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Mathematical connection ability on creative problem solving with ethnomathematics nuance learning model

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Abstract

The purpose of this research was to analyze the completeness of mathematical connection ability on Creative Problem Solving with ethnomathematics nuance learning model and its differences on Direct Instruction learning model and to analyze the influence of cultural love attitude toward mathematical connection ability. The materials in this research were rectangle, square, and trapezoid. The population in this research were students of grade VII A, VII B, and VII C at a junior high school in Wonosobo academic year 2017/2018 and selected with cluster random sampling. Particularly, grade VII A was chosen as the experimental class and taught by using Creative Problem Solving with ethnomathematics nuance learning model, while grade VII B as a control class that was taught by using Direct Instruction learning model. The data collection methods used were documentation, written test, and questionnaire. The research instrument used were written test and questionnaire. Then, the data were analyzed by one-sided proportion test, two-point equality test, equality test of two proportions, and regression analysis. Eventually, the results showed that (1) the mathematical connection ability of grade VII students with Creative Problem Solving with ethnomathematics nuance learning model reached the classical completeness; (2) the average of mathematical connection ability by using Creative Problem Solving with ethnomathematics nuance learning model of grade VII better than average of mathematical connection ability using Direct Instruction learning model; (3) the cultural love attitude affected to mathematical connection ability.

1. Introduction

Mathematics as one of fields of study occupies an important role in education. Based on Permendiknas No. 22 Year 2006, the purpose of mathematics subject is that students are expected to be able to understand the concepts of mathematics, explaining concepts interconnectedness and applying concepts of algorithms flexibly, accurately, efficiently, and appropriately, in terms of problem solving. That is, after studying mathematics, they should be able to link between mathematics concepts inside or outside.

The standard of the National Council of Teachers of Mathematics (NCTM) as cited by Van de Walle (2008) explains that the main standard in mathematics learning is problem solving ability, communication ability, connection ability, reasoning, and representation. It shows that the ability of mathematical connection should be possessed by learners because the ability is one of the main standards in learning mathematics that links mathematics with other mathematical material, other fields, or daily life.

Research by Mhlolo et al (2012) in South Africa shows that teachers must be able to streamline learning so that students can develop mathematical connection ability. Again, in Thailand, research by Jaijan & Loipha (2012) shows that students' mathematical connection ability increases with active student learning so that learning is not teacher-centered.

Dewi (2013) describes that mathematical connections ability as the ability to associate mathematical concepts between mathematical

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concepts themselves (in mathematics and linking mathematical concepts with other fields Or outside mathematics), which include: connections between mathematical topics, scientific disciplines others, and daily life. For that reason, mathematical connection ability should be owned by each student to solve the problems of mathematics including junior high school students though.

Behind the facts of the importance of mathematics and mathematical connections ability, on the contrary, the fact shows the opposite result the fact actually shows the opposite result. The result of Sugiman's research (2008) shows that the ability of mathematical connection of junior high school students is low, that is only 53.8%. Of that percentage, only 63% of students who have mastered interconnection aspect of mathematics topics, 41% students have mastered aspect of connection between mathematics topics, 56% students who have mastered the aspect of mathematical connections with other subjects, and 55% students who have mastered aspects of mathematical connection with daily life.

Regarding to preliminary finding, mathematical connections ability becomes the goal of learning mathematics which is very important. With mathematical connections ability, students' understanding of mathematical learning will increase.

Based on the results of the interview conducted with mathematics teachers at a junior high school in Wonosobo, it reports that (1) many students only memorize the concepts and formulas, but when they face the problem of stories which is connected to the daily life then they got difficulties in completion; (2) mathematical problems which are given have not been connected to the student residence culture; (3) mathematics learning by using Direct Instruction model.

Additionally, as the effort to enhance mathematical connection ability, a teacher must be able to choose the appropriate learning model in the classroom. One of them is by doing mathematics learning by using Creative Problem Solving with ethnomathematics nuance learning model. Creative Problem Solving is a model for solving problems creatively. According to Saputra & Mashuri (2015), the Creative Problem Solving learning model provides the widest opportunity for students to solve mathematical problems in their own way. The problems contained in this model may be mathematics problems related to daily life.

The results of the research conducted by Suryani et al (2013) show that the average of students learning outcomes with Creative Problem Solving learning model is better than with expository learning. This is because the Creative Problem Solving model has several advantages, which can challenge students' ability as well as give satisfaction to find a solution, increase students learning activity, help students how to transfer their knowledge to understand real life problem, and give opportunity to them to apply their knowledge in the real life. Through the learning model Creative Problem Solving, the students are expected to enhance mathematical connections ability.

According to Mastur as quoted by Nofitasari et al (2015), ethnomathematics is study of conceptions, traditions, mathematical practices and the work of educating and making group members aware that (1) they have knowledge; (2) they can compile and interpret their knowledge; (3) they are able to acquire academic knowledge; and (4) they are able to compare two different types of knowledge and choose the one that is suitable for solving the problems they face. Ethnomathematics is used to link mathematics with students' understanding of the culture of their residence.

