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The Effectiveness of LKPD Mobile Learning on the PBL Model of Environmental Change Material to Increase Interest in Learning and Critical Thinking of Grade X High School Students

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ABSTRACT: This study aims to find out: (1) the effectiveness of LKPD mobile learning model problem-based learning on environmental change material used to increase the learning interest of grade X high school students; (2) the effectiveness of LKPD mobile learning model problem-based learning on environmental change material used to improve critical thinking of grade X high school students. This type of research is quasi-experimental with a pre-test design and post-test control group design. The limited trial subjects in this study were 34 grade X students of Senior Hight School 1 Ngabang. The field test subjects consisted of 36 experimental class students and 36 students for the control class in grade X of Senior Hight School 1 Ngabang. Data collection used several instruments, namely interviews, needs analysis questionnaires, assessment questionnaires for material experts, media expert assessment questionnaires, RPP expert assessment questionnaires, syllabus expert assessment questionnaires, biology teacher assessment questionnaires, student response questionnaires, learning interest questionnaires, critical thinking test sheets. Data analysis techniques use the normality test, homogeneity test, T-test, Mann-Whitney test, and n-gain score. The results showed that: (1) LKPD mobile learning model problem-based learning is effective in increasing students' interest in learning. The increase in interest in learning according to the n-gain score that occurred in the experimental class achieved a score of 0.7 in the high category, and (2) LKPD mobile learning problem-based learning model is effective in improving students' critical thinking. The increase in critical thinking according to the n-gain score that occurred in the experimental class achieved a score of 0.8 in the high category.

KEYWORDS: LKPD mobile learning, problem-based learning, interest in learning, critical thinking.

I. INTRODUCTION

Education is a learning process to acquire knowledge. The knowledge gained is then used by humans as provisions in their lives. The basis for achieving this knowledge requires an interest in learning to follow a learning process. Interest in learning is a drive in a person or a factor that causes interest or attention effectively, which causes the choice of an object or activity that is profitable, fun, and over time will bring satisfaction in him (Ramadani & Simamora, 2022). An interest in a person is the basis of a person's willingness to reach the end of an education, namely knowledge that can be used as a provision in his life.

Interest in learning will provide desire, passion, and feelings of liking to carry out the process of behavior change through various activities such as seeking knowledge and experience (Munawaroh et al., 2022). Based on research (Marti'in, 2019) The low interest in learning of grade XI students of Senior Hight School 5 Pontianak is in the "High" category which means that the interest in learning students needs to be even more active. Based on aspects of the school environment such as teaching methods 93%, curriculum 94%, teacher relations with students 76%, student relations with students 88%, media or learning tools 88%, based on the data obtained as a whole reached an actual score of 810 from the ideal score of 960 with a percentage of 84% including the "high" category. The low interest of students learning about science learning will worsen the low learning achievement of students in science learning. Based on a survey at Senior Hight School 1 NGABANG, it was conducted in 2 classes, namely class X MIPA B and X MIPA C and each class has 3 categories of percentage of student interest in

studying biology subjects. In class X MIPA B high category which is 5.88%; medium category is 38.24% and low category is 55.88%. In class X MIPA C high category is 8.33%; medium category at 41.67% and low category at 52.94%.

Opinion (Sarah et al., 2021) The cause of low interest in learning in terms of physiological aspects of student health factors can affect interest in learning if these students experience health problems and body disabilities. The low interest in learning students from aspects of the school environment used is not appropriate such as the applicable curriculum, teacher teaching methods, relationships between students and students, relationships between teachers and students, and media or learning tools.

The most important thing after interest which is the basis of one's encouragement to participate in a learning process, which is no less important is the existence of critical thinking skills that must appear in each student in an education. Critical thinking plays an important role in the learning process to reach the end of learning. The ability to think critically possessed by students is very important during the learning process to train trust and develop their thinking power (Agnesa & Rahmadana, 2022).

