



Improving children's critical thinking skills in elementary school through the development of problem based learning and HOTS models

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ABSTRACT

The purpose of this research is to find learning model steps that are able to develop critical thinking skills, as well as to analyze students' learning outcomes. The combination of Problem Based Learning (PBL) and Higher Order Thinking Skills (HOTS) model steps is a learning strategy that is expected to be implemented effectively. The method used in this research is Research and Development. The research stages can be broken down as follows: (1) the preparation stage, (2) the Problem Based Learning and HOTS Model Development stage, (3) the model effectiveness analysis stage. The results of the research on the development of the Problem Based Learning and HOTS Model obtained an increase in students' critical thinking skills of 42.50, and learning outcomes with an average score of 86.14. Students' critical thinking gain of 0.75 is included in the high category. The conclusion from the research results is that the Problem Based Learning and HOTS models are effectively implemented in learning at SDN Kertak Hanyar, in other words can improve critical thinking skills, and student learning outcomes. As a follow-up to the results of this study, a wider dissemination of the steps of the Problem Based Learning and HOTS model will be carried out to teachers at Banjar Regency elementary schools

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1. INTRODUCTION

Facing intense competition in the 21st century, humans are required to have three important abilities in thinking, namely: critical thinking, creative, and being able to solve problems (Radiansyah, et al., 2022). Current learning must equip students with 4 skills in the form of critical thinking, creativity and innovation, communication, collaboration (4C). These four skills are needed, especially the critical thinking skills to deal with more complex problems for students in the future in producing superior human resources. One of the educational problems that is in the spotlight in the 21st century is the learning model used by teachers in schools, especially in elementary schools, most of them still use conventional models that are teacher centered. Learning is expected to be student-centered. Creating student centered learning in the 21st century, according to Nisa & Prasetyo (2018), is by changing the view of learning from teacher centered to student centered learning. Teachers must make changes to learning patterns from conventional models, by carrying out learning transformations in the form of updating learning models that can develop critical thinking skills so that students can be trained in

facing more complex challenges in the future. Updating models that are appropriate to learning, will attract the attention of students to be active and they will try to optimize their respective abilities, so that it will help them develop critical thinking skills in solving problems (Prasetyo & Kristin, 2020).

Critical thinking skills are included in higher order thinking skills (Davidi, Sennen, & Supardi, 2021). This ability is very much needed in the 21st century now, because critical thinking skills are able to create something that is very necessary in learning in schools. Elementary school children are at golden times to develop their critical thinking skills. Students can discuss and conduct experiments, so educators must find appropriate learning models to develop students' critical thinking skills. The learning model that has been used so far at the elementary school level has not developed much of students' critical thinking skills, so a learning model is needed that can provide opportunities for students to develop their thinking skills. The Problem Based Learning and HOTS model is an answer that can be used to develop students' critical thinking skills in elementary schools.

Problem Based Learning is an innovative learning that is student-centered, placing the teacher as a motivator and facilitator, where students are given the opportunity to work autonomously to construct their learning (Trianto, 2014). The Problem Based Learning model facilitates students to use thinking skills in solving useful everyday problems (Radiansyah, et al., 2022). This model is process-centered, relatively time-framed, problem-focused, meaningful learning units by integrating concepts from a number of components, be it knowledge, disciplines or fields (Kristanti & Subiki, 2017). Problem Based Learning implements a learning system by incorporating problem solving in the process, thus encouraging students' thinking skills to solve existing problems. (Anggraini & Wulandari, 2021). The Problem Based Learning model can be a place to develop students' critical thinking skills and higher thinking skills (Pramudya, Kristin, & Anugraheni, 2019). To develop students' critical thinking skills, it is necessary to have the Problem Based Learning and Hots model in learning activities. The Problem Based Learning Model is learning that accommodates students to use higher order thinking skills (HOTS). Problem Based Learning and HOTS are learning models that can be used to direct learning activities to be more contextual, full of meaning and a means to improve intelligence (Jamaludin, 2017).

