

The Effect of Combined Problem Based Learning and Scaffolding Models on Students' Critical Thinking Ability

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Abstract

This study aims to determine the effect of Combined problem-based learning and scaffolding models on students' critical thinking ability at SMP Negeri 21 Palu. This type of research is a quasi experiment. The research was conducted in two class groups: class VII and class VIII B as the experimental class. The data collection technique uses purposive sampling. The main instrument used was the 7th-grade of critical thinking essay test which consisted of 8 questions. Data were analyzed by a non-parametric test. It is the Wilcoxon test signed ranks test. Obtained the results that Asymp.Sig (2-tailed) is 0,000 on the critical thinking ability test, H_1 is accepted, this means that there is a significant effect of the combined problem-based learning and scaffolding models on the critical thinking ability of students at SMP Negeri 21 Palu in the 2019 / 2020 school year.

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Introduction

One aspects of thinking ability that need to be emphasized in science learning in facing changes in technology and society today are critical thinking ability. Competency standards for primary and secondary education unit graduates state that students must be able to demonstrate thinking, and critical, and creative ability in building, using, and applying information about the surrounding environment to be able to solve problems (BNSP, 2006).

The ability to think critically in students about a problem faced in the learning process is needed because the problems faced in the learning process are absolute. The learning process is a place to study concepts in facing various challenges. Critical thinking is a process that can be taught to students, but note that the teacher must be able to choose and determine the right learning model by inviting students to study funds to solve the problems themselves.

Ardiyanti & Winarti (2013), state that the science learning process is not enough to be carried out by conveying information about concepts, but also must understand the process of the occurrence of scientific phenomena by sensing through exploration activities by completing collaboratively.

Before science learning should be designed in such a way so that students get good and meaningful activities.

In solving a scientific problem, students are required to have the ability to think logically, analytically, systematically, critically, and creatively. According to Nurlaeli et al. (2018), the ability to think critically in science involves the activities of testing, questioning, connecting, and evaluating all aspects that exist in a situation or problem.

The ability to think critically is very important for students, because this low thinking ability has an impact on student learning outcomes is also low. Indicators of low students' critical thinking ability include the lack of reasoning ability of students in problem-solving. This is indicated by the fact that students are less able to interpret the meaning or meaning of various experiences or materials by asking or answering questions. Students also do not feel enthusiastic about participating in learning and lack confidence in explaining the opinions or results of working on student worksheets during learning.

With the low ability of students to think critically in mastering the theoretical aspects of science learning, it is necessary to provide assistance that can stimulate to improve the quality of critical thinking ability. The selection of learning models is

considered one way that can be done to help students solve problems faced individually. The role of the teacher in training students' critical thinking ability in science lessons can be done by selecting the right learning model. The learning model chosen must have a student-centered learning syntax.

One learning model that has this character is the problem-based learning model because according to Farisi et al. (2017), the problem-based learning model prepares students to think critically and analytically. In the process of applying the problem-based learning model, the teacher provides full opportunities for students to be active and involved in learning activities. The teacher is only a facilitator whose job is to motivate students to want to take part in group discussion activities. Besides that, Hayanah et al. (2019), explain that problem-based learning is learning that uses unstructured real (authentic) problems,

In addition to problem-based learning which can affect student activity, there is also another learning, It's the scaffolding model learning which provides assistance to students who can solve problems that are difficulty. Sunaryo (2018), scaffolding is providing assistance to students during the early stages of development and reducing this assistance and providing opportunities for students to take over greater responsibility as soon as students can do it. Rahmawati, (2016), learning with scaffolding makes it easier for students to understand science concepts through a connecting bridge between initial knowledge and science material so that students' thinking becomes more systematic.

Problem-based learning and scaffolding learning models are applying contextual learning principles to steps that make students active. The problem-based learning model and the scaffolding learning model can produce a new learning stage that is more supportive of the achievement of student competencies.

Problem-based learning and the scaffolding model is one of the learning models oriented to what students do, and also to what they think when doing these activities. The teacher's more prevalent role in problem-based learning and the scaffolding model is as a guide and facilitator so that students learn to think and solve problems based on their own abilities and desires.

