APPLICATION OF PROBLEM BASED E-LKPD TO STUDENTS' STATISTICS LEARNING OUTCOMES

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Abstract

This study aims to determine whether the application of problem-based E-LKPD can improve the learning outcomes of statistics of class VIII students of SMPN 1 Libureng. This research is a pre-experimental research with one group pretest-posttest method. The population in this study were all VIII grade SMPN 1 Libureng consisting of 2 classes and the sample of this study was class VIII B as many as 28 students. The research instruments used were pretest and posttest for student learning outcomes before and after the application of problem-based E-LKPD on statistics material. The data generated in this study will be analyzed with a quantitative approach through the application of descriptive statistical methods and inferential statistical analysis. The percentage of implementation of learning activities based on the overall lesson plan is 97% has been implemented. In addition, the average pretest score of students was 39.85 and the posttest score of students was 82.04 from an ideal score of 100. The normalized N-gain score was 0.69 in the moderate category and met the category of completeness in KKM and classically by 85.19%. Meanwhile, student responses obtained an average of 91.07% out of 100% in the very high category. The results of inferential statistical analysis of this study showed that the student learning outcomes test data were normally distributed and homogeneous. The hypothesis test used in this study is the one sample t-test where the P_{value} is 0,000 which indicates H_0 is rejected. So that the results of the study can be concluded that there is an increase in student learning outcomes in statistics through the application of problem-based E-LKPD in class VIII B SMP Negeri 1 Libureng.

Keywords : Problem Based E-LKPD, Statistics

A. Introduction

The development of science and technology is growing so rapidly that human skills and expertise will also continue to increase along with the times. This change includes the use of online-based technology in the learning process (Indriani & Sakti, 2022). Technology currently has a very significant role in the context of education, especially in the learning process of mathematics.

Based on the Regulation of the Minister of National Education of the Republic of Indonesia Number 16 of 2007 which states that one of the indicators of teacher competence is to carry out assessment and evaluation of learning processes and outcomes. This indicator explains in more detail that teachers must determine significant aspects of learning processes and outcomes to be assessed and evaluated based on the characteristics of the subject, determine appropriate assessment and evaluation methods, develop instruments for asessing and evaluating learning processes and outcomes and analyzing learning outcomes for various purposes (Nadzra, dkk, 2018).

Mathematics is an important subject taught at every level of education. Therefore, mathematics learning must be diverse to improve students' abilities (Talib, 2017). One of the main reasons is so that students can develop problem solving skills, which include understanding the problem, making mathematical models, solving models, interpreting solutions, and communicating ideas using symbols, tables, diagrams, or other media to explain situations or problems. Another problem that arises is that in learning mathematics in the classroom, there is still a tendency to focus on the teacher as the only source of knowledge (Arjanggi, dkk, 2021).

One of the determinants of the success of the learning process and the achievement of mathematics learning objectives is learning tools. Learning tools are devices used in the learning process which consist of syllabus, lesson plans (RPP), teaching materials, and learning outcomes tests (Sarira, et al, 2019). Education today needs to adapt to technological advances that require teachers to create learning materials using technology. One form of learning material that can be developed is the Learner Worksheet (LKPD) (Maharani & Hakim, 2022).

Learner Worksheet (LKPD) is a printed learning material that includes a summary of material, learning activity guides, tasks, and evaluation exercises used in the student learning process to achieve certain competency standards. However, as technological advances continue to develop, printed LKPD can be converted into electronic form with the aim of attracting student interest, being more practical and economical. One type of Learner Worksheet (LKPD) is the use of electronic

LKPD, which refers to student exercise sheets that are digitally run and applied in a structured and sustainable manner over a period of time (Ramlawati, dkk, 2014).

E-LKPD is a change from printed LKPD to an electronic form that has the ability to facilitate students in learning independently, without being limited by location and time (Sumanik, 2022). This electronic LKPD can be prepared and customized according to the learning objectives and creativity of each teacher. Then, students can access this electronic LKPD through an internet connection with the hope that this will help students understand the material taught by the teacher and ensure the achievement of learning objectives (Ramadhana & Hadi, 2021). Electronic LKPD (e-LKPD) has higher advantages and attractiveness when compared to conventional printed LKPD because it can include elements such as video, sound, animation, images and navigation, which can increase students' enthusiasm and interest in learning, avoid boredom, and is more practical and economical because it does not require printing costs (Indah Monica, dkk, 2023).

