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ABSTRACT

Students experience difficulties in working on and solving non-routine problems. This means that students' high-level thinking abilities are still relatively low. One solution is to use HOTS-based LKPD through the problem-based learning model. The aim of this research is to find out whether HOTS-based LKPD through the PBL model is effective in reducing absolute value inequality. This research is a type of quantitative research. The method used in this research is quasi-experimental design in the form of a nonequivalent control group design. The sample in this study was determined using the purposeful sampling technique. The experimental class was given treatment using HOTS-based LKPD via the PBL model, while the control class used a conventional learning model. The techniques and tools for collecting data for this research are through tests and documentation. The data analysis technique was tested through descriptive statistical analysis and inferential statistical analysis, as well as the N-Gain Score test. The results of this research show that learning using HOTS-based LKPD through the PBL model in the experimental class is within the effective criteria with a percentage level of effectiveness of 81.21%, while learning using the conventional model in the control class is within the criteria of being quite effective with a percentage level of effectiveness of 54.47 percent. The conclusion is that the HOTS-based LKPD through the PBL model is effective in reducing absolute value inequality material.

Keywords: *LKPD, HOTS, and problem-based learning.*

INTRODUCTION

Mathematics is a universal science that underlies the rapid development of science and technology today. Based on the results of student observations and teacher interviews at SMAN 1 Baitussalam, researchers found that most students had difficulty solving non-routine problems. According to Putri (2018: 892), non-routine math problems are more complex mathematical problems than routine math problems in general, so high-level thinking skills are needed for problem solvers. Ibu Nurmala, S. Pd., as one of the teachers in the field of mathematics studies at SMAN 1 Baitussalam who the researcher interviewed said that in general students are able to solve routine math problems. But when given non-routine math problems, some students experience problems in solving these math problems. So it can be concluded that one of the causes of students at SMAN 1 Baitussalam experiencing problems in solving non-routine math problems is because the students' high thinking skills are still relatively low.

Researchers also found that the learning outcomes of students at SMAN 1 Baitussalam were still relatively low. This can be proven based on the acquisition of mathematical test scores that are still often below the minimum completeness criteria (KKM $\geq$ 70), including the absolute value inequality material. One of the causes of the low mathematics learning outcomes of students at SMAN 1 Baitussalam is due to the occurrence of a suboptimal learning process, both in terms of the use of learning models and media as well as learning motivation and mathematical abilities of students.

Based on the problems that have been described, a solution is needed to overcome the low ability to think at a higher level and improve the mathematics learning outcomes of students at SMAN 1 Baitussalam. One of them is to use HOTS-based LKPD in the mathematics learning process in the classroom. LKPD is one of the devices that can support the learning process. According to Maqfirah (2020: 10), LKPD is one of the means to facilitate the learning process which contains information, questions, commands, and instructions regarding learning materials.

Suryana and Indrawati (Ketaren, 2022: 26) suggest that HOTS-based LKPD is a teaching material that can be used by students as a guide in understanding and answering complex non-routine mathematical problems. The results of Purwasi and Fitiyana's research (2020: 73) show that the use of HOTS-based LKPD can improve students' higher-order thinking skills in mathematics learning. The results of Ketaren's research (2022: 34) show that HOTS-based LKPD is effective in improving students' mathematics learning outcomes.

It can be concluded that HOTS-based LKPD is LKPD consisting of core material equipped with non-routine problems. Where non-routine problems in LKPD are expected to train students' non-routine mathematical problem solving skills. So with this, the results of learning mathematics and the ability to think at a higher level of students can also increase. One of the learning models that can be used is *Problem Based Leaning*. According to Pia, et al

METHODS

This research is a type of quantitative research. According to Sugiyono (2021: 16), the quantitative approach is an approach used in researching certain populations or samples. The aim is to test established hypotheses where the data analysis is statistical. The method used in this study is *Quasi Experimental Design* with a form of *Nonequivalent Control Group Design*. The sample in this study was determined by *Purposive Sampling* technique, where class X-1 with 24 students was used as an experimental class and class X-2 with 18 students was used as a control class. According to Sugiyono (2021: 133), *purposive sampling* technique is a sampling technique based on certain circumstances. In this study, the research sample was selected based on the teacher's consideration. The experimental class was given *treatment* using HOTS-based LKPD through the PBL model, while the control class used a conventional learning model.