Based on research Lestari et al., (2017) A total of 60% of students have critical thinking skills that do not appear to develop or are still underdeveloped. Underdeveloped learners' critical thinking skills are identified through the description of learners' answers that are less precise or incorrect. Most students' answer descriptions have not shown a good and coherent mindset in delivering answer descriptions and do not relate the right concepts. Based on a survey at Senior Hight School 1 NGABANG, the implementation of the 2013 curriculum in schools has not focused on "Student-Centered Learning" students. Preliminary critical thinking studies are carried out in 2 classes, namely class X MIPA B and X MIPA C and each class has 3 categories of percentage of critical thinking of students in studying biology subjects. In class X MIPA B high category is 8.82%; the medium category is 35.29% and the low category is 55.88%. In class X MIPA C high category is 8.33%; the medium category is 38.89% and the low category is 52.94%. Based on preliminary critical thinking studies that have been conducted at Senior Hight School 1 Ngabang, critical thinking students are still lacking or low. Therefore, educators need to find the right learning solutions and find appropriate learning strategies to encourage increased interest in learning and critical thinking in students. According to Sudarmiani, (2020) In realizing an increase in interest in learning and critical thinking in students, contextual science learning related to problems that take place around students is needed.

Based on the results of interviews with biology teachers at Senior Hight School 1 Ngabang, in the process of learning biology in the classroom, they have implemented LKPD which can be accessed online in PDF form. Research Sari & Ma'rifah, (2020) said that LKPD mobile learning can increase students' interest in learning because the presentation and packaging of LKPD in the form of applications can foster feelings of pleasure and interest in learning biology. The use of LKPD is one way that can be used to help students to be more active in constructing their knowledge by the demands of the 2013 curriculum. This is by (Iqbal et al., 2018) who said LKPD can help add information about concepts learned through systematic learning activities. LKPD contains instructions for use, practicum instructions, experiments, materials, and practice questions. The purpose of LKPD is to help students to be more active and avoid passive students. Based on the criteria for the preparation and development of LKPD, according to (Melawati et al., 2022) The main function of LKPD is to encourage students to be active during learning activities through a series of activities that have been designed according to the applied learning model, such as discussion, observation, and experimental experiments so that during the development of LKPD must be creative, to meet the criteria for implementing learning activities effectively. According to (Sujatmika et al., 2019) The benefits of using LKPD in the learning process are that it can hone science process skills, and scientific attitudes, develop students' skills and interests in their learning objects, make it easier for teachers to manage activities in the learning process and help teachers guide students in finding concepts, and construct them independently or in groups through learning activities, changing learning conditions to be more active, which is based on participants Didik (Student Center) and make it easier for teachers to monitor the success of student learning in achieving targeted learning goals.

(Park et al., 2020) said that with the continued development of information technology, the combination of education and information technology is getting closer, so based on field data and previous research results in this study researchers tried to develop mobile learning LKPD with different variations, namely using Google Sites in which there are photos, videos, material descriptions, questions and links to student answer sheets and links supporting other learning materials that can be accessed online. LKPD mobile learning is expected to increase students' interest in learning. This is based on student data which reveals that as many as 100% of students already have smartphones, while 59.97% of students already have laptops or personal computers, then as many as 84.31% of students have sent school assignments online via e-mail digital messengers using laptops/notebooks/gadgets. Based on this data, it can be assumed that learners will be potentially interested in operating LKPD

mobile learning if implemented in schools. This also encourages the development of LKPD mobile learning in this research presented in a Google site-based website format that can be accessed by students via smartphones or laptops.

The results of the survey at Senior Hight School 1 NGABANG, namely the application of the 2013 curriculum in schools, are still focused on "Student-Centered Learning" students, and the preliminary study of critical thinking is still categorized as low, so in this study, researchers tried to apply a problem-based learning (PBL) learning model that is expected to overcome these problems. The PBL learning model is one of the standard recommendations for the learning model process according to the 2013 curriculum, namely the problem-based learning model (Yew & Goh, 2016). Problem-based learning is a learning model that involves students in an investigation that allows them to interpret and explain surrounding or real-world phenomena and build their understanding of these phenomena (Veli, 2014). The PBL model is characterized by real-world problems as a context for students to learn critical thinking and problem-solving skills and to acquire knowledge that can generate their curiosity (Saputra et al., 2019). Problem based learning (PBL) merupakan suatu model pembelajaran yang inovatif dan memberikan kondisi aktif kepada siswa, sehingga relevan untuk digunakan dalam pembelajaran dengan karakteristik siswa yang pasif selama pembelajaran (Demirel & Dağyar, 2016). Problem-based learning helps improve learning development in a mindset, one of which is critical thinking. Students work in collaborative groups to identify what they need to learn to solve problems. They engage in self-directed learning experiences and then they apply their new knowledge to the problem and reflect on what they learned and the effectiveness of the strategies used (Zhou, 2020). Problem-based learning is a student-centered educational model (Yew & Goh, 2016). Critical thinking is included in the category of learning and innovation skills, a 21st-century skills framework (Partnership for 21st Century Learning, 2019). (Duran & Dökme, 2016) also explained that critical thinking skills are one part of the purpose of education because critical thinking skills make learning meaningful.