Elementary school-age students are in the concrete thinking phase, so the use of the Problem Based Learning and HOTS models will provide meaningful experiences to students in the learning process, and build their higher-order thinking skills and critical thinking. Higher Order Thinking Skills (HOTS) are skills that require analytical skills to think about information and data in solving problems (Radiansyah, et al., 2022). The main purpose of applying HOTS in learning is to improve students' thinking skills at a higher level, especially those related to the ability to think critically in receiving various types of information, to think critically in solving a problem, and to be able to make decisions in complex situations. (Jannah, et al., 2022)

HOTS in the field of education closely related to Bloom's Taxonomy included in the category of analyzing, evaluating, and creating from a student. In relation to Problem Based Learning and HOTS, it will stimulate students to think critically. On the basis of that goal, a new learning model or a combination of previous models that was developed in such a way is needed in the world of education, therefore researchers feel it is very necessary to develop a Problem Based Learning and HOTS learning model.

2. RESEARCH METHOD

This research is development research. Research and development is carried out to produce a product. This is in accordance with the opinion of Sugiyono (2013: 297) R&D is a research method used to produce certain products, and test the effectiveness of these products. Borg & Gall also stated that development research aims to produce products based on findings from a series of trials, through individuals, small groups, medium groups, field trials, revised to obtain results or products that are adequate or suitable for use. (Setyosari, 2012:215). The type of R&D research used in this study is the Borg and Gall (2003:81) design model.

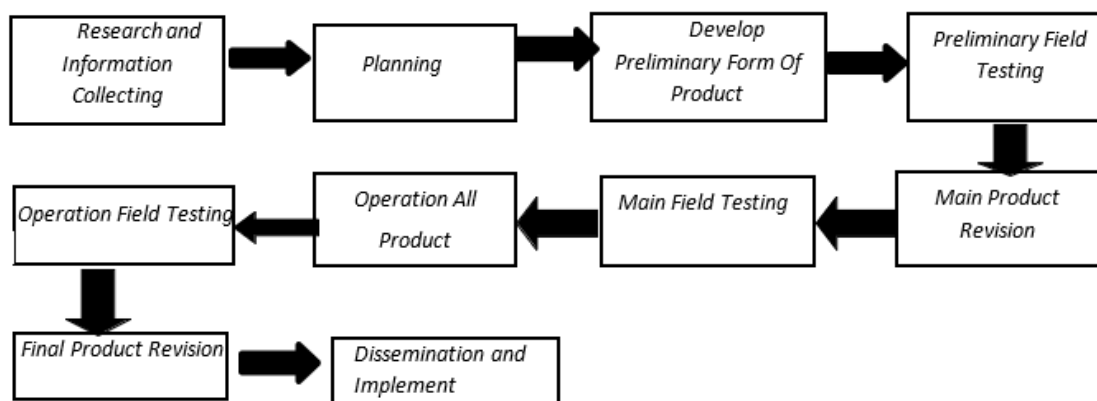


Figure 1. R&D steps can be seen in the following figure;

This research was conducted over a period of one year with funding from LPPM ULM Banjarmasin. This study aims to improve the critical thinking skills of elementary school students through the development of Problem Based Learning and HOTS learning models at SDN Kertak Hanyar, Banjar Regency. SDN Kertak Hanyar located in the Wetland area, as the location required by LPPM ULM. The stages of the research are as follows: (1) the learning observation stage, (2) the development stage of the Problem Based Learning and HOTS model, (3) the stage of formulating the steps of the Problem Based Learning and HOTS model, and (4) Validation and Implementation.

The research was conducted at SDN Kertak Hanyar, Banjar Regency, South Kalimantan. This research is development research. Development research is research that aims to produce research products in the form of learning models. The data collection technique used in this study was carrying out the pretest (initial test), giving treatment, and carrying out the posttest (final test). After the model steps have been formulated, then validated by experts, then revisions are carried out. To see the legibility of the model steps, it is tested on a limited basis, then necessary improvements are made. Data analysis techniques are carried out in the following stages: 1). Provide pretest and post test scores on learning outcomes using the Problem Based Learning and HOTS models according to Uno's opinion, (2017), 2). make critical thinking learning outcomes intervals. Based on Ridwan's opinion (2015), 3). Calculating the average pretest and posttest scores using the Supardi's formula (2016), 4). Calculate the standard deviation and variance using the formula from Supardi (2016), 5). Then carry out normality and homogeneity tests and calculate the Gain of critical thinking skills and learning outcomes, categorize the calculation results using the Hake standard according to Sundayana's opinion (2020), 6). Doing a comparative hypothesis test with the t-test according to Supardi (2016).