The problem-based learning model is a learning that is recommended to be used based on

the 2013 curriculum but it has not been carried out in its entirety and has not been maximized so that the results obtained by students are still not as optimal as expected, while scaffolding learning is learning that has never been implemented in SMP Negeri 21 Palu. For this reason, the researcher wants to reveal about the application of problem-based learning and scaffolding. In order to train students to learn to think critically, because students at SMP 21 Palu, so far, have very low ability to think critically about a problem in science learning.

The problem background can be formulated whether the combination of the problem-based learning and the scaffolding learning model can affect students' critical thinking ability, especially in science or science material at SMP Negeri 21 Palu.

Materials and Method

This type of research is a quasi experiment. The research design used Pretest and post-test design. The design of this research can be seen in Table 1.

Table 1. Research design

Class	Pretest	Treatment	Posttest
Experiment	O	X	O

Information: O : Pretest/posttest experimental class

X : PBL and Scaffolding model alloy treatment

This research was conducted at SMP Negeri 21 Palu for the 2020/2021 academic year in class VII and class VIII. The population in this study were all students of SMP Negeri 21 Palu who were registered in the 2019/2020 academic year

The sample in this study was class VII A and class VIII A. The researcher chose class VII A with 25 students and class VIII B with 20 students. The sampling technique used in this study was purposive sampling.

The operational definition of a variable is a definition based on observable or observable defined properties. In this study, the operational definition of the variables is problem-based learning model is learning that begins by exposing students to problems, with all the knowledge and abilities students have, students are asked to solve problems using conceptual concepts.

The scaffolding learning model is learning that provides assistance to groups who have difficulty finding their own concepts and investigating them themselves, the assistance is

carried out in stages at the beginning of learning and then reduces the assistance when students are able to do it themselves.

Students' critical thinking ability is the ability to analyze or evaluate information obtained from observations, experience, common sense or communication, using aspects of critical thinking ability, such as providing simple explanations, building basic ability, concluding, and strategies and tactics.

Types and sources of data

The type of data obtained in this study is quantitative data. The data source is primary, data obtained from the results of student work. The data collected consists of the following data: (1) Data on critical thinking ability is obtained through an essay test. This test is to find out how much students' critical thinking ability is by bending the pretest before learning and posttest after learning. (2) The activity data of the ongoing learning process.

Data normality test

The normality test used is the Kolmogorov - Smirnov test with the help of SPSS 18.0

Significance level (α) = 0.05

Test decision

H_0 is accepted if sig > 0.05, H_1 is accepted if sig < 0.05

Homogeneity test

The calculation of the homogeneity test in this study used Levene's test with the help of SPSS 18.0.

Significance level (α) = 0.05

Test decision

H_0 is accepted if sig > 0.05, H_1 is accepted if sig < 0.05

Hypothesis test

The non-parametric test is the Wilcoxon test

The basis for making decisions is as follows:

If the value is Sig. (2-tailed) > 0.05, then H_0 is accepted and H_1 is rejected.

If the value is Sig. (2-tailed) < 0.05, then H_1 is accepted and H_0 is rejected

Results and Discussion

Samples data of pretest and posttest

Table 1. The results of data on the class samples' pretest and posttest scores in critical thinking ability

	N	Min	Max	Mean
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Pretest	45	18.00	35.00	24.755600
Posttest	45	39.000.00	70.00	54.4000
Valid N (listwise)	25			

Critical thinking normality test

Table 2. Results of normality test of critical thinking ability

	Results	
N	90	
Normal Parameters ^a , b	Mean	54.08
	Std. Deviation	10.214
	Absolute	.199
Most Extreme Differences	Positive	.135
	Negative	-.199
Kolmogorov-Smirnov Z	1.464	
Asymp. Sig. (2-tailed)	.028	

Homogeneity test of critical thinking

Table 3. Result of homogeneity test of critical thinking ability

Test of Homogeneity of Variances			
results_Samples			
Levene Statistics	df1	df2	Sig.
13.806	1	38	.001

