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The Problem Based Learning Model with Etnomatematics Nuance by Using Traditional Games to Improve Problem Solving Ability

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Abstract

The purpose of this study was to determine the effectiveness of the Problem Based Learning (PBL) model with etnomatematics nuance by using traditional games to improve students problem solving ability. The population in this study was the fourth grade students of SDN Mandirancan, Kebasen, Banyumas Academic Year 2017/2018. Sampling was done by using simple random sampling. Data collection technique applied was problem solving ability tests, observation and documentation. This study was analyzed by using t-test. The results show that (1) the ability of problem solving using PBL models with etnomatematics nuanced by using traditional games has reached the classical completeness 75%, (2) the average scores of problem solving ability by using the model of PBL with etnomatematics nuanced by using traditional games was better than the average scores of problem solving ability by using the model of expository, (3) the average gap of problem solving ability by using the model of PBL with etnomatematics nuanced by using traditional games was better than the average gap of problem solving ability by using expository model. Based on the above results, it can be concluded that the model problem based learning with etnomatematics nuanced by using traditional games is effective in improving students' problem solving ability.

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INTRODUCTION

Currently, Indonesia is using the Curriculum of 2013 for the education unit of elementary and secondary education, particularly in the fourth grade of elementary school. Mathematics subject has become separate subjects, and not included in the thematic mode. It is stated in Regulation of The Minister of Education and Culture No. 24, 2016 on Core Competence and Basic Competence Subject on Curriculum 2013 on elementary and secondary education. The results of research of Trends in International Mathematics and Science Study (TIMSS) in the last 5 years show that the mathematics achievement of the basic level in Indonesia has not gain optimal score. The findings in the fourth grade of SDN Mandirancan show that mathematics achievement in the fourth grade were mostly still under the minimum learning mastery criteria, which was at 68.

In addition, teachers are still less precise in applying the teaching methods which then lead students have less interest in solving a mathematical problem (Hadi & Radiyatul, 2014). National Council of Teacher of Mathematics (NCTM) according to Vendiagrys (2015) stated that problem solving plays an important role in mathematics in mathematics education. This is due to people need in order of intellectuals who are able to solve problem systematicaly and are able to make interpretation in either spoken or written language that is easily understood (Fatimah, 2012). Stages of problem solving ability based on the stages proposed by Polya in Wardani (2010) are: (1) understanding the problem, (2) creating a problem solving plan, (3) conducting the problem solving plan, and (4) looking back.

The research results of conducted by Wiguna, et al (2016) stated that in grade V of SDN 8 Banyuning, Bali the problem solving ability on mathematics subject was still very low. The results of the first semester of mathematics test, only 13 of 26 students who obtained score of minimum learning mastery criteria, which was at 65. The research results of Maria, et al (2013) stated that most of students face many difficulties in solving the types of problems in the aspect of problem solving, although the information is clear and complete. Ruseffendi (1991) says that a problem is a matter of solving a problem for a person if he has the knowledge and ability to solve them. According to Abdullah, et al (2015), the problem solving ability in the area of Demak Regency is still low, there were 18 of 40 students who faced the same difficulty.

The research results of Anisa (2014) states that in general the result of mathematical problem solving ability in Garut Regency was not satisfying, at around 30.67% of the ideal score. The research result of Prabawa & Zaenuri (2017), stated that the problem solving ability in Wates, Yogyakarta has not met the expectations, students were having not enough ability to master mathematical notations and classify ideas in order to perform the analysis problem solving ability. The result of research by Lintang, et all (2017) stated that the results of pretest in SDN Nguter, Sukoharjo Regency show low problem solving ability, only 50% of students who reached the criteria critical minimum which is at 68. Based on the above problem solving ability, therefore, it is necessary to conduct a study to be able to improve the problem solving ability in elementary school.

Abdullah, et al (2015) states that the model of PBL is a good learning model to improve the learning outcomes in problem solving ability. PBL is one of the innovative learning model applied to develop students thinking skills to solve a problem (Nugraha, et al, 2017). PBL model provides the opportunity for students to work in groups or individual in order to identify what too known and to learn to solve problems (Fatchurrohmah, et al, 2017). Syntax of PBL in Hosnan (2016) are: (1) orienting students to the problem, (2) organizing students to learn, (3) guiding the individuals and groups investigations, (4) developing and presenting the work, as well as (5) analyzing and evaluating the process of problem solving.