Table 1. Gain Category

Normalized Gain Value	Interpretation
$-1.00 \leq g < 0.00$	There was a decline
$g = 0.00$	No decline
$0.00 < g < 0.30$	Low
$0.30 \leq g < 0.70$	Currently
$0.70 \leq g < 1.00$	High

3. RESULTS AND DISCUSSIONS

Based on the research that has been done, the research results are obtained from the scores of students' skill tests, namely the initial test (pretest), final test (posttest), and an increase in scores between the pretest and posttest using the Problem Based Learning and HOTS model.

Table 2. Analysis of Pretest Scores

Data	Number of Students (n)	Average	Standard Deviation	Variance	Min Value	Max Value
Pretest	22	43,64	44,66	1994,81	30	60

Based on the table above, it can be seen that the average student before being given the action was 43.64 with the lowest score being 30 and the highest score being 60, as well as the standard deviation of 44.66 and the variance of 1994.81.

Table 3. Analysis of Final test scores (Posttest)

Data	Number of Students (n)	Average	Standard Deviation	Variance	Min Value	Max Value
Posttest	22	86,14	88,16	7772.78	75	100

Based on the table above, it can be seen that the average student after receiving the action was 86.14 with the lowest score of 75 and the highest score of 100, and the standard deviation of 88.16 and the variance of 7772.78

Table 4. Pretest and Posttest Homogeneity Test Results Model Project based learning and HOTS

Data	Variance	Homogeneity F_{count}	F_{table}	Decision
Initial (pretest)	1994,81	3.90	4.35	Homogeneous
End (posttest)	7772.78			Homogeneous

Based on the table above, it can be seen that after the homogeneity test was carried out on the initial and post-test values, $F_{count} < F_{table}$ or $3.90 < 4.35$.

Table 5. Test the Value of N-Gain Pretest and Posttest

	Pretest	Posttest	gains	Category
Amount	960	18895	0.75	Tall

As for increasing high-level thinking skills (HOTS) and Critical Thinking of 0.75. The skill gain of the students at SDN Kertak Hanyar was 0.75, which was included in the high category. The results of the t test on pretest and posttest scores can be done by testing the hypothesis, then the t value (t_{count}) is compared with the t-value of the t distribution table (t_{table}). The way to determine the value of t_{table} is based on the significant level $\alpha = 0.05$ and $dk = n-1$, then $dk = 22 - 1 = 21$, then t_{table} is seen in the t distribution table with $dk = 21$.

Table 6. T-Test Score Pretest and Posttest

N	Md	Σxd^2	t_{table}	t_{count}	hypothesis	Conclusion
22	42.5	2388	1.72472	8,22	Take Ho	Significant

Based on the t test table, it can be seen that $t_{count} = 8.22$ and $t_{table} = 1.72472$ then t_{count} compared to t_{table} , it can be concluded that $t_{count} > t_{table}$, which means it is significant. This means that at the 95% confidence level there is a significant difference between before (pretest) and after (posttest) given the action by applying the Problem Based Learning and HOTS models

Based on the results of the study, with one Group Pretest-Posttest Design, namely a research model that gives treatment to only one group without a comparison group. Measurements were carried out 2 times, namely before the experiment (pretest) and after the experiment (posttest). In conclusion, students who were the sample in this study get the same rights, namely the initial test (pretest) and the final test (posttest). The difference is that when the initial learning test was carried out it did not

use the Problem Based Learning and HOTS model, while in the final learning test it used Problem Based Learning and HOTS. This study aims to determine the increase in critical thinking skills and learning outcomes in the implementation of the Problem Based Learning and HOTS models. The discussion of the results of this study was made based on the analysis of the results of the initial test (pretest), the results of the final test (posttest), an increase in the results of critical thinking skills, learning outcomes, and the magnitude of the influence on the use of the Problem Based Learning and HOTS model in SDN Kertak Hanyar, Banjar Regency. HOTS is one of the students' cognitive processes in analyzing systematically and specifically the activities they face (Azizah, Sulianto & Cintang, 2018).

