

THE EFFECTIVITY OF PROBLEM-BASED LEARNING ASSISTED BY SNAKES AND LADDERS GAMES ON STUDENTS DIVERGENT THINKING ABILITY

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Abstract: This study aims to determine the effectiveness of problem-based learning assisted by the game of snakes and ladders on students' divergent thinking skills. The type of research is quasi-experimental, and it was conducted at a public junior high school in Semarang for the 2022/2023 academic year. The sampling technique in this study used purposive sampling, the population in this study was the entire class VIII, and the sample in the study was class VIII F as the experiment class (KF) and class VIII E as the control class (KE). The instrument used was a test result of student learning with five description questions, the hypothesis test used is one sample t-test, independent t-test, and z-test with sig 0.05. Based on the results of the study, it was found that the experimental class learning outcomes were higher than the control class learning outcomes. One sample t-test obtained that $t_{count} = 6.045$ while $t_{table} = 0.683$, so that $t_{count} > t_{table}$, it can be said that KF capability average exceeds 70, independent t-test obtained sig < 0.05 which is 0.001. The average of students with learning model problem-based learning with the help of snakes and ladders game on divergent thinking ability more than the average divergent thinking ability of mathematics. It can be said that 75% of students in the experimental class completed it classically. Learning with problem-based learning assisted by snake and ladder games on the students' divergent thinking skills was effective for the mathematics learning outcomes of class VIII students.

Keywords: *Problem Based Learning, Snake & ladder games, Divergent Thinking Ability*

INTRODUCTION

Learning by relating to real life using games allows students to explore their thoughts comfortably. The curiosity that students have is awakened to explore questions presented in an actual form and assisted by playing more to attract students' attention to learning. Learning is not enough just by memorizing the facts and concepts; it is also required to find them by developing thinking ability and solving problems. Through learning, students are actively involved in exploring nature [1]. Teachers need to design a pleasant learning atmosphere so that student interest can arise in participating in learning. Therefore, an appropriate learning model is needed so that students more easily understand the lessons. The learning model used when learning influences the mindset of students to build students interest in solving and understanding math problems. One of the suitable models to use is problem-based learning [2].

The experience students get from the environment will be the material or problem to be solved. Based on these experiences, students can identify the problems presented in learning. Authentic problems are essential in PBL [3]. The problem-based learning model (PBL) with the demonstration method is an approach in learning that helps students to find problems from a real thing, collect information through self-determined strategies to take a problem-solving decision which will then be presented in the form of performance, with a learning model that fosters students' divergent thinking ability. Learning media also has a significant role in student learning.

Types of learning media in the world of education have developed very rapidly, affecting the

development of learning psychology and the education system [4]. Problem Based Learning has also been widely recognized as an effective approach to immersing learners in contextual and authentic learning settings [5]. Psychologically, learning media is very helpful for children's psychological development in terms of learning. It is said so because psychologically, teaching aids in the form of learning media greatly facilitate students in terms of learning because the media can make abstract things more concrete (real) [6].

Teaching media during learning will greatly help the learning process's effectiveness in delivering lesson content. Media use in learning stimulates students' divergent thinking ability in working on problems. Divergent thinking represents a style that allows the generation of ideas in a context where the selection criteria are relatively vague and more than one solution is correct [7]. Therefore, divergence is used to develop creative ideas by exploring solutions to existing problems [8]. Systematic and repetitive techniques in the game will make them learn at their own pace and time; games have an *entertainment* side that can motivate students in learning so that there is an increase in students' understanding of the concepts contained in the game [9-10].

Divergent thinking is the part of creative thinking that provides various possible answers based on the information provided, emphasizing quantity, variety, and authenticity of answers. Divergent thinking has four aspects: fluency, flexibility, originality, and elaboration [11].

Divergent thinking ability affects the achievement of mathematics learning outcomes and has an essential role in working on math problems. The snake and ladder game media is an alternative that can hone students' divergent thinking abilities. Snakes and Ladders is a board game for children played by two or more people [12]. The game board is divided into small boxes; ladders and snakes are drawn in some boxes that connect them to other boxes. Through this snake and ladder game media, students will more quickly master the material [13-15]. Therefore, this study aims to see the effectiveness of problem-based learning assisted by the snake and ladder game on students' divergent thinking abilities.