1. Data Collection Techniques and Tools

The techniques and tools of this research data collection are through tests and documentation. The test in this study consists of two stages, namely *pre test* and *post test*. The test question instrument consists of two non-routine description questions related to the linear absolute value inequality material of one variable.

2. Data Analysis Techniques

The data analysis technique is tested through descriptive statistical analysis and inferential statistical analysis in the form of Saphiro Wilk normality test, homogeneity, and t test and *N-Gain Score test*. If the significance value of the Independent Sample t-Test or Mann-Whitney U Test < 0.05, then the HOTS-based LKPD research hypothesis through the PBL model is effective on absolute value inequality material in class X SMAN 1 Baitussalam is accepted. If the significance value of the Independent Sample t Test or Mann-Whitney U Test > 0.05, then the hypothesis of HOTS-based LKPD research through the

PBL model is effective on absolute value inequality material in class X SMAN 1 Baitussalam is rejected.

RESULTS AND DISCUSSION

1. Research Results

A.Experimental Class

Before carrying out the research, researchers have tested the validity and reliability of the research instrument. In this study, the research instrument was tested by three raters (assessors or experts) of Mathematics Education. Validity test, the question instrument gets an average score of 0.88 (very valid) and the LKPD instrument gets an average score of 0.87 (very valid). Reliability tests, question instruments get an average score of 0.6 (reliable) and LKPD instruments get an average score of 0.55 (quite reliable). Validity test, the LKPD instrument received an average score of 0.87 (very valid). Feasibility, the three raters stated that the question instrument and LKPD were suitable for use in this study.

Research in the experimental class was carried out as many as two meetings. At the 1st meeting, researchers gave a pre-test to find out how the initial ability of higher-order thinking of students. At the 2nd meeting, researchers began to provide treatment in the learning process in the experimental class. There are three activities during the learning process, namely: preliminary activities, core activities, and closing activities.

The results of the initial and final ability of higher-order thinking of experimental class students will be presented concisely in the following table.

Table 1. Initial and End Capability Summary Experimental Class Higher Order Thinking

Student Values	**Category**	***Pre Test***		***Post Test***	
		Multiple Learners	**Percentage**	**Multiple Learners**	**Percentage**
$x \geq 70$	Complete	19	79,16%	24	100%
$x < 70$	Incomplete	5	20,83%	0	0%
Sum		**24**	**100%**	**24**	**100%**

By **Table 1.** Retrieved that before Given *treatment* There are 19 students who have completed achieving scores (KKM ≥ 70) with a completeness

percentage of 79.16%, while 5 students have not completed achieving scores (KKM ≥ 70) with a completeness percentage of 20.83%. But after it was given *treatment*, There are 24 experimental class students who have completed the score (KKM ≥ 70) with a completion percentage of 100%.

A.Control Class

Research in the control class was carried out as many as two meetings. At the 1st meeting, researchers gave a *pre-test* first to find out how the initial ability of higher-order thinking of students. At the 2nd meeting, researchers began to provide *treatment in the* learning process in the control class. There are three activities during the learning process, namely the introduction activity, the core activity, and the closing activity.

The results of the initial and final thinking abilities of the control class learners will be presented concisely in the following table.

Table 2. Initial and End Capability Summary High-Level Thinking Control Class

Student Values	**Category**	***Pre Test***		***Post Test***	
		Multiple Learners	**Percentage**	**Multiple Learners**	**Percentage**
x ≥ 70	Complete	17	94,44%	18	100%
x < 70	Incomplete	1	5,55%	0	0%
Sum		**18**	**100%**	**18**	**100%**

By **Table 2.**Retrieved that = before given *treatment* there are 17 students who have completed achieving scores (KKM ≥ 70) with a completeness percentage of 94.44%, while 1 student has not completed achieving scores (KKM ≥ 70) with a completeness percentage of 5.55%. But, after it is given *treatment* There are 18 control class students who have completed the score (KKM ≥ 70) with a completion percentage of 100%. The results of descriptive data analysis will be presented in the following table.