Assessment on the pretest, the student's score is 43.64 with the lowest pretest score of 30 and the highest is 60 so it needs to be improved. In the pretest, students had not received the Problem Based Learning and HOTS model of learning in class, and students' critical thinking skills were still low.

Students' critical thinking skills before being given an action (pretest).

Pretest activities are carried out with the aim of knowing critical thinking skills and student learning outcomes. The results showed that the average score of students' abilities in class before being given action by applying the Problem Based Learning and HOTS model was 43.64, which means that it is included in the low category in critical thinking. For researchers, this average value is still low and action is needed. The low ability to think critically in students can be caused by several factors (Wiyoko, 2019), such as caused by the learning model used by the teacher has not been able to improve students' critical thinking skills.

Before the pretest was carried out, the students were conditioned first, and the researcher gave an explanation of the purpose and objectives of the meeting. Each student was given a pretest question sheet and was told the steps in doing it, then students were asked to do it. After the test ended the researcher checked the pretest question sheet and the results were that many students had low scores. When examined there were still many errors in the answers and there were still many students who had not been able to develop answers to answer the questions given. To overcome these problems, it is necessary to have a Problem Based Learning and HOTS Model to help improve students' critical thinking skills. Because it is so important, the ability to think critically can be considered as the main goal of the learning process (Sulianto, 2008). Critical thinking skills are also needed by students to study and understand objects or natural phenomena (Anjarsari, 2014), therefore teachers need to optimize students' critical thinking skills in the learning process (Dewi et. al., 2019)

Students' critical thinking skills after being given treatment (posttest)

Posttest activities are carried out after being given an action using the Problem Based Learning and HOTS Model. The result is that the average value of students' abilities is 86.14, which means that they are included in the high category of critical thinking skills. The average score when the Problem Based Learning and HOTS Model was applied to critical thinking skills increased compared to before the Problem Based Learning and HOTS Model was applied, the posttest average score was higher than the pretest average.

Based on the average difference between the initial test (pretest) and the final test (posttest), there was an increase in critical thinking skills using the Problem Based Learning and HOTS model of 42.50. t test results obtained $t_{\text{count}} > t_{\text{table}}$ or $26.09 > 2.01290$. This shows that H_0 is rejected, which means that there is a significant difference in the increase in students' critical thinking skills between the pretest and posttest results. This increase is due to the use of the Problem Based Learning and HOTS Model. To find out the increase in the value of students' critical thinking skills, an analysis of the increase in value before and after the action was carried out which was calculated by the normalized gain test. The results of the analysis of the normalized gain value, an average of 0.75 with the high category.

Based on this description it can be concluded that there are differences in pretest and posttest, thus the Problem Based Learning and HOTS Model can improve students' critical thinking skills. Learning outcomes increase or scores above the KKM, illustrating that students have succeeded in their learning process (Agnafia, 2019).

4. CONCLUSION

Based on the results of the analysis and discussion that has been carried out, it can be concluded that the implementation of Problem Based Learning and HOTS model has an effect on the critical thinking of fourth grade students at SDN Kertak Hanyar. This can be seen from the following data: (1) There is a significant increase in learning outcomes, the class average score on the pretest (pretest) with the class average score on the final test (posttest); (2) Based on the average score of the test there is an increase in students' critical thinking skills. Based on the gain index, there are differences in students' critical thinking skills before and after being given an action with a high result category. Based on these conclusions, the researcher wants to provide advice to teachers at SDN Kertak Hanyar to apply Problem Based Learning and HOTS Model in learning at elementary school. Whereas for other researchers it can be used as a reference for information about the implementation of learning with the Problem Based Learning and HOTS Model. This research is limited to improving critical thinking skills in elementary school students. Future research is expected to be able to carry out research on problem-based learning models for improving psychomotor and affective students in elementary schools. Future research is also suggested to conduct research on HOTS in middle school or childhood education students. Research at other levels needs to be carried out and can be collaborated on thematic approaches and independent curricula throughout Indonesia.

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