The learning model that can be used to improve learning achievement and ability in the student learning process is through the problem-based learning (PBL) model (Rizki, et al, 2016). Problem-based learning is one of the learning models that is in line with the provisions contained in Permendikbud Number 103 of 2014 and Permendibud Number 22 of 2016. This learning approach emphasizes the high level of student activity and creativity, provides inspiration, provides a learning experience that is fun and full of initiative, and focuses on students as the main subject in the learning process (Pitriyana & Karnita Arafatun, 2022).

Rifa'i, Pratidiana, & Septiani (2022) stated that problem-based learning is a learning approach that uses real-world problem situations as a framework where students can develop critical thinking skills and problem-solving abilities, as well as gain essential understanding of the subject matter. In the problem-based learning model, students are invited to apply the concepts they have learned by facing problems given at the beginning of learning, which are then discussed and solved together. The problems given are adjusted to the students' level of thinking and needs.

The advantages of problem-based learning (PBL) include improving student learning outcomes, fostering student initiative in activities, motivating students

internally to learn, and encouraging the development of interpersonal relationships when working in groups (Rizki, et al, 2016). The application of problem-based learning (PBL) in the teaching process can encourage students' active involvement, where they are directly involved in the exploration and understanding of learning materials. The problem-based learning (PBL) learning model involving E-LKPD as an interactive tool to encourage students to actively participate in the mathematics learning process. Learners are given tasks or problems that they must solve. The E-LKPD acts as a tool that allows learners to record information and access the resources needed to understand and solve the mathematical problems faced. The media functions as a tool to assist teachers in providing material to students and the media plays a role in supporting the process of delivering teaching material to students (Rahman, dkk, 2024).

B. Methods

Research Type and Design

This research is a quantitative research with pre-experimental method involving one class as an experimental class. This experimental class will receive treatment in the form of problem-based E-LKPD application. The research design used in this study was a one group pretest - posttest design, which was designed as follows:

Table 1. Experimental Design One Group Pretest-Posttest Design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2

Description:

O_1 = giving *pretest* to the experimental class

X = giving treatment to the experimental class in form of applying problem-based E-LKPD

O_2 = giving *posttest* to the experimental class

Research Population and Sample

The population of this study were students of class VIII SMP Negeri 1 Libureng consisting of 2 classes with a total of 60 students. Sampling in this study using cluster random sampling technique. From the results of the draw, one sampling unit or class was selected as the research sample, namely class VIII B with 28 students as the sample at SMP Negeri 1 Libureng.

Instruments

The instruments used in this study were learning outcome tests and learning implementation sheets. The instruments were used to assess the extent to which students understood and made progress in the statistics material taught through the application of problem-based E-LKPD. The learning outcome test instrument in this study includes pretest and posttest. Meanwhile, the learning implementation sheet is used to evaluate the extent to which a learning model can be implemented properly. The learning outcome test instruments that have been made by researchers are shown in the following table:

Table 2. Task Description

Task	Task Characteristics
Task 1. Consider the frequency distribution data below. 	No	Value	Frequency
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1	50	3
2	60	2
3	70	3
4	80	5
5	90	7 | From the table, draw a line chart and a pie chart	Students should draw points on the horizontal (x) axis indicating values (50, 60, 70, 80, 90) and on the vertical (y) axis indicating frequencies (3, 2, 3, 5, 7). Students should think of the sum of the frequencies of the data and determine the percentage of frequency of each value to the total frequency. Then each section in the circle should be labeled with the corresponding value as well as the percentage to give a clear picture.
Task 2. A data set of math test scores of a group of students is 4, 2, 7, 3, 2, 6, 7, 8, 3, and 7. Determine: • The mean (average) value of the data set • The median value of the data set • The mode value of the data set	Students must calculate the mean value of a data set by summing all the values and dividing by the number of data, students must determine the median value of a data set by sorting the data and finding the Middle value, and students must identify the mode of a data set as the most frequently occurring value.