Table 4. Wilcoxon test output for critical thinking ability

Ranks				
	N	Mean Rank	Sum of Ranks	
Posttest - Pretest	Negative Ranks	0a	.00	.00
	Positive Ranks	25b	13.00	325.00
Ties	0c			
Total	25			

a. Posttest < Pretest
b. Posttest > Pretest
c. Posttest = Pretest

Statistics Test a	
	posttest - pretest
Z	-4,383b
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Table 5. Wilcoxon test output for critical thinking ability

Ranks				
	N	Mean Rank	Sum of Ranks	
Posttest - Pretest	Negative Ranks	0a	.00	.00
	Positive Ranks	20b	10.50	210.00
Ties	0c			
Total	20			

a. Posttest < Pretest

b. Posttest > Pretest
c. Posttest = Pretest

Statistics Test a	
Posttest - Pretest	
Z	-3.925b
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

The percentage of students when viewed the results of the pre-test and post-test critical thinking sample class VII and class VIII sample which applied the combined learning model of problem-based learning and scaffolding, there is a difference in the scores of the pretest and post-test results, it can be seen that the score of the class sample after applying the alloy model of problem-based learning and scaffolding increased. In other words, the posttest score is higher than the pretest score

These results are also supported by statistical test analysis on hypothesis testing using the Wilcoxon signed ranks test for students' critical thinking ability, showing that the implementation of the combined problem-based learning and scaffolding models in the sample class has a significant effect on the critical thinking ability of students at SMP Negeri 21 Palu. This is in accordance with Research conducted by Adam & Gultom (2018), who states that the results of the t-test show that there is a significant influence between the Biology learning model of problem-based learning on student's critical thinking ability at MTs Negeri 1 Rantau Prapat. This is also because the problem-based learning model has the advantage of planning problems and solving them.

This is in line with the opinion of Sudarman (2007), that PBL is a learning approach that uses real-world problems by applying critical thinking processes and problem-solving ability to obtain essential knowledge and concepts from learning materials. This is also in accordance with the statement of Al-Tabany, (2014), that trying on their own to find solutions to problems and the knowledge that accompanies them, results in truly meaningful knowledge. A logical consequence is that trying to find solutions to problems independently will provide a concrete experience. This experience can also be used to solve similar problems because the experience provides its own meaning for students.

This is also in accordance with Rahmawati (2016), that the teacher scaffolding learning model

can emphasize students on interactions in the learning process, motivate and link student interest with learning tasks, simplify learning tasks so that they can be more managed and achieved by students, provide assistance in the form of guidance, giving examples, keywords or other things that can lure students towards independent learning, directing students who have a high zone of proximal development (ZPD) to help students who have a low zone of proximal development (ZPD) so that it helps students focus on achievement learning objectives, and can improve thinking ability in order to gain knowledge so that it is expected to improve student learning outcomes.

The same thing was expressed by Kurniasih (2012), that scaffolding in learning is a teaching strategy consisting of teaching a new skill by inviting students to work together to complete a task that is too difficult if students complete it themselves. The teacher provides full and continuous learning assistance, in this case scaffolding to help students build an understanding of new knowledge and processes. The above opinion is also reinforced by Stone (1998), that the concept of scaffolding is used to define and explain the role of adults or groups who are more capable of supporting children's learning and development. Although scaffolding does not provide the right keywords about how the learning process takes place, scaffolding provides an understanding of the interactions between adults and children.

The selection of problems presented is adjusted to suitable material for students to study. The material studied in this study is environmental pollution and the digestive system in humans. Its implementation follows the syntax of the combination of problem-based learning and scaffolding models. The combination of problem-based learning and scaffolding models has been applied in accordance with the stages of the learning model. This is in accordance with the opinion of Nurbaiti et al. (2016), that problem-based learning can encourage students to be sensitive to a problem that is around them, and learning activities can improve not only by heeding, writing, and remembering what the teacher gives but must interact well in suggesting ideas and results learning

During the learning process, the teacher uses student worksheets (SW) to streamline the learning process. The Students' Worksheet used has been designed and adapted to the steps in the combined learning model of problem-based learning and

scaffolding. During learning, students are given problems, then they work together in groups, giving scaffolding encourages students to develop their initiative, motivation, and resources. When students are able to build knowledge and develop their abilities, scaffolding is reduced or even completely eliminated (Kurniasih, 2012).