Logically, LKPD mobile learning developed in the presentation of learning materials follows the PBL syntax by making problems a starting point for discussion to be analyzed and synthesized to find solutions. The PBL method encourages students to work together in groups to find solutions to real-world problems. Problem orientation is given to activate the curiosity of learners before starting to learn a subject. The PBL learning model prepares students to think critically and analytically, and students can obtain and use learning resources appropriately. This is by (Phungsuk et al., 2017) said that the problem-based learning model has stages of learning activities such as direct observation activities. This observation activity can lead to critical thinking in students. Problem-based learning also contributes to higher-order thinking or critical thinking. According to Nisa et al., (2018) Critical thinking skills can improve in problem-based learning activities that provide conditions for solving complex problems in real life so that it will give rise to a culture of thinking in students. Based on the problems previously described, the purpose of this study is to determine the Effectiveness of LKPD mobile learning PBL Model Environmental Change Material to Increase Learning Interest and Critical Thinking of Class X High School Students.

II. MATERIAL AND METHODS

This type of research is quasi-experimental with a pre-test design and post-test control group design. The limited trial subjects in this study were 34 grade X students of Senior Hight School 1 Ngabang. The field test subjects consisted of 36 experimental class students and 36 students for the control class in grade X of Senior Hight School 1 Ngabang. Data collection used several instruments, namely interviews, needs analysis questionnaires, assessment questionnaires for material experts, media expert assessment questionnaires, RPP expert assessment questionnaires, syllabus expert assessment questionnaires, biology teacher assessment questionnaires, student response questionnaires, learning interest questionnaires, critical thinking test sheets. The instrument validity technique involves validity methods by media experts, material experts, RPP experts, and Syllabus experts. Data analysis techniques use the normality test, homogeneity test, T-test, Mann-Whitney test, and n-gain score.

III. RESULTS AND DISCUSSION

Results of the Critical Thinking Effectiveness Test

Test the effectiveness of critical thinking in this study using an independent sample t-test. The hypothesis test in this study aims to determine the effectiveness of LKPD mobile learning in improving students' critical thinking. Before the independent sample t-test is carried out, analysis prerequisite tests are carried out, namely the normality test and the homogeneity test.

1) Normality Test

The normality test in this study uses Shapiro-Wilk test statistics which aims to find out whether the data is normally distributed or not. The data used in the normality test are pretest scores for the critical thinking of students in the experimental class and control class. Based on the results of statistical analysis, data are obtained in Table 1 below:

Table 1. Results of the Initial Critical Thinking Data Normality Test

Kelas	Probability (Significance)	(p) Sig	Information
Control	0,675	P > 0,05	Usual
Experiment	0,400	P > 0,05	Usual

Based on the results of the normality test analysis contained in Table 1, it can be seen that the control class and experimental class have a significance value greater than 0.05 (sig > 0.05), this value shows that the initial critical thinking data in the control class and experimental class are normally distributed.

2) Variant homogeneity test

The homogeneity test of variance in this study uses the homogeneity of variances test which aims to find out whether the data obtained is homogeny or not. This homogeneity test is performed after the normality test is met. The data used for the homogeneity test used initial critical thinking data in the control class and experimental class. Based on the statistical results of the homogeneity test, data can be obtained which can be seen in Table 2 below.

