Developing Problem-Based Learning Models to Build Critical Thinking Skills for Grade Five Students of Elementary School

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Abstract. Learning is both a process and a product. The results of the needs analysis at SDN Lampung Selatan and Bandar Lampung showed that teachers and students needed learning and LKPD that facilitated critical thinking skills. The appropriate learning to meet these needs is PBL and LKPD-oriented LKPD. To meet the needs in accordance with the characteristics of students and teachers, PBL and PBL-oriented LKPD were developed. The development steps follow the development procedure of Borg and Gall. The results of the development show that the PBL and LKPD developed are effective in improving students' critical thinking skills. Effectiveness is influenced by the parental role variable by 65% in increasing critical thinking skills.

Keywords: PBL learning model · PBL-oriented LKPD · Critical Thinking Skill

1 Introduction

Critical thinking skills are crucial learning outcomes that should be instilled in students as early as possible. The facts at SDN Gugus Raden Intan, particularly class V, reveal that critical thinking skills development has begun to be introduced into learning, although the results have not been as predicted. This critical thinking capacity can be developed through a variety of methods, including Problem-Based Learning (PBL). Various research findings indicate that the use of PBL can help students develop critical thinking skills. The findings of a study conducted by Uliyandari et al. (2021) study suggest that PBL can help students build concepts and critical thinking skills in undergraduate education science students [1]. Ikman et al. (2016) state the same thing: critical thinking skill is the ability to think that reflects on the ability to make decisions that can be accounted for [2]. The findings of this study show that there is a substantial difference in students' critical thinking ability in mathematics topics between students who are taught with PBL and students who are taught conventionally. This is true for all ability improvement classifications, including high, medium, and low.

According to Pratiwi and Wuryandi (2020), PBL has an impact on the growth of student's motivation and learning results in the medium or medium category [3]. This

suggests that the use of PBL can aid in the development of critical thinking abilities. According to the findings of interviews with fifth-grade elementary school teachers in the Raden Intan cluster, while fifth-grade teachers in the Raden Intan cluster have created learning with PBL, the use of PBL has not significantly strengthened critical thinking skills. The occurrence at SDN Gugus Raden Intan supports the findings of Argaw et al. (2017), who found no significant variation in motivation to learn physics [4]. Furthermore, research suggests that PBL might boost learning motivation; therefore, PBL must be carefully structured. This suggests that if PBL is correctly planned, it has the potential to increase students' critical thinking skills. As the results of research by Agustina, et.al (2017) suggest that PBL syntax can be designed by taking problems from TV, the internet, and newspapers [5].

Based on the results of research on PBL and efforts to improve learning outcomes and critical thinking skills by applying PBL, it is concluded that the PBL phases cannot be applied thoroughly to every student. PBL phases need to be adapted to internal and external conditions. The external conditions in class V of SDN Gugus Raden Intan show the diversity and various obstacles. Likewise, internal conditions exist within students. There are various variations of internal conditions, including the initial knowledge and abilities possessed by students. For this reason, so that the application of PBL can build critical thinking skills in students, especially at SDN Gugus Raden Intan, PBL needs to be developed according to 1) the conditions of diversity and existing constraints and 2) the diversity of internal conditions that exist in students. And relevant research studies, it is necessary to develop PBL to build students' critical abilities that are following students' internal and external characteristics. Therefore, in this study, we created a problem-solving learning learning model to build critical thinking ability in line with the internal and external characteristics of fifth graders, and a problem-solving learning model for building critical thinking ability. The purpose is to check the effectiveness of the learning learning model. Skills Cultivate the ability to think in line with the characteristics of class V elementary school students inside and outside the school.

2   Research Methods

The study was carried out in a public elementary school in the Raden Intan Cluster of the Candipuro District of South Lampung. The data gathering period runs from March to October 2022. This study made use of both qualitative and quantitative data. Qualitative data was gathered through interviews with educators and observers. While quantitative data were acquired via questionnaires issued to Class V educators and students in the form of expert validation questionnaires, which included material specialists, linguists, and media experts, surveys on educator usability and student readability were also distributed. Product feasibility data analysis techniques and LKPD (Student worksheets) product effectiveness data analysis techniques were employed in this study to collect data.

