted by giving treatment to a class, here in after referred to as the experimental class compared to the class that was not given treatment, here in after reffered to as the control class. In this study, the experimental class received treatment in the form of applying the problem based learning method to learning mathematics, and the control class received treatment from conventional methods in learning mathematics.

This research was conducted at SMP Negeri 8 Yogyakarta which is located at Kahar Muzakir street number 2, Terban village, Gondokusuman district, Yogyakarta city, Special Region of Yogyakarta 55223 for the 2022/2023 academic year. The population in this study were class VIII students of SMP Negeri 8 Yogyakarta for the 2022/2023 academic year, in March 2023 to be precise. The population in this study was class VIII students of SMP Negeri 8 Yogyakarta for the 2022/2023 academic year consisting of 10 classes. While the samples in this study were class VIII I (experimental class) and VIII H (control class). Where in each class there were 32 students, so that the number of samples for this study were 64 students. The class was taken based on the recommendation of the Mathematics teacher for grade VIII at SMP Negeri 8 Yogyakarta.

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The technique of collecting data on higher order thinking skills is to use a pretest and posttest in the form of an essay. Before being used in the research, the instrument was tasted for validity and reliability using SPSS software. Test the effectiveess analysis of the problem based learning method using the Paired Sample T-test if the data meets the prerequisite test, but if the data does not meet the prerequisite test then use the Wilcoxon Signed Rank Test(Indriani & Pasaribu, 2022). The analysis test also uses the Independent Sample t-test if the data meets the prerequisite test, but if the data does not meet the prerequisite test then use the Mann-Whitney U test(Lita, 2022). Data analysis techniques in this study used a significance level of 5%. Hypothesis H0 is accepted if the significance value is more than 5% and hypothesis H0 is rejected if the significance value is less than 5%.

RESULTS

Before the research was carried out, scores were taken in other classes (trial class) outside the experimental and control classes to collect data which would later be tested for validity and reliability first. The validity test was carried out 2 times, namely expert validity and item validity and item validity using SPSS 20 for windows. The validity of the expert reviewing the instrument covers elements of grammar to knowledge.

Test the validity of the instrument items to get the result that all 2 instrument questions are valid. The way to determine whether or not the item is valid is to compare the pearson correlation value with the correlation, if the Pearson Correlation > Correlation value then the item is valid(Rifa Hanifa Mardhiyah et al., 2021). After passing the instrument validity test, its reliability was tested using SPSS software. Based on the results of the test class reliability test, it was obtained that Cronbach's Alpa r was 0,736. Meanwhile, correlation with a significance of 0,05 and df N – 2 = 30 – 2 = 28 is 0,3610. Because Pearson Correlation > Correlation, it is declared reliable. Comparison of the results of students higher order thinking skills on posttest scores can be seen in Table 1.

Table 1. Comparison of data on students higher order thinking skills

No	Class	Total value	Participants	Mean
1	Experiment	2130	24	88,75
2	Control	1915	30	63,8

Based on Table 1. It can be seen that the number of participants between the experimental class and the control class is different. Therefore, it is not possible to obtain a comparison of the scores for higher order thinking skills based on the total scores obtained by the experimental class and the control class. However, with these data get the average value of each class. So, you can see a comparison of values using the average value. Based on the data above, the average value of the experimental class is 88,75 and the control class is 63,8. The data is then tested for analysis to determine the effectiveness of problem based learning to improve higher order thinking skills. Before the analysis test was carried out, a normality test was first carried out using the Shapiro-Wilk normality test. The use of the normality test using the Shapiro wilk is considered to have a better level of consistency than other tests(Oktaviani & Notobroto, 2014) and the homogeneity test using the Levene statistic test so that later it can be found out whether to use a parametric or non parametric analysis test(Usmadi, 2020). The results of the Shapiro-Wilk normality test can be seen in Table 2.

Table 2. Shapiro-Wilk Normality Test Results

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Data	Significance Value	Information
Eksperimental class pretest	0,001	Not normally distributed
Eksperimental class posttest	0,000	Not normally distributed
Control class pretest	0,003	Not normally distributed
Control class posttest	0,081	Normally distributed

Basedon Table 2 above, it can be seen that the normally distributed data is only the posttest value data for the control class, which has a significance value greater that 0,05 (> 0,05), which means that th posttest value for the control class comes from a normally distributed population. In contrast, the experimental pretest and control pretest data values have a significance value of less than 0,05 (< 0,05), which means that the data are not normally distributed. Next is the homogeneity test using the Lavene statistic test. The homogeneity test results can be seen in Table 3.

Table. 3 Homogeneity Test Results

Data	Significance Value	Information
Pretest value	0,694	Homogeneous data
Posttest value	0,000	The data is not homogeneous

Based on Table 3. It can be seen that the pretest value has a reater significance value of 0,05 (> 0,05), meaning that the pretest values of the two classes are homogeneous. Conversely, the posttest scores have a significance value of less than 0,05 (< 0,05), meaning that the posttest scores of the two classes are not homogeneous.