Table 2. Homogeneity Test Results of Early Critical Thinking Data Variants

Result	Probability (Significance)	(p) Sig	Information
Based on mean	0,949	P > 0,05	Usual
Based on median	0,923	P > 0,05	Usual
Based on the median and with adjusted df	0,923	P > 0,05	Usual
Based on tried	0,951	P > 0,05	Usual

Based on the results of the homogeneity test analysis contained in Table 2 above, it can be seen that the control class and experimental class have a significance value greater than 0.05 (Sig > 0.05) in critical thinking so that it can be concluded that the research subjects have the same or homogeneous variance.

3) Students' Initial Abilities in Control Class and Experimental Class

The initial ability test of students is carried out to determine whether the learning media used by students before learning is carried out affects the critical thinking ability of students from the experimental class and control class. Hypothesis testing is performed using a t-test through an independent sample t-test. The results of the initial ability analysis test of students can be seen in Table 3 below.

Table 3. Independent Sample Test Results T-Test Initial Critical Thinking

Result	Probability (Significance)	Sig. (2-tailed)	Information
Equal Variances Assumed	0,273	P > 0,05	Learning media does not affect students' critical thinking
Equal Variances Not Assumed	0,273	P > 0,05	Learning media does not affect students' critical thinking

Based on Table 3 above, the results of the critical thinking test of early students between students in the control class and the experimental class have the same ability or there is no difference in the critical thinking ability of students, which means that the learning media before learning begins does not affect the critical thinking of students. This can be seen from the results of the analysis test obtained a significant value of > 0.05. This is because the learning treatment has not been applied so it affects the learning outcomes of critical thinking.

4) Test the Effectiveness of Using LKPD Mobile Learning to Improve Students' Critical Thinking

This effectiveness test is to measure the effectiveness of the LKPD mobile learning PBL model in the control class and experimental class. Students of class X MIPA A Senior Hight School 1 Ngabang (control class) and X MIPA D Senior Hight School 1 Ngabang (experimental class) are test subjects who have the same initial ability in terms of critical thinking. This is evidenced from the results of the normality test and homogeneity of initial critical thinking data, it is known that the data is normally distributed and the research subjects have the same or homogeneous variance.

The independent sample t-test was conducted to determine the effectiveness of the LKPD mobile learning PBL model in improving students' critical thinking on the subject of environmental change.

a) Independent Sample Test t-Test for Critical Thinking of Students

The independent sample t-test was conducted by analyzing the critical thinking post-test data of students from the experimental class and the control class. The results of statistical group analysis on the independent sample t-test of the critical thinking of students can be seen in the following table:

Table 4. Group Statistic Independent Sample t-Test Critical Thinking of Students

Group Statistic				
Class	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Control	36	84,03	8,112	1,352
Experiment	36	93,67	4,175	0,696

Based on Table 4 group statistics, in the control and experimental classes it is known that the number of samples in each class is 36 students. The average critical thinking of experimental class students was 93.67 while the control class was 84.03. The average learning using LKPD mobile learning model PBL is higher than control classes that do not use LKPD mobile learning model PBL. This shows that the LKPD mobile learning PBL model on the subject of environmental change can help improve students' critical thinking. The results of the independent Sam t-test for critical thinking can be seen in Table 5 below.

Table 5. Test Results in Independent Samples t-Test Critical Thinking Students

Independent Samples Test							
t-test for Equality of Means							
Postest Results	**T**	**Df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
						Lower	**Upper**
Equal variances assumed	-6,339	70	0,000	-9,639	1,520	-12,671	-6,606
Equal variances not assumed	-6,339	52,326	0,000	-9,639	1,520	-12,690	-6,588

Based on Table 5 test results independent sample t-test sig value. (2-tailed) obtained results of 0.000 < α 0.05. That is, Ha is accepted or there is a significant difference in the use of the LKPD mobile learning PBL model on the subject of environmental change on improving critical thinking of experimental class students with control classes that do not use the LKPD mobile learning PBL model. This shows that the LKPD mobile learning PBL model is effective for improving students' critical thinking with a very significant difference in tests between experimental class students and control class students. This is evidenced by the results of independent samples t-test testing it is known that there are significant differences between students whose learning uses LKPD mobile learning model PBL and control classes who do not use LKPD mobile learning model PBL.