Product feasibility data analysis approaches were utilized to create Problem Based Learning learning models to develop students' critical thinking skills, and then expert and practitioner validation tests (educators) were performed utilizing a validation instrument. The following are the validation tests for the generated problem-based learning model products: 1) Validation test by one of the media expert lecturers; 2) Validation test by

one of the material expert lecturers; 3) Validation test by one of the linguist lecturers; 4) Usability validation test by practicing educators. The questionnaire instrument on the use of the product has 4 answer choices that are following the content of the question. The following formula can be used to find the total scoring score:

$$Score = \frac{Score\ on\ the\ instrument}{Total\ Highest\ Score} \times 4 \tag{1}$$

A data analysis technique for LKPD product effectiveness was used to determine the effectiveness of the problem-based learning learning model. Below is the t-test formula used to test the effectiveness of the PBL model for building critical thinking skills.

$$t = \frac{X_1 - X_2}{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2} \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \tag{2}$$

Description:
X_1 = average score of group 1,
X_2 = average score of group 2,
S_1 = sum of square of group 1,
s_2 = sum of square of group 2,
n_1 = number of subjects/sample group 1,
n_2 = number of subjects/ sample group 2.

3   Findings and Discussion

A. *Findings*
1) *Product Trial Phase*

Following expert validation, the initial product trial was conducted as a small group study to determine the attractiveness, convenience, and utility of employing PBL-based LKPD. Eight students from class IV A SD Nurul Huda Islamic School were assessed in small groups, with two students in the high category, three in the middle category, and three in the poor category. The taking of this small group trial subject is based on the acquisition of thematic scores on the previous theme. The following is a table of the results of the recapitulation of the results of the attractiveness, convenience, and usefulness of PBL-based LKPD.

Table 1. Results of Attractiveness Test, Ease and Benefit of PBL-Based LKPD

No	Test Type	Average Score	Criteria
1	Attractiveness	3,85	Strongly Attractive
2	Easiness	3,72	Strongly Easy
3	Usefulness	3,81	Strongly Useful

According to Table 1, the attractiveness test results have 5 indices, with a score of 154 out of a maximum score of 160. The final score after conversion is 3.85 and the category is "very interesting". The convenience test, which consisted of four indications, received a score of 119 out of 128. The total score after conversion was 3.72 in the "Very Easy" category. The LKPD Benefit Test is the result of the following evaluations: The utility test received a score of 61 out of a maximum score of 64. The overall score was 3.81 in the very useful category. Analysis shows that PBL-based worksheets are generally very fun, easy, and useful for students. Therefore, his PBL-based LKPD is effective for learning and can be further extended and evaluated.

2) *Usage Trial Phase*

Students from SD Nurul Huda Islamic School in grades IV B and IV C participated in this field trial, totaling 27 students. It was carried out at this stage to determine the effectiveness of employing LKPD in boosting critical thinking skills in the control and experimental classes of SD Nurul Huda Islamic School's fourth grade (Table 2).

3) *Critical Thinking Ability Data for Experiment Class and Control Class*

4) *Usage Trial Phase*

The experimental class (X1) had a mean pretest score of 58.49, a posttest score of 81.17, and an N-gain of 0.55, placing it in the intermediate category. The control class (X2) had a pretest value of 53.55, a posttest value of 61.73, and an N-gain of 0.20, which was in the low range. The experimental and control classes have similar pretest scores, but the experimental class has higher posttest scores than the control class, and the experimental class has higher N-gain values than the control class. This means that using the PBL-based LKPD in the experimental class improves critical thinking skills for Topic 9 Subtopic 2.

5) *Analysis of Critical Thinking Skill Indicators*

The Table 3 shows the rise in the average value of each indicator of critical thinking skills among students in the experimental and control groups.