This is in line with the opinion of Haniin et al. (2015), that when students experience difficulties, it is necessary to have scaffolding (guidance). The scaffolding aims to help students who are experiencing difficulties so that if given assistance and guidance can solve an existing problem, it can make students understand a certain concept, and assistance will be reduced along with the increase in the knowledge of students (Rusli & Widodo, 2014)

Students are encouraged to think critically when solving problems, be active in discussions, and express opinions to friends and teachers. This is in line with research by Prasetiani et al. (2016), which states that during the problem-based learning process, researchers act as facilitators who guide students if there are difficulties in solving problems.

The test results obtained are tests that are carried out after students carry out a combination of problem-based learning and scaffolding models. During learning, students have indirectly used their critical thinking ability in solving problems. This is in line with the opinion of Ibrahim & Nur (2011), Students who get very good grades are students who are actively involved in learning activities. They are active in conveying their ideas during discussions and focus on working on students' worksheets.

Almost all students have been able to write down the completion steps in the direction that matches the purpose of the problem. It can be seen from the answers written by students, for instance; being able to parse information, use concepts, and correct completion steps. If the problem analysis is carried out correctly, the written solution leads to the solution referred to in the problem, and the completion steps are carried out until it is finished, then the student can be said to be able to analyze the problem.

However, not all students can decide, assess, support, deny or write conclusions appropriately. Providing problem-solving steps can be done if students are able to analyze the problem appropriately, understand the meaning of the question correctly, and provide the right reasons/evidence. Almost all students who are

categorized as lacking in critical thinking ability are students who are less prepared to learn. This can be seen from the lack of student initiative during learning, such as chatting and playing. In addition, these students are also less persistent in solving problems. The inability of students to evaluate and create solutions causes the combined learning model of problem-based learning and scaffolding to not really help these students to think critically.

In implementing the combination of problem-based learning (PBL) and scaffolding models in this study, the researcher has several limitations/weaknesses. There are some students who basically have less interest in solving problems, so they feel reluctant to cooperate in solving problems. From a psychological review, it is said that interest is characterized by focused attention, increased cognitive and affective function, and persistent effort (Ainley et al., 2002).

Attention and effort can be potential mediators for changing conceptions. In addition, some students are also too dependent on their group mates who, according to them, are smarter, so some students tend to be lazy in expressing their opinions. This is in line with Prasetyani (2016), who said that in PBL there is a possibility that students will become too dependent on discussion groups, so students may lack the comfort and ability to work alone when solving problems.

This is also in line with the opinion (Rahayuningsih & Qahar, 2014) that learning occurs when students learn to handle tasks that have not been learned but the task is still within the range of ability or the task is in the zone of proximal development (ZPD) (Buyung & Dwijanto, 2017). Afrizon et al. (2012), explained that the ability to think critically needs to be trained as early and as often as possible.

The PBL model can improve concept understanding because the model asks students to solve existing problems that are in accordance with the literature so that students think and learn to understand it. Arief et al. (2016), stated that a learning approach that is suitable to be applied in the classroom will be able to become a factor in the learning success of students both independently and in groups. The ability to think critically will be more optimal and effective if the PBL model is applied for a long time for certain materials because if it has become a routine and it is used more frequently in

learning, it will get used and skilled by itself (Masek & Yamin, 2011).

Conclusions

There is a significant effect of the combined the problem-based learning and the scaffolding models on students' critical thinking ability at SMP Negeri 21 Palu. It is proven that the Asymp.Sig (2-tailed) is 0.000 on the critical thinking ability test so that the sig value is less than 0.05 or (0.000 < 0.05) in the Wilcoxon test of the critical thinking ability then H_1 is accepted.

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