Measurement of students' critical thinking at the beginning and end of students between the control class and the experimental class using 10 description test questions filled in by 36 control and experimental classes. The description of the data on the measurement of students' critical thinking between the control class and the experimental class at Senior Hight School 1 Ngabang can be seen in Table 6 below.

Table 6. Description of Learners' Critical Thinking Measurement Data between Experimental Class and Control Class

Description	**SMA Negeri 1 Ngabang**			
	Class			
	Control	**Experiment**		
	Before	**After**	**Before**	**After**
Top Rated	80	100	80	100
Lowest Value	37	70	43	83
Sum	2026	3025	2059	3372
Average	56,27778	84,02778	58,77778	93,66667
Increase (%)	49,30898	59,35728		
Average N-Gain Score	0,618175	0,832743		
Category Average Gain N-Gain Score	Keep	Tall		

Based on the description of the data in Table 6, it is known that the percentage of critical thinking of the experimental class is 59% while the control class is 49%. This shows that there is a difference in the percentage increase in critical thinking between the experimental class and the control class, which means that the increase in critical thinking of students before and after the learning process between the experimental class and the control class has a significant difference. The average increase in N-gain of the experimental class was higher at 0.83 compared to the control class at 0.62. This shows that learning by using LKPD mobile learning with PBL learning models on the subject of environmental change is effective in improving students' critical self-reliant abilities. The increase in the average N-gain score between the experimental class and the control class can be seen in the following figure.

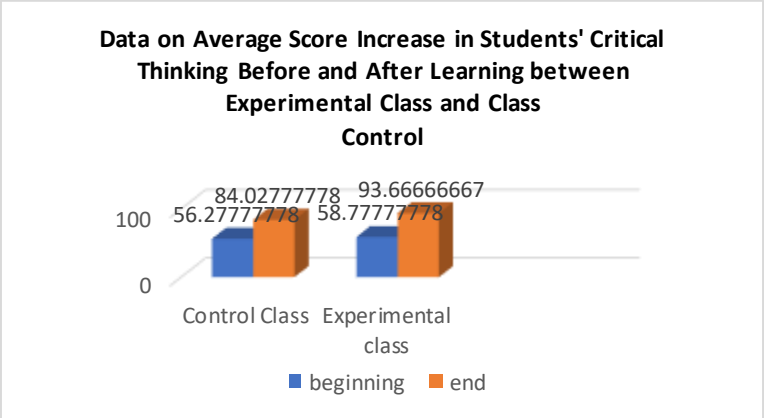

Figure 1. Data Bar Chart of Early and Late Learners' Average Critical Thinking Score Increase between Experimental Class and Control Class

Based on the results of independent samples, t-tests on the critical thinking of experimental class students increased higher than the control class. Experimental classes whose learning uses the LKPD mobile learning PBL model have proven effective in increasing students' critical thinking. This is because learning using the LKPD mobile learning model PBL can present learning by analyzing an environmental problem displayed in the LKPD mobile learning and then investigating the problem to find a solution to the environmental problem.

b) Test the Effectiveness of LKPD mobile learning PBL model on Student Learning Interest

The effectiveness of the LKPD mobile learning PBL model on learners' learning interests was analyzed using non-parametric statistics using the Mann-Withney test. The results of the Mann-Withney test can be seen in Table 7 below.

Table 7. Mann Whitney Pretest Results Learning Interest

	Learning Interest
Mann-Whitney U	642,000
Wilcoxon W	1308,000
Z	-0,068
Asymp. Sig. (2-tailed)	0,964

The output results above show that p < a value of α (0.964 > 0.05), meaning that there is no real difference in learning interest between the control class and the experimental class before learning, so it can be concluded that the control and experimental classes have the same learning interest before the learning process.

Table 8. Mann Whitney Postest Test Results Learning Interest

	Minat Belajar
Mann-Whitney U	256.500
Wilcoxon W	922.500
Z	-4.416
Asymp. Sig. (2-tailed)	.000

The output results above show that p < a value of α (0.00 < 0.05), meaning that there is a significant difference between the experimental class (the learning process using the LKPD mobile learning model PBL) and the control class (the learning process without using the LKPD mobile learning model PBL). This shows that there is a real difference between the control class and the experimental class so it can be concluded that the LKPD mobile learning PBL learning model affects the learning interest of students. The magnitude of the increase can be seen based on the n-gain score presented in Table 9 below.