According to Ismawanto (2014), the purpose of using ethnomathematics is to help students become aware to think mathematically according to their culture and make it easier for students to learn mathematics that suits with the environment which is close to their lives. It is expected that the learning of mathematics through ethnomathematics can create the character of students who understand the culture well and apply it in daily life, so that their culture has indirectly been preserved through learning mathematics during the learning process in the classroom. Creative Problem Solving with ethnomathematics nuance is a learning model that emphasizes creative problem solving, where problems are related to the student's residence culture.

Based on the backgrounds mentioned above, there are several research problems of this study, as follows: (1) does Creative Problem Solving with ethnomathematics nuance learning model complete? (2) is the average of mathematical connection ability using Creative Problem Solving with ethnomathematics nuance learning model of grade VII better than Direct Instruction learning model? (3) How does the influence of cultural love attitude on mathematical connection ability?

In line with the formulation of the problems above, the general purposes of this research are to analyze: (1) the completeness of Creative Problem

Solving with ethnomathematics nuance learning model, (2) the difference of Creative Problem Solving with ethnomathematics nuance learning model and Direct Instruction learning model, (3) the influence of culture love attitude toward mathematical connection ability.

2. Methods

This research is an experimental research, the research design was posttest only control design. In posttest only control design, there were two groups which were chosen randomly. The research design is presented in Table 1.

Table 1. Research Design

Initial Data	Class	Treatment	Test
The scores of mathematics final exam in odd semester	Experiment	Creative Problem Solving with ethnomathematics nuance learning model	Mathematics connection ability test, attitude love culture questionnaire.
The scores of mathematics final exam in odd semester	Control	*Direct Instructions* learning model	Mathematical connection ability test.

The population of this study were students of grade VII A, VII B, VII C in even semester at a junior high school in Wonosobo academic year 2017/2018. The sampling was done by cluster random sampling technique. After the retrieval, grade VII A was chosen as the experimental class which was taught by using Creative Problem Solving with ethnomathematics nuance learning model and VII B as the control class which was taught using Direct Instruction learning model.

The data collection methods were documentation method, written test, and questionnaire. Firstly, documentation method was conducted used to obtain the data which contain the name and number of students who were the members of the population and to determine the sample members. In addition, it was used to collect the scores of mathematics final exam in odd semester class VII A, VII B, VII C at a junior high school in Wonosobo academic year 2017/2018 which were analyzed in order to know the initial ability of students. Secondly, the written test method was used to obtain the final data of students' mathematical connection ability who were sampled in the research, the questions of the test were the form of description that had previously been tested. Thirdly, the questionnaire method was performed to obtain cultural love attitudes data. The result of culture love attitude questionnaire after applied Creative Problem Solving with ethnomathematics nuance learning model was conducted to know the influence of culture love attitude to mathematical connection ability.

Based on the result of mathematical connection ability test instrument analysis which included validity, reliability, difficulty level, and different problem, there were 6 of 10 items worthy to be used as a test question to measure mathematical connection ability. The items were numbers 2, 4, 5, 6, 7, and 9. While the results of questionnaire test analysis instrument that included the validity and reliability, there were 17 attitude statements on the love culture questionnaire which were used to measure culture love attitude.

Further, the data analysis techniques of this study was a one-sided proportion test, two-point equality test, equality test of two proportion, and regression analysis.

3. Result and Discussion

Based on the results of the initial analysis, the data shows that the samples in the study were normally distributed, had homogeneous variance, and there was no average difference in the two sample classes. In other words, the sample came from the same conditions or circumstances.

After being given different treatment on the experimental class and control class, the data obtained the test of students' mathematical connection ability, and culture love attitude questionnaire. The final data of both class mathematical connection capability used in the research are presented in the following table

Table 2. Mathematical Connection Scores Data

Class	N	Average	SB	Highest Scores	Lowest Scores
Experimental	23	74,47	16,94	100	40
Control	26	66,23	12,78	83	33

3.1. Mathematical Connection Ability

Based on the data obtained from 22 students, 19 students have reached completeness, while the rest have not. Based on the results of classical completeness test, from 70 students who were taught by using Creative Problem Solving ethnomathematics nuance learning model successfully achieved classical completeness based on KKM established at a junior high school in Wonosobo, at least 65% students have achieved classical completeness. It means that more than 65% of the total number of students in Creative Problem Solving with ethnomathematics nuance learning model class can be said to be complete. It shows that mathematical connections ability in that class successfully achieved the expected results.