Geni & Hidayah (2017) states that the various problems encountered in the daily lives of students can be appointed as learning problems and then look for the solution. The characteristics

and culture in the environment will attract development in accordance to the local content of learning. It is indeed that learning requires an innovation of learning that encourages students to build new knowledge. Etnomatematics is a mathematics subject which grow and develop in a particular culture (Yusuf, 2010). Culture is referring to a set of norms or general rules that applied in society, beliefs, and values that are recognized in the same communities (Hammond, 2000).

There must be a habit in students environment or neighborhood, one of that is traditional games playing. Learning through games playing is a learning theory of Dienes which mention that there are six stages, one of which is a game that applying rules (Hudojo, 1988). Game which is relatively close to the students is a traditional game, one of the many games that are played by students, although it is becoming obsolete demand. Banyumas has a wide variety of traditional games, such as hopscotch game, checker, gatheng, and so on.

One of the benefits of hopscotch game is that this game can increase interpersonal intelligence. In this game, students are required to exercise patience, self control, reduce anxiety, and train the concentration, so that they can be able to measure their abilities in the facing problems (Marneskliker, 2015). Based on observations in SDN Mandirancan, there were two arenas of game, they were hopscotch *(engklek)* and checkers game *(dam-daman)* that was found in the school yard. Hopscotch game arena was only used by students to play, as can be seen in Figure 1 below.

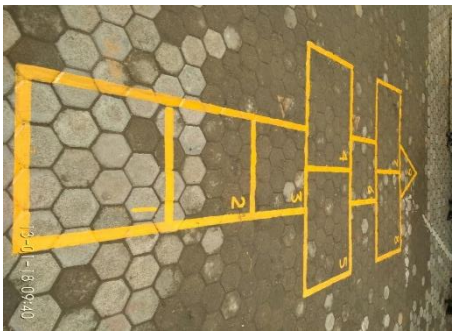

Figure 1. The Arena Game of Hopscotch *(Engklek)*

Prastika & Sukadi (2015) states that checkers is a type of defensive and attacking game which is similar to chess. The game is a line formed in such a way and provide stone or tile fragments with two different groups. Two players take turns attacking each other to devour his troops and also survive. Players who manage to fail down of the opposing force will be the winner. The arena of hopscotch game and checkers can be an alternative way of teachers in teaching as a means of applying the understanding of concept of geometry and space and shape such as square, rectangular, and triangular in grade IV. Figure 2 below was show the arena game of checker.

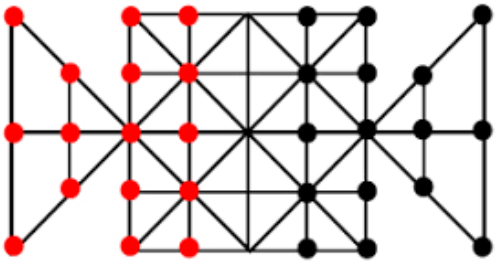

Figure 2. The Arena Game of Checker (*Dam-Daman*)

Syntax of PBL with etnomatematics nuanced by using traditional games were as follows. (1) The students orientation of problems: the students pray, the teacher conveys information about the material to be studied and the learning objectives. (2) Allocating students to learn: students observing a hopscotch game image or checker, break out groups, and distributing worksheets. (3) Guiding the individual or group experience: Students collect information about the problems of plan with etnomatematics nuanced etnomatematika by using traditional game, and solving problems on worksheets. (4) Developing and presenting the work: students were presenting their work in front of the class. (5) Analyzing and evaluating the process of problem solving: the teacher helps the student in reflecting or evaluating their work.

Based on the above problems, the formulation of the problem in this study is how effective of PBL models with etnomatematics nuanced by using traditional games can improve

students problem solving ability? The effectiveness of the learning model can be seen from the classical completeness of test, the average difference of test and the mean difference of test. The purpose of this study was to determine the effectiveness of PBL models with etnomatematics nuanced by using traditional games to improve students' problem solving ability.

METHODS

This study is an experimental research. The study design applied was true experimental design. The experiment design chosen was pretest posttest control design, there were two randomly selected groups as presented in Table 1.

Table 1. Research Design

Class	Treatment		
Experiment	T1	Learning with model of PBL with etnomatematics nuanced by using traditional games.	T2
Control	T1	Learning with expository model.	T2

Information:
T1: Problem Solving Ability Pretest.
T2: Problem Solving Ability Posttest.