Table 9. Data on increasing student interest in Learning

Class	Learning Interest		N-Gain Score	Category
	Pretest	Postest		
Control	64,14286	78,63889	0,404272	Keep
Experiment	63,44444	88,11111	0,674772	Tall

Based on Table 9, it can be concluded that there is an increase in learning interest in the control class and experimental class, but there are differences in the category of improvement between the two classes. In the control class, the n-gain score of learning interest was 0.404272, in the increase it was categorized as medium while in the experimental class of learning interest, the n-gain score was 0.674772, and the score was categorized as high. Based on these results, it can be concluded that the use of the LKPD mobile learning PBL learning model affects student learning interest, which is higher than the control class during the learning process without using LKPD mobile learning PBL learning model. The score of increased interest in learning each aspect of the control class and experiments before and after the learning process can be seen in the following graph.

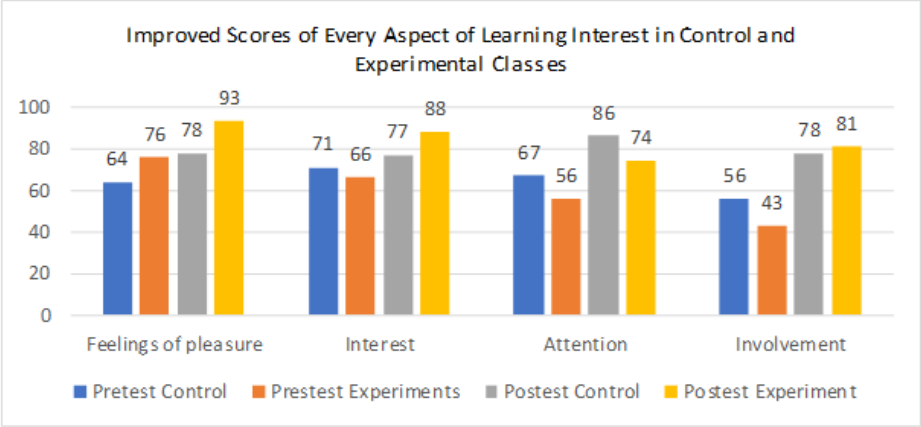

Figure 2. Graph of increased learning interest in control classes and experiments.

Graph 2 shows that scores on each aspect of feelings of pleasure, interest, attention and engagement from the control class and experimental class improved. However, the increase in the experimental class (the learning process using LKPD mobile learning PBL learning model) is higher than the control class (the learning process without using LKPD mobile learning PBL learning model). The percentage increase in interest in learning each aspect of the control class and experiments before and after the learning process can be seen in the following graph:

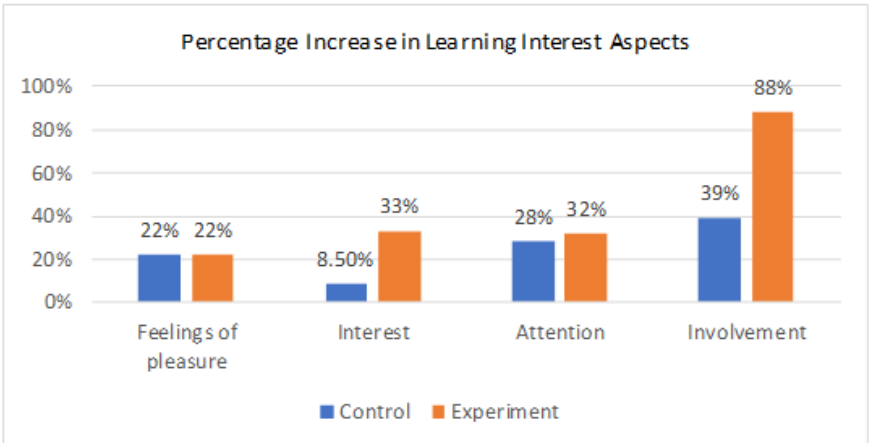

Figure 3. Percentage increase in learning interest in control classes and experiments

The graph above shows that the percentage in each aspect of learning interest, namely in the control class and experimental class, has increased, namely aspects of feelings of pleasure, interest, attention, and involvement increased after the learning process. However, the increase in the experimental class (learning process using LKPD mobile learning PBL learning model) was higher than the control class (learning process without using LKPD mobile learning PBL learning model).