Data Collection

Data on learning outcomes in this study were collected through pretests and posttests given to students. The pretest was given before the experimental class received treatment and students were asked to answer the questions. While the posttest is used to assess the extent of the students' learning outcomes score and whether there is an increase after the experimental class receives treatment.

Data Analysis

The data analysis techniques used in this study are descriptive statistical analysis and inferential statistical analysis. Descriptive statistical analysis is a way to summarize and describe data obtained from one group of subjects measured

twice: before (pretest) and after (posttest) receiving treatment or intervention. Descriptive statistical analysis includes the mean of pretest and posttest, median (middle value), mode (most frequently occurring value), standard deviation (measure of data distribution), and data visualization such as graphs or diagrams. Inferential statistical analysis in this study was applied to test the research hypothesis by utilizing SPSS software and through one sample t-test analysis.

C. Result and Discussion

Result

The results of this study aim to see the level of student learning outcomes by applying problem-based E-LKPD where the learning tools applied contain the syntax of the problem-based learning model, namely orienting students to the problem, organizing students in learning, guiding individual and group investigations, developing and presenting work, and evaluating the problem-solving process. The learning outcome indicators include remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6).

Descriptive Statistical Analysis

The percentage of learning implementation based on the learning model implementation sheet that corresponds to the lesson plan (RPP) of Statistics material that has been made by the researcher is shown in the following table:

Table 3. Percentage of Learning Implementation

Meeting to	Percentage of Learning Activities Implemented
2	100%
3	100%
4	94%
5	91%
6	100%
Mean	**97%**

Then the percentage based on student learning activities shows that the average value in the second and third meetings is 85% which is in the very good category. Meanwhile, in the fourth meeting it reached 91%, the fifth meeting 92%, and the sixth meeting increased to 95% which is in the very good category, so that student learning activities are said to be very good because they have met the criteria

classically, namely $\geq 75\%$ of students are actively involved in the learning process.

The results of the statistical analysis of the learning outcomes test of students in class VIII B SMP Negeri 1 Libureng before and after participating in problem-based E-LKPD learning are shown in the following table:

Table 4. Data Analysis of Learning Outcomes Test Statistics

Statistics	*Pretest* Value	*Posttest* Value
Mean	39,85	82,04
Median	40,00	83,00
Variance	54,51	142,42
Standard Deviation	7,38	11,93
Minimum Score	30	55
Maximum Score	58	100

The distribution of scores, frequencies, and percentages is shown in the following table:

Table 5. Distribution of score, frequencies, and percentage of learning outcomes tests

No	Learning Outcomes Score	Category	*Pretest*		*Posttest*	
			Frequency	Percentage	Frequency	Percentage
1	85-100	Very High	0	0%	10	37,04%
2	75-84	High	0	0%	13	48,15%
3	55-74	Medium	1	3,70%	4	14,81%
4	21-54	Low	26	96,30%	0	0%
5	0-20	Very Low	0	0%	0	0%

Overall, based on the table above, it is obtained that in the pretest score as many as one learner is in the interval of 55-74 in the medium category with the lowest percentage of 3.70% and as many as 26 learners in the interval of 21-54 in the low category with the highest percentage of 96.30%. Whereas in the posttest scores as many as 10 learners were in the interval of 85-100 very high categories with a percentage of 37.04% then as many as 13 learners in the interval of 75-84 high categories with the highest percentage of 48.15% and as many as 4 learners in the interval of 55-74 medium categories with the lowest percentage of 14.81%.

Based on students' pretest and posttest scores, the normalized N-gain score analysis was carried out. The analysis of the normalized N-gain score was carried out to determine the increase in student learning outcomes.

Table 6. Normalized *N-gain* Score Data

Value Interval	Frequency	Percentage	Category
$0,00 < N.G < 0,30$	2	7 %	Low
$0,30 \leq N.G < 0,70$	11	41%	Medium
$0,70 \leq N.G \leq 1,00$	14	52%	High

Based on the table above, it is obtained that the learning outcomes of students who are in the low category are 2 students with a percentage of the normalized N-gain score of 7%, 11 students in the medium category with a percentage of the normalized N-gain score of 41%, and 14 students in the high category with a percentage of the normalized N-gain score of 52%.

Analysis based on the minimum completeness criteria (KKM) set by the school, using posttest scores or the results of understanding the concepts of class VIII B after the application of problem-based E-LKPD.