RESEARCH METHOD

This study uses a quantitative approach with a quasi-experimental type of research, namely the research method used to find the effect of certain treatments on a controlled condition. [16] this study uses an experimental class and a control class. A quasi-experimental class is used to compare one or more experimental groups that are given treatment, namely the experimental class, with one comparison group that is not treated, namely the control class. The population of this study was all eighth-grade students in one of the junior high schools in Semarang in the 2022/2023 academic year. The sampling technique in this study used random sampling and class VIII F as the experimental class (KF). Which obtained a problem-based learning model with the help of the snake and ladder game and class VIII E as the control class (KE) with a conventional learning model totaling 64 students. The data collection method used is a divergent thinking ability test, and data analysis techniques include a completeness test on KF. A minimum completeness score of 70, a proportion completeness test on KF, an average difference test for KF and KE, and a different proportion test for KF and KE. There are four hypotheses to be tested in this study by conducting initial tests in the form of normality and homogeneity tests with sig. = 5%, acceptance criteria H_0 if sig > 5%. Hypothesis testing in this study uses three tests, as shown in Table 1 below, with H_0 as a statistical hypothesis where there is no effect on the given treatment.

Table 1. Description of the hypothesis test

Hypothesis testing	Criteria	Category
One simple t-test		
Independent sample t-test	$count > t_{table}$	H_0 rejected
z test	$Z_{count} > Z_{table}$	

RESULT AND DISCUSSION

Based on the results of the pre-test that has been carried out, the lowest score of students is 23.21

from KF, and the highest score is 96.42 from KE. The results of the pre-test can be seen in Table 1.

Table 1. Pre-test results

Class	Average	Standard deviation
Experiment	53.46	21.18
Control	53.01	22.95

After treatment was carried out in the experimental class with a problem-based learning model assisted by the snake and ladder game, the students' lowest score was 65.22 from KE, and the highest was 97.1 from KF. The post-test results can be seen in Table 2.

Table 2. Post-test results

Class	Average	Standard deviation
Experiment	79.01	8.46
Control	71.20	9.49

Furthermore, the normality test and homogeneity test were carried out on KF and KE

Table 3. Normality test results

Class	Sig.	Category
Experiment	0.138	normal
Control	0.123	normal

Based on Table 3, it is obtained that sig = 0.138 and 0.123 > 0.05. Because the sig value is more than 5%, then H_0 is accepted. It means that the data is normally distributed.

Homogeneity test

Table 4. Homogeneity test results

Class	Sig.	Category
Experiment control	0.862	homogeneous

Table 4 shows that the value of sig = 0.826 > 0.05. Because the sig value is more than 5%, then H_0 is accepted. It means that the data comes from a homogeneous population. Next, the average ability of the experimental class will be tested using the One Sample T-Test.

Table 5. The results of the one-sample t-test

class	Test Value= 70			
	t	df	Sig	Mean difference
Experiment	6.045	31	0.200	9.528

Table 5 shows that $t_{count} = 6.045$ while $t_{table} = 0.683$, so that $t_{count} > t_{table}$, so that H_0 is rejected.

It can be said that the KF capability average exceeds 70. Furthermore, the classical completeness test was carried out to determine whether learning mathematics with the model problem-based learning with the help of the snakes and ladders game on divergent thinking ability can help students go beyond classical learning mastery for divergent thinking ability. The criteria for classical learning completeness are at least 75% of the student population who exceed the classical completeness test score of 70, with the classical completeness test calculated using the formula

$$z = \frac{\frac{x}{n} - \pi_0}{\sqrt{\frac{\pi_0(1 - \pi_0)}{n}}}$$

description:

z: calculated z value

x: the number of students who exceed BTA

π_0 : the value of the hypothesized proportion, which is 75%

n: number of samples

Then obtained,

$$z = \frac{\frac{28}{32} - 0,75}{\sqrt{\frac{0,75(1 - 0,75)}{32}}} = 4,00$$

It can be found that $z_{count} = 4,00$ and $z_{tabel} = 0,159$ while so $z_{count} > z_{tabel}$, it can be said that

75% of students in the experimental class completed classically. The average difference test used aims to determine whether students with model learning problem-based learning with the help of snakes and ladders game on divergent thinking ability is better than students who get conventional learning. The results of the independent t-test can be seen in Table 6.