Table 3 shows that the posttest average value is greater than the pretest average value for each indicator level in the experimental class. The feature of inference ability has the greatest gain in N-Gain in the posttest average of 83.33. This demonstrates that students' abilities are adequate. While the evaluation aspect of 75.93 is the lowest indicator. The

Table 2. Recapitulation of N-Gain for Experiment Class and Control Class

Number of Students	Experimental Class (X_1)				Control Class (X_2)			
	Average of *Pretest*	Average of *Posttest*	*N-Gain*	Criteria	Average of *Pretest*	Average of *Posttest*	*N-Gain*	Criteria
27 Students	58,49	81,17	0,55	Medium	53,55	61,73	0,20	Low

Table 3. Results of Critical Thinking Indicator Analysis

Aspect	Experimental Class				Average	Control Class				Average
	Indicator					Indicator				
Question Number	1	2	3	4		1	2	3	4	
	1	3	5	7		1	3	5	7	
	2	4	6	8		2	4	6	8	
	9	11	13	15		9	11	13	15	
	10	12	14	16		10	12	14	16	
	17	19	21	23		17	14	21	23	
	18	20	22	24		18	16	22	24	
Pretest	66,05	56,17	52,47	59,26	58,49	59,26	52,47	41,36	55,56	53,55
Posttest	82,72	82,72	75,93	83,33	81,17	69,14	59,26	54,94	63,58	61,73
N-Gain	0,49	0,61	0,49	0,59	0,55	0,24	0,14	0,23	0,18	0,20

average pretest score for the critical thinking ability indication is 58.49. This category denotes students who have critical thinking skills before utilizing PBL-based LKPD but had low objectivity scores. The average posttest on measures of students' critical thinking skills increased by 83.33 after utilizing PBL-based worksheets. Meanwhile, the N-Gain score for each sign of critical thinking ability is 0.55 or (55%).

Furthermore, it is known in the control class that the posttest average value for each material indication, as well as the critical thinking ability value, is higher than the pretest value. This demonstrates that while students' scores in each of the material indicators climbed in the control class, they remained at the lowest level of achievement in the experimental class. The interpretation component had the biggest gain in N-Gain for the average posttest in the control class, at 69.14%. The evaluating aspect has the lowest indicator at 54.94. In this case, students are directed to develop the best method for tackling the problem. The average pretest score for the critical thinking ability indication is 53.55. This category denotes that students already possess the ability to think critically. The control group, which was not treated differently than the experimental group, received an average posttest score on the critical thinking ability indicator that increased by 61.73. Meanwhile, the N-Gain score for each indicator of critical thinking ability is equal to 0.20 (20%). According to the findings of the examination of the rise in critical thinking ability indicators, students in the experimental class have higher critical thinking abilities than those in the control class. This means that PBL-based LKPD is more effective than traditional methods of improving critical thinking skills.

6) *Attractiveness, Ease, and Benefit of PBL-based LKPD*

Create a PBL-based LKPD that is appealing, simple, and practical. The attractiveness test of PBL-based LKPD is summarized in the Table 4.

According to Table 4, the attractiveness test results have 5 indicators, with a score of 154 out of 160. The final rating after conversion is 3.85 in the "very interesting"

Table 4. Results of the Attractiveness, Ease, and Benefits Test of PBL-based LKPD

No	Test Type	Average Score	Criteria
1	Attractiveness	3,85	Strongly Attractive
2	Easiness	3,72	Strongly Easy
3	Usefulness	3,81	Strongly Useful

Table 5. Hypothesis Test Results of T-Test

Characteristics			Conclusion
ttable	tcount	Index	
2,006	8,14	$t_{table} < t_{count}$	Ha accepted

category. The convenience test, consisting of four indications, received a total score of 119 out of 128. After conversion, the final score for the "very easy" category was 3.72. The result of the next test is the LKPD utility test. The utility test score was 61 out of a total of 64. The final score was 3.81 in the very useful category.

7) *PBL-Based LKPD Effectiveness Difference Test*

The Independent Sample t-Test was used to prove the significance of the differences between the two groups. The t-test was performed by comparing the value of the variance in the untreated control group to the variation in the experimental group treated with PBL-based LKPD.

The test criteria are if $t_{count} \geq t_{table}$ with $= 0.05$ then Ha is accepted and vice versa if tcount $\leq$ ttable then Ha is rejected. The results of the critical thinking ability hypothesis test can be seen in the Table 5.

Based on calculations with Dk $= 14$ and a significance level of 0.05 (5%) the results obtained tcount $= 8.14$ while ttable $= 2.006$. Because tcount $= 8.14 >$ ttable ($\alpha = 0.05$) $= 2$ then Ho is rejected and Ha is accepted. As a result, there is a difference in efficacy between critical thinking skills developed utilizing PBL-based developed LKPD and critical thinking skills developed without PBL-based developed LKPD for fourth-grade students at SD Nurul Huda Islamic School.