Table 7. Analysis of *posttest* value KKM

Result of Concept Understanding	KKM	Category	Frequency	Percentage
posttest	≥ 75	Completed	23	85,19%
	< 75	Not Completed	4	14,81%

Based on the table above, it shows that 23 students are categorized as complete learners with a percentage of 85.19% and there are 4 students who are not complete with a percentage of 14.81%. In addition, student learning outcomes are also directed at achieving classical learning outcomes which show that the percentage of students who are classically complete is 85.19% > 75%.

The response results are then classified into the following table:

Table 8. Frequency Distribution of Student Response

Interval	Frequency	Percentage	Category
$x \geq 80\%$	25	89,29%	Very High
$60 \leq x < 80\%$	3	10,71%	High
$40 \leq x < 60\%$	0	0	Medium
$20 \leq x < 40\%$	0	0	Low
$x < 20\%$	0	0	Very Low
Total	**28**	**100%**	
Average		**91,23**	**Very High**

Based on the table above, it shows that from the student response questionnaire filled out by 28 students, 89.29% of students gave responses in the

very high category, while 10.71% of students gave responses in the high category. The average score of student responses is 91.23, which is also classified in the very high category, so student responses meet the learning effectiveness standards with an average score of student responses exceeding 75.

Inferential Statistical Analysis

The normality test method used is Shapiro-Wilk. The normality test produces a p value that indicates the extent to which the data follows a normal distribution. If the p value is greater than the significant level of 0.05, then the data is considered to follow a normal distribution.

Normality test of pretest posttest

The results of the *pretest-posttest* normality test are presented in the following tablet:

Table 9. Normality Test Results of *Pretest-Posttest* Learning Outcomes Data

Test	*Shapiro Wilk*		
	Statistics	df	Sig.
Pretest	0,949	27	0,201
Posttest	0,926	27	0,055

Based on the data in the table above, the sig value or P_{value} for pretest data is 0.201 where the value is greater than the sig value of 0.05 and the sig value for posttest data is 0.055 which is greater than the sig value of 0.05, so based on the testing criteria it can be concluded that the pretest and posttest data studied are normally distributed.

Homogeneity test

The basis for decision making in the homogeneous test is as follows:

- If the sig value $\geq 0,05$, then the data is homogeneous
- If the sig value $< 0,05$, then the data is not homogeneous

Table 10. Homogeneity Test Results *Pretest-Posttest* Data Learning Outcomes

Levene Statistics	df1	df2	Sig.
3,090	1	52	0,085

Based on the table above, it shows that the Sig. Or P_{value} value obtained is 0.085 according to the basis for making homogeneous test decisions if the sig value is $\geq 0,05$ then the data is homogeneous.

Hypothesis test

Furthermore, hypothesis testing is carried out with a one sample t-test using software. The results of the one sample t-test on the KKM scores are shown in the following table:

Table 11. Hypothesis Test Results One Sample t-Test KKM

Test	N	Mean Difference	One Sample t-Test		
			t	df	Sig. (2-tailed)
Posttest	27	7.037	3.064	26	0.005

Based on the table above, it can be seen that the Sig. (2-tailed) or P_{value} value is 0.005, meaning that the average posttest score is more than 75. If $P_{value} < 0,05$ it can be stated that H_0 is rejected and H_1 is accepted. So it shows that the average statistical learning outcomes of students are more than 75 after the application of problem-based E-LKPD.

The results of the one sample t-test on the normalized N-gain score are shown in the following table:

Table 12. Hypothesis Test Results One Sample t-Test *N-Gain* Score

Test	N	Mean Difference	One Sample t-Test		
			t	df	Sig. (2-tailed)
Posttest	27	0.59973	10.062	26	0.001

Based on table 4.12, it can be seen that the Sig value. (2-tailed) or P_{value} value is 0.001, meaning that the average score of normalized gain is more than 0.3. If $P_{value} < 0,05$ it can be stated that H_0 is rejected and H_1 is accepted. So it shows that the average normalized gain score of students' statistics learning outcomes is more than 0.3 after the application of problem-based E-LKPD.