The population used in this study was the fourth grade students of SDN Mandirancan in Academic Year of 2017/2018. The sampling technique used was simple random sampling. Methods of data collection in this study were test, observation, and documentation. The result of prerequisite test results can be seen in Table 2.

Table 2. The Result of Prerequisites Test

Prerequisites test	Score	Sig.	Conclusion
Normality test	0.200	0.05	Normal distribution of data
Homogeneity test	0.124	0.05	Data homogeneous
Test similarity average	0.140	0.05	The population has the same capacity

RESULTS AND DISCUSSION

The final data of scores of problem solving abilities on both classes can be seen in Table 3 below.

Table 3. The Results of Problem Solving Abilities

Class	N	Mean	Max	Min	Complete (%)
E	33	87.12	100	73	100
K	32	78.28	100	67	87.50

Information :
E: Experiments Class
K: Control Class

The results of the analysis can be described as follows. (1) The classical completeness of test showed $z_{value} = 3.316$. The rejection area of $H_0 = z_{value} \geq z_{(0,5-\alpha)}$. The value of z of the standard normal distribution list is $z_{(0,45)}$. 0.3264, since $3.316 > 0.364$, therefore, H_1 is accepted. Means that the problem solving model of PBL with matematics nuanced of traditional games have reached the classical completeness by 75%. (2) The average difference test by using independent sample t-test with statistical significance test $\alpha = 5\%$, in the table of independent sample test column sig. (2-tailed) is $0.001 < 0.05$, it means that H_1 is accepted. Means that the average problem solving ability by using the model of PBL with etnomatematics nuanced of traditional games is better than average of problem solving ability by using expository model. (3) The result of the average difference test using independent sample t-test with significant value of $\alpha = 5\%$ in the table of independent sample test column sig.(2-tailed) obtained score of $0.003 < 0.05$, means that H_1 is accepted. Therefore, the average difference of problem solving ability by using the model of PBL with etnomatematics nuance of traditional games is better than the problem solving ability by using the model of exspository.

Based on the above results, it can be summed up as follows: (1) the ability of problem solving using the model of PBL with etnomatematics nuanced of traditional games have reached the classical completeness of 75%, (2) the average of problem solving ability by using the model of PBL with etnomatematics nuanced of traditional games is better than average of problem solving ability by using the model of expository, (3) the average difference of problem solving ability by using the model of PBL with etnomatematics nuanced of traditional games is better than the average difference of problem

solving ability by using the model of expository, it can be concluded that the model of PBL with etnomatematics nuanced of traditional games is effective in improving the students' problem solving abilities.

The effectiveness of PBL model with etnomatematics nuanced by using traditional games in improving problem solving ability, in solving problems, students not only able to answer the problem, but also to recheck the answer in order to obtain the correct answer based on the right concept can be seen in Figure 3.

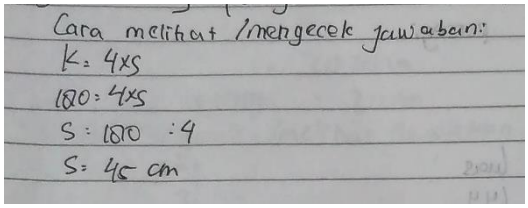

Figure 3. Student Recheck The Answer

Shanti & Maman (2015) state that in the approach of problem solving ability, students are required to identify the problems of mathematics, able to analyze a problem that involved the process of solving the problem, and finally, the students are able to apply the concepts that have been obtained for other cases or other examples, including time to complete the exercises. PBL learning process with etnomatematics nuanced by using traditional games become important since students will learn with the problems they encountered everyday such as some games found in Banyumas namely hopscotch and checker. The problems originating from etnomatematics with traditional game will be more interesting, such as the subject matter of square circumference as shown in Figure 4.

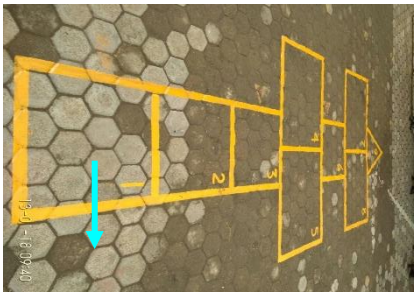

Figure 4. The Hopscotch Arena of Square

The first step in problem solving ability is to understand the problem. The experimental class using worksheet with etnomatematics nuance by using traditional games, such as hopscotch and checkers. It attracted the attention of students, since the game which is in school become a problem in mathematics that should be completed by the student.