B. *Discussion*

1) *Attractive, Easy, and Useful PBL-Based LKPD Products in Thematic Learning*

According to Borg and Gall, researchers followed numerous development milestones in the creation of PBL-based LKPD. Researchers created PBL-based LKPD products following the LKPD development processes, which were then confirmed by specialists. Based on a convenience test administered to eight students. Students are interested in learning through PBL-based LKPD and in working on questions from the supporting information in the PBL-based LKPD, resulting in a score of 3.85 in a very interesting category.

Furthermore, a 3.72 in the very easy category and a 3.81 in the very useful category were earned. Students are encouraged to acquire theme learning utilizing PBL-based LKPD because they find it easier to understand the content of the lesson. According to Ernawati (2011: 28), one of the advantages of the PBL learning model is the ability to enhance problem-solving abilities [6]. The challenges provided in PBL do not have to be difficulties encountered in ordinary life, but might be in the form of simulations designed to develop students' thinking skills and capacities in solving these problems. PBL-based worksheets are intended to engage students and encourage them to take an active role in problem-solving during the learning process. This is in line with Trianto (2010) the purpose of the PBL model is to help students develop thinking skills and problem-solving skills, learn authentic adult roles and become independent learners.

2) *Effective PBL-Based LKPD Products to Improve Critical Thinking Skills*

Established PBL-based LKPD on effectiveness of critical thinking skills using PBL-based LKPD development compared to not using LKPD development in students in grade 4 of SD Nurul Huda Islamic School showed the difference. Mean N-gain values obtained through pretest and posttest critical thinking skills administered in experimental and control classes are known. The results obtained are very different, with an average pretest score of 58.49 and a posttest score of 81.17 for the experimental class, with an N-gain of 0.53 for the intermediate category. In the low category, the control class had a mean pretest score of 53.21 and a posttest score of 61.73, with an N-gain of 0.16. This indicates that the experimental class acquired more critical thinking skills than the control class.

The results of the increase in N-Gain for critical thinking skills using PBL-based worksheets are consistent with the model used in the learning presentation design that is assembled into a multi-sensory, multi-intelligence, and brain-compatible package, including specific instructions for creating an effective learning environment, designing curriculum, delivering content, and facilitating the learning process. Each indicator experienced an increase in critical thinking. In the experimental class, the highest average gain was 83.33, which was in the inference aspect. This shows the ability of students is fairly good. While the lowest indicator is the evaluation aspect of 75.93. The recapitulation of the average value of the highest critical thinking ability indicator in the control class is found in the interpreting aspect of 69.14. Meanwhile, the lowest indicator is the evaluating aspect, which is 54.94. In this case, students are led to find the right strategy in solving the problem correctly.

The Independent Sample t test was used to demonstrate the significance of the differences between the two groups. The t-test findings are shown in table 37 (page 85), where the results of the hypothesis test computation yielded tcount = 8.14 and ttable = 2.006. Because tcount > ttable, and 8.14 > 2.006, Ho is refused whereas Ha is approved. So it can be inferred that there is a difference in the effectiveness of critical thinking skills in fourth-grade students of SD Nurul Huda Islamic School who utilize PBL-based LKPD development against those who do not use developed LKPD. The difference that occurs is due to the learning process when using PBL-based worksheets in the experimental class. It is proven that the use of LKPD is one of the factors that make students able to

understand the material better, namely by using several stages in the PBL model so that students' critical thinking increases.

4   Conclusion

Students are interested in learning through PBL-based LKPD and in working on questions from the supporting information in the PBL-based LKPD, resulting in a score of 3.85 in a very interesting category. Furthermore, a 3.72 in the very easy category and a 3.81 in the very useful category were earned. Students are encouraged to acquire theme learning utilizing PBL-based LKPD because they find it easier to understand the content of the lesson.

The results of critical thinking skills tests in the experimental and control groups are considerably different; for the experimental group, the average pretest value is 58.49, while the posttest value is 81.17, with an N-Gain of 0.53 in the medium category. In the low category, the control class had an average pretest value of 53.21 and a posttest value of 61.73 with an N-Gain of 0.16. This suggests that PBL-based LKPD is more effective than traditional approaches to improving critical thinking skills.

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