Table 6. Results of independent sample t-test

T-test for equal means			
	t	df	sig
Equal variances assumed	3,580	62	0.001
Equal variances not assumed	3,580	62,000	0.001

Obtained $sig < 0.05$, which is 0.001, then H_0 is rejected, so an average of students with learning model problem-based learning with the help of snakes and ladders game on divergent thinking ability more

than the average divergent thinking ability of mathematics taught by conventional learning.

The difference in proportion test determines the number of students who exceed students' mastery with model learning problem-based learning. The help of the snakes and ladders game on divergent thinking ability is more than the average divergent thinking ability of conventional learning mathematics. In this test, the right-side test statistic is used [17] with the following formula.

$$Z = \frac{\frac{x_1}{n_1} - \frac{x_2}{n_2}}{\sqrt{pq \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

With $p = \frac{x_1 + x_2}{n_1 + n_2}$ and $q = 1 - p$

description:

x_1 = the number of students in the experimental the group that exceeded completeness

x_2 = the number of students in the control group who exceeded completeness

n_1 = number of students in the experimental group

n_2 = number of students in the control group

Then obtained,

$$Z = \frac{\frac{28}{32} - \frac{15}{32}}{\sqrt{0,22 \left(\frac{1}{32} + \frac{1}{32} \right)}} = 3,46$$

According to the results of the calculation of the proportion test obtained by $z_{count} = 3.46$ and $z_{tabel} = 0.999$, because $z_{count} > z_{tabel}$, then H_0 is rejected, so the Proportion of completeness Effectiveness of problem-based learning assisted by the game of snakes and ladders on students' divergent thinking ability more than the proportion of students' mathematical mastery taught by conventional learning.

Based on the research results above, the experimental class with a problem-based learning model assisted by the game of snakes and ladders on students' divergent thinking ability is considered effective. In this learning model, students can understand and enjoy the learning process well. This study is in line with the results of this study. [19] The problem-based learning model is appropriate for learning mathematics because this model encourages students to be actively and creatively involved in learning and builds students' knowledge in solving problems in

learning problems in the classroom. Also, this model can construct material with real life. It means that there are also effects on student learning outcomes, including knowledge, attitudes, and ability. The results of the researchers stated that the problem-based learning (PBL) model in learning mathematics contains activities that can strengthen learning mathematics, clarify learning objectives, and provide stimulation to be diligent and active in learning and learning, resulting in increased interest in learning mathematics [19]. The proportion test shows that learning with a problem-based learning model assisted by snakes and ladders on students' divergent abilities is better than conventional learning. Using snakes and ladders with a game design makes students sharpen their divergent thinking, namely in setting the time for playing and the questions being worked on. According to students' divergent abilities, students can answer the questions in the game well. Learning mathematics with snakes and ladders game media can motivate students to learn to develop abilities that involve students actively in learning. Mentions that the results of student learning motivation after the snake and ladder game media is applied by 75% with good criteria [20]. So, students' learning motivation has increased, and there is an effect of using snakes and ladders game media on students' learning motivation, the learning media used has an influence on effectiveness in the learning process. The divergent thinking ability of students can be well developed when the learning model used is assisted by the game of snakes and ladders

CONCLUSION

The media and models used in the learning process have a large enough contribution to the psychology of students in mathematics. The use of problem-based learning models assisted by snakes and ladders turns out to have good effects on students' divergent thinking processes. Students become more active and enjoy learning mathematics more, and the learning outcomes obtained by students have a good improvement.

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