Table 3. SPSS 16.0 Output Descriptive Statistical Test **Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest Experiment	24	33.33	94.44	76.2696	14.96925
Post Test Experiment	24	86.11	100.00	95.8308	4.63554
For the test of controls	18	69.44	94.44	84.4089	8.09183

Post Test Check	18	80.55	100.00	92.1250	5.65883
Valid N (listwise)	18				

Based on **Table 3.**, It can be known that in the experimental class, the *lowest* pre-test results were 33.33, the highest score was 94.44, and the average score was 76.26. Then for the *experimental class post test* results, the lowest score was 86.11, the highest score was 100, and the average score was 95.83. Where there was an increase from *pre-test* results to *post-test results* with a difference in value of 19.57.

The *pre-test results of* the control class obtained the lowest score of 69.44, the highest score of 94.44, and the average score of 84.40. Then for the *control class post test* results, the lowest score was 80.55, the highest score was 100, and the average score was 92.12. Where there was an increase from *pre-test* results to *post-test results* with a difference in value of 7.72.

Based on the normality test, there are data that have not been distributed normally so the Wilcoxon test is carried out where the value of Asymp. Sig. (2-tailed) Wilcoxon test < 0.05. The homogeneity test, it is found that the data is not homogeneous. Because the data is abnormal and inhomogeneous, the conditions for performing the t test are not met. Therefore, the Mann Whitney U test is performed where the value of Asymp. Sig. (2-tailed) test Mann White U 0.035 < 0.05. That is, the hypothesis that states that LKPD is based on HOTS through the PBL model on absolute value inequality material is effectively accepted. The results of the N-Gain Score test will be presented in the following table.

Table 4. Test N-Gain Score

	N-Gain Score	
	Experimental Class	**Control Class**
Average	0,8121	0,5447
Minimal	0,20	-0,17
Maximum	1,00	1,00
Percentage	81,21%	54,47%

Based on **Table 4**., The effectiveness rate of HOTS-based LKPD learning through the PBL model in the experimental class is in the effective criteria with a percentage effectiveness rate of 81.21%. The level of effectiveness of learning with conventional models in the control class criteria of less effective with a percentage of effectiveness rate of 54.47%.

1. Discussion

The purpose of this study was to determine the effectiveness of HOTS-based LKPD through the *Problem Based Learning* model of absolute value inequality material. This research is an *experimental* research with *the Quasi Experimental Design method* in the form of *Nonequivalent Control Group Design*.

The sample, class X-1 which amounted to 24 students as an experimental class and class X-2 which amounted to 18 students as a control class. Data on the higher-order thinking skills of students in this study were obtained through *pre-test* and *post-test*.

The results showed that the effectiveness of learning using HOTS-based LKPD through the PBL model in the *experimental* class was in the effective criteria with a percentage of effectiveness rate of 81.21%, while the effectiveness rate of learning with conventional models in the control class was in the less effective criteria with a percentage of 54.47%. Based on the results of research and data analysis, it was concluded that HOTS-based LKPD through the PBL model was effective in absolute value inequality material. This is in line with several previous studies, one of which is the results of research by Noviati, et al (2022: 15) stating that HOTS-based LKPD is effective in improving students' critical thinking skills.

CONCLUSION

A class is said to achieve learning completeness when the percentage of learning completeness reaches 85%. In the initial ability test, the experimental class has not reached learning completeness with a completion percentage of 79.16%. But at the time of the final ability test, the experimental class managed to achieve learning completeness with a percentage of 100%. While in the control class, both in the initial ability test and the final ability test, the control class was declared to have achieved learning completeness because the percentage of completeness had exceeded 85%. So it can be concluded that the HOTS-based LKPD through the *Problem Based Learning model* is effective on absolute value inequality material in class X of SMAN 1 Baitussalam with a percentage effectiveness rate of 81.21%.

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1. For teachers, this research is expected to help teachers find solutions to improve higher-order thinking skills and student learning outcomes in mathematics learning.
2. For schools, this research is expected to be used as a reference in improving the quality of mathematics learning at SMAN 1 Baitussalam.

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