Based on the results of the results of the calculation of the normality test and homogeneity test, it can be concluded that the next analysis test uses a non parametric analysis test because there are values that are not normal and are not homogeneous so that this does not meet the requirements of the parametric analysis test. This non parametric analysis test uses the Wilcoxon Signed Rnk Test. This test aims to determine whether there is an average difference between two paires samples. The Wilcoxon Signed Rank Test using IBM SPSS software can be seen in Table 4.

Table 4. Statistical Test Wilcoxon Signed Rank Test Problem Based Learning Class

Pretest-Posttest Class Project based Learning	
Z	-4.746[b]
Asymp. Sig. (2-tailed)	.000

Based on the Wilcoxon statistical test above, the significance value of Asymp. Sig. (2-tailed) is 0,000. The significance value is less than the significance level (0,000 < 0,05), then H0 is rejected nd H1 is accepted. This means that there is a difference in the average score between the pretest and posttest in the experimental class. This means that the experimental learning method is effective for improving students high level thinking skills. The average value of the experimental class pretest before treatment was 32 while the posttest average value after treatment was 88,75. This shows an increase from before the treatment until after the treatment, namely the use of experimental learning methods, with an average difference of 56,75. The next test is the Mann-Whitney U test. This test was conducted to find out whether the problem based learning method

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was effective in increasing higher order thinking skills or not. The results of the Mann-Whitney U test can be seen in Table 5.

Table 5. Mann-Whitney U Test Results

	Posttest Results
C	197,500
Wilcoxon W	662,500
Z	-2,907
Asymp. Sig. (2-tailed)	0,004

From the table above, the Asymp.Sig.(2-tailed) value is 0,004. This significance value is less than 0,05 (< 0,05) which results in H0 being rejected and H1 being accepted. So that, the conclusion that can be obtained is that the problem based learning method is effective for increasing students higher order thinking skills.

This research was conducted in class VIII SMP Negeri 8 Yogyaarta with one class as the experimental class and one class as the control class, where the experimental class used the problem based learning method and the control class used conventional learning methods. The material used in this study is Cirle material. What is investigated in this study is the effectiveness of problem based learning methods to improve students higher order thinking skills.

In learning using problem based learning and conventional learning methods, both have aspects of high level thinking skills in the form of questions that contain 2 description question. To find ou the extent of higher order thinking skills, there are several things that must be applied in answering the question. Among them the ability to be able to analyze, evaluate and create.

The problem based learning method is carried out by giving students problems in each group. Ho in the group will work together to solve these math problems. Then the results of solving the math problems will be presented in front of the class and students from other groups can ask questions about solving problems that they feel are not understood or other students can express their opinions if they have ther problem solving ideas.

To describe the results of data analysis from the research conducted, the following describes the results of the studies that have ben studied:

1. The difference in average scores between classes using problem based learning and conventional learning methods.

Differences in average scores using problem based learning and conventional methods to improve highr order thinking skills were analyzed using the Wilcoxon Signed Rank Test. The use of the Wilcoxon Signed Rank Test is because the data does not meet the ruquirements of the assumption test (normal and homogeneous) so this study uses non parametric data calculations, namely by using the Wilcoxon Signed Rank Test t find out the difference in the average value of problem based and conventional learning methods.

From the test results using the Wilcoxon Signed Rank Test, it was found that there was an increase in the average score in the aspect of higher order thinking skills in the two learning methods used before and after treatment. However, the increase in the average value of thinking skills in the class that applied the problem based learning method was higher than that in the class that applied conventional learning methods.

2. An effective method to improve students higher order thinking skills.

The analysis that was cerried out next was the Mann-Whitney U Test statistic. The analysis was carried out to find out whether the problem based learning method was effective in improving students higher order thinking skills. From the test results using the Mann-Whitney U Test statistic, it shows that the Asymp.Sig.(2-tailed) value is 0,004. This significance value is less than 0,05(< 0,05). Thus, the problem based learning method is effective for improving students higher order thinking skills.

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CONCLUSION

Based on the results of quantitative research conducted at SMP Negeri 8 Yogyakarta on Circle material in the even semester of the 2022/2023 academic year. It can be concluded that he problem based learning method is effective for increasing higher order thinking skills. This can be seen from the results of the posttest after treatment. The results of students higher order thinking skills in problem based learning class are hiher than in conventional class. This is evidenced by the results of the test using the Mann-Whitney U test to get the results that this significance value is less than 0,05 (< 0,05). Thus, the problem based learning method is effective for increasing students higher order thinking skills and the problem based learning method can be used as an alternative learning method to improve students higher order thinking skills

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