Improvement in every aspect of learning interest showed that the control and experimental classes improved, but the percentage of improvement in the experimental class was higher than that of the control class. Judging from the aspect of control class involvement, it is 39%, while the experimental class is 88%, which shows that the control class has a much lower increase than the experimental class. This is because the experimental class uses the PBL learning model which involves practicum so the involvement activity in the experimental class is greater than the control class that uses the 5M learning model, which is only observing, questioning, collecting information, or trying, associating and presenting the results of investigations without practicum carried out in the learning process so that the results of the percentage of involvement in the control class are lower than the experimental class.

DISCUSSION

The Effectiveness of LKPD Mobile Learning Model Problem-Based Learning Increases Students' Interest in Learning and Critical Thinking

The effectiveness of the LKPD mobile learning PBL model developed to increase students' interest in learning and critical thinking is carried out through large group trials. The results of the analysis of large group trials show that the use of the LKPD mobile learning PBL model is effective in increasing students' interest in learning and critical thinking after participating in learning using LKPD mobile learning PBL model.

LKPD mobile learning PBL model can increase interest in learning and students. This is because the design of the LKPD mobile learning PBL model developed is supported and equipped with images, videos, and articles that explain problems related to the environment around students to indirectly train students in solving environmental change problems that occur in the surrounding environment. This is in line with (Wahyuni et al., 2021) said that the design of LKPD affects the interest in learning of students. As well as the attractive appearance of LKPD can also make it easier for students to understand the material (Agustina, 2018).

LKPD mobile learning PBL model developed in it contains activities that contain environmental problems that exist around students. This can encourage students' critical thinking because students can easily imagine directly the problems in LKPD mobile learning so that students can think critically and can formulate ideas for solving problems/solutions related to environmental damage through conservation/mitigation efforts. The results of learning activities that have been carried out show that the LKPD mobile learning PBL model can improve students' critical thinking.

In line with research conducted by (Kartikasari et al., 2021) Which says that the application of the problem-based learning model can improve critical thinking and student achievement. With the application of the problem-based learning model, students feel challenged to solve problems, because the problem-based learning model is a learning model that exposes students to a real problem to be able to solve their problems and can provide opportunities for students to find concepts by exposing students to real-world problems and helping students to improve learning abilities in a critical mindset, and active learning.

Based on the research that has been done, it is stated that the development of the LKPD mobile learning PBL model on the subject of environmental change has been tested for feasibility and effectiveness. Based on this, the LKPD mobile learning PBL model can be used in the biology learning process of high school / MA class X to increase students' interest in learning and critical thinking. LKPD mobile learning PBL model can be accessed through the website. LKPD mobile learning PBL model developed has the advantage of real problems that occur in the environment where students live, (Landak Regency) so that students more easily understand environmental problems that occur and provide problem-solving solutions to these environmental problems. That way it makes learning easier to understand and can increase students' interest in learning and critical thinking. In addition, the developed LKPD mobile learning PBL model can be easily accessed and used anywhere and anytime.

Based on the results of the above research are in line with the opinion (Irwandi & Fajeriadi, 2020) That said, the environment can develop automation and the ability to transfer students' understanding to new contexts independently. The real problem that occurs in the environment where students live as an effort to use the environment in learning is that making it a learning resource will train students to use adaptive thinking and behavior systems.

IV. CONCLUSION

Based on the results of the study, it can be concluded as follows: 1) LKPD mobile learning PBL model can effectively increase student learning interest based on the results of the analysis of the average n-gain score of student learning interest which is 0.7 with a

high category through LKPD features equipped with photos, videos and articles of environmental problems that can be accessed in the form of websites and presented in the form of google sites. 2) LKPD mobile learning PBL model can effectively improve students' critical thinking based on the results of the analysis of the average gain of students' critical thinking score, which is 0.8 with a high category through environmental problems around students

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