Discussion

This research was conducted at SMP Negeri 1 Libureng in class VIII B with 28 students as the research sample. The results of observations of the implementation of learning conducted by observers can be seen, that in the second, third and sixth meetings the learning was well implemented according to the lesson plans made by researchers with a percentage reaching 100% in the very good category. Whereas at the fourth and fifth meetings there were parts that were not implemented, namely the teacher asked students to observe the relationship based on the information or data provided, the teacher asked students to make conclusions

about the problem, and the teacher explained the learning plan for the next meeting, so the percentage was only 94% and 91% in the very good category. The average percentage of overall learning implementation is 97% with a very good category. Based on Benda's opinion (2022) that the implementation of learning is in accordance with the steps contained in the lesson plan.

The results of observations of the implementation of learning conducted by observers can be seen, that the learning outcomes of students before the application of learning through problem-based E-LKPD show that there are no students who achieve individual completeness (scoring at least 75) in the very low category with a percentage of 100% or as many as 27 students so that they do not meet the criteria for classical completeness. After data analysis, the learning outcomes of students taught by applying problem-based E-LKPD showed that there were 23 students out of a total of 27 students or 85% of students who achieved individual completeness (scored at least 75) in the very high category and met the criteria for classical completeness. The incompleteness of learning outcomes was influenced by several factors including there were still students who had difficulty expressing their opinions and there were students who behaved not as expected. The researcher saw that there were one or two students who had difficulty interacting or exchanging opinions with their groupmates and some students were not interested in learning mathematics but were curious about the use of liveworksheet that the teacher applied.

The average score of the pretest is 85% and the average score of the posttest is 15%, indicating that there is a significant increase in learning outcomes after learning using this approach so that it can be concluded that the ability of students' learning outcomes in understanding statistical material increases, this is in line with what is stated by Puspitasari (2022) that learning outcomes refer to the final results used as a determinant of whether a learning program has succeeded or failed. This assessment is based on indicators that appear during the process of teaching and learning activities. Furthermore, the Normalized Gain test or an increase in learning outcomes shows that the N-gain value or the average normalized gain of students after using problem-based E-LKPD is 0.69. This shows that the increase in learning outcomes of students in class VIII B SMP Negeri 1 Libureng after the application

of problem-based E-LKPD is in the moderate category because the gain value is in the interval $0,30 \leq$ N.G $< 0,70$. The success achieved was created because learning using problem-based E-LKPD allows students to learn more actively, with an attractive E-LKPD display and easily accessible anywhere making an increase in the enthusiasm of students in participating in learning. Based on the opinion of Riza (2022), electronic LKPDs that are designed are interesting and innovative because their use is still rare in the context of learning, so that they can arouse the interest of students to utilize these electronic LKPDs.

The results of the inferential analysis showed that the posttest data had met the normality test and homogeneity test which were prerequisite tests before conducting hypothesis testing. The hypothesis test used is the one sample t-test method. The hypothesis test results show that the $P_{value} < \alpha$, which is $0,000 < 0,05$. Thus, it can be concluded that H_0 is rejected and H_1 is accepted. That is, there is an increase in learning outcomes after the application of problem-based E-LKPD. This is in line with research conducted by Adawiyah, Amin, Ibrahim & Hartatik (2021), stating that through E-LKPD it can improve student learning outcomes.

D. Conclusion

Based on the results of research and discussion of improving student learning outcomes through the application of problem-based E-LKPD to the statistics learning outcomes of class VIII B students at SMP Negeri 1 Libureng, the percentage of the implementation of learning activities based on the overall lesson plan is 97% has been implemented. In addition, the average pretest score of students is 39.85 and the posttest score of students is 82.04 from an ideal score of 100. The normalized N-gain score was 0.69 in the moderate category and met the category of completion in KKM and classically by 85.19%. Meanwhile, the student learning activity score obtained an average of 89% and the student response score obtained an average of 91.23% of 100% in the very high category. This shows that there is an increase in the value of student learning outcomes after the application of problem-based E-LKPD to student statistical learning outcomes. The hypothesis test uses one samples t-test where testing of the KKM and normalized gain score is carried out, the results of which state that H_0 is rejected and H_1 is accepted so that

it can be concluded that there is an increase in student learning outcomes in statistics through the application of problem-based E-LKPD in class VIII B SMP Negeri 1 Libureng.

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