By measuring hopscotch arena in the form of square, students will be able to actively asking about the information that they have not known, and classifying constituent arena of hopscotch in the form of two dimentional figure in order to determine the appropriate alternative answers. Fakhriyah (2014) states that the process of problems solving is to help students to integrate the knowledge they gained prior to the issue or information obtained to be able to offer various alternative solutions. Different conditions was experienced by the control group. The teacher's help in providing stimulation to explore the knowledge students really become a main staple, so that teacher requires proper technique in exploring the students' knowledge. Students tend to be passive in learning, since teacher is the one who provide information that must be known by the students. That is due to that the model of expository is teacher centered model.

The second stage is to conduct a plan of problem solving. In this stage, students were able to write down the exact formula to solve the problems. Students in the experimental class can calculate the area of the playing area hopschotch. Students could determine the exact formula that is 2 area of a rectangle that is 2 x (p x l) with the caption number 2 is the number of rectangles, and (p x l) is a formula for the area of rectangles, as shown in Figure 5.

Figure 5. The Hopscotch Arena of Rectangle

The third stage was carrying out the plan of the problem solving. Students can solve problems with the plans that have been made at an earlier stage well. In this stage, students usually replace the mathematics sentence with the formula used to solve problems with the numbers available on the key problem that were known. The next problem to solved was triangles, as presented in Figure 6.

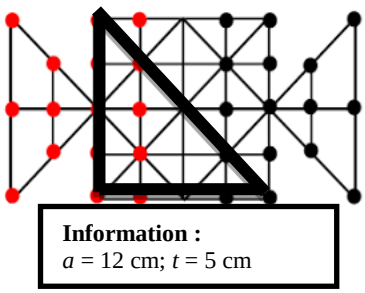

Figure 6. The Arena of Checker *(Dam-Daman)*

Based on Figure 6 above, it can be concluded the area of a triangle = ½ *x a x t* by replacing *a* = 12 cm, and *t* = 5 cm then multiplied by ½. Most of students in the experimental class was able to complete this phase. In this stage, students in the control class still found a lot of mistakes in writing sentences mathematics and multiplying the number and units in the shape. This happened since students were accustomed that they will obtain explanation from the teachers, meanwhile, students sometimes do not pay attention to the information provided by the teacher.

The fourth stage is to look back. In this stage, students can provide what is known parable on the issue to be asked and vice versa or use another formula in solving the problem. Based on Figure 6 above, students can be likened to what they known that is the base and wide and asked the height of the triangle, then the students activity is to find a formula of height in the triangle on the arena of checker.

In this stage, students in the experimental class felt a little bit confused since they have not been accustomed to recheck their own answers. This condition was not different from the control class, in this stage, the students still felt confused since the problems they faced only in the third stage which is only to solve problem without rechecking the answers so that there are possible answers are wrong and will affect the learning achievement which will be not maximum.

The use of learning models which is easy to implement and appropriate to the material will make the students to be able to understand more about the material presented by the teacher, and the cultural habits of students can create a mathematical problem then look for the right solution. Supriyati, et al (2015) states that in the application of etnomatematics based learning model, the material being taught can be easily accepted by the students and the learning can be more meaningful since the problems is related to their daily life that issues such as culture in the student environment or neighborhood. Muzdalipah & Yulianto (2015) states that traditional games that develop contain mathematical concepts. Therefore, traditional games are not just for fun or game, but it can be use as learning source in mathematics to develop the students problem solving ability.

CONCLUSION

Based on the results and discussion, it can be concluded that learning by using the model of Problem Based Learning with etnomatematics nuanced by using traditional games is effective in improving students' problem solving ability. This is demonstrated through, the average problem solving abilities of the fourth grade students in the PBL model with etnomatematics nuanced by using traditional games have reached the classical completeness of 75%. The average of problem solving ability by using PBL models with etnomatematics nuanced by using traditional games is better than average of problem solving ability by using expository model. The average gap of problem solving ability by using the model of PBL with etnomatematics nuanced by using traditional games was better than the average gap of problem solving ability by using expository model.

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