Based on the result of analysis by using t test for mathematical connection ability scores from experiment class and control class, it is obtained $t_{count} = 1{,}93$, while t_{table} with $\alpha = 0{,}05$ and $dk = 23 + 26 - 2 = 47$ is $t_{(0{,}95)(47)} = 1{,}676$. Because $t_{count} > t_{table}$ then H_0 is rejected, it means on rectangular material, square, and trapezium mean of mathematical connection ability of grade VII which use Creative Problem Solving with ethnomathematics nuance learning model was higher than Direct Instruction learning model. In addition, by using the z test, it is obtained that $z_{count} = 1{,}89$, while z_{table} with $\alpha = 0{,}05$ is $z_{0{,}45} = 1{,}64$. Because of $z_{count} > z_{table}$ then H_0 is rejected, it means on the material of rectangle, square, and trapezoid proportion of grade VII which taught using Creative Problem Solving with ethnomathematics nuance learning model was higher than the proportion of Direct Instruction learning model. This can be interpreted that Creative Problem Solving with ethnomathematics nuance learning model is better than Direct Instruction learning model.

For more, the discussion which was conducted during the process of Creative Problem Solving with ethnomathematics nuance learning model, students were grouped heterogeneously. This activity could foster students to help each other as a group build, guide, and express ideas in his mind both verbally and in writing. The application of the Creative Problem Solving with ethnomathematics nuances learning model by connecting rectangular, square, and trapezoidal material to the culture in Wonosobo can create a pleasant atmosphere and eliminate the saturation of students during learning so as to foster their interest in learning mathematics. Thus, the material taught was more easily accepted by students and the learning became more meaningful.

Unlike control class that used direct Direct Instruction learning model, learning was like teacher-centered so they were less active in learning. In this class, the collaboration between students was not noticed and the explanation was directly given by the teacher to students, as the result students were bored since there was no variation during the learning process. In addition, it caused many students in control class to be incomplete or have a score under 70 in the mathematical connection ability test.

3.2. The Influence of Cultural Love Attitude on Mathematical Connection Ability

The attitude of love for culture in Creative Problem Solving with ethnomathematics nuance learning model class can be seen from the score of the questionnaire on cultural love attitudes transformed with Method of Succesive Interval (MSI). Based on simple linear regression test, it was found that the love culture attitude had an effect on mathematical connection ability. The magnitude of the influence of cultural love attitude to students' mathematical connection ability of 60,2%. It means that the variations which occurred in the mathematical connection ability of students was 60,2% influenced by the attitude of love culture in the equation $\hat{Y} = 0{,}609 + 1{,}534X$, while the rest of 39,8% was influenced by other variables.

Since the learning nuances of ethnomathematics students who has an attitude of love to the culture, students will be interested and enthusiastic about the material taught, because it relates to the growing cultures society. By linking the learning with real phenomena experienced by students, they can learn more fun and can enhance the spirit of students in following the learning.

Ethnomathematics nuances learning also contributes to the implementation of character education in the curriculum 2013. The existence of cultural nuance learning can enhance the attitude of cultural love that is part of one aspect of character education namely the love attitude of the homeland. Based on these reasons, the learning of ethnomathematics can be used as an alternative learning that can be implemented by teachers in the implementation of curriculum 2013.

The Wonosobo culture which was mentioned during Creative Problem Solving with ethnomathematics nuance learning model process

is typical food, dance, batik, and building is presented in Figure 1.

(a) Talunombo's Batik

(b) Rigen

(c) Stagen

(d) Sagon

(e) Wonosobo District Pavilion

(f) Dwarawati's Temple

Figure 1. Various Cultures in Wonosobo

Based on the result of research, Creative Problem Solving with ethnomathematics nuance learning model is better than Direct Instruction learning model. This is due to the following factors.

(1) In Creative Problem Solving with ethnomathematics nuance learning model, teachers prepare a series of questions that are guiding and digging in the learning process by linking the subject matter with the real life of students with the existing culture in Wonosobo. Figure 2 shows the connection of rectangular material to the wall of Arjuna Temple

Figure 2. The Connection of Rectangular Material to the Wall of Arjuna Temple

(2) In Creative Problem Solving with ethnomathematics nuance learning model students in the group build their own knowledge with the thinking process that relates to knowledge of students' attitudes and experiences with new knowledge being learned in solving math problems so that learning becomes more meaningful. This is in line with the opinion of Rajagukguk (2011: 429), that problem solving is a part of a very important mathematics curriculum because in the learning process and completion of the students are expected to gain experience

using the knowledge and skills already possessed to apply to problem solving. In group of students discussing with a group of friends work on worksheets so that they train mathematical connections ability. In direct learning, teacher-centered activities, students receive only the knowledge conveyed by the teacher.

(3) In Creative Problem Solving with ethnomathematics nuance learning model, materials and exercises on rectangular, square, and trapezoidal issues are presented by linking the existing cultures of Wonosobo in relation to rectangles, squares and trapezoids such as Arjuna Temple, Puntadewa Temple, sagon, stagen, rigen, Wonosobo District Pavilion and others. In addition, through learning activities that are associated with existing culture in the environment of students resulted in lesson material is more easily accepted by students so that students become passionate and motivated in teaching and learning activities as well as foster love and care of students to the culture.

4. Conclusion

Based on the results of research that has been conducted at a junior high school in Wonosobo and discussion about the mathematical connections ability on Creative Problem Solving with ethnomathematics nuance learning model with rectangular, square, and trapezoid as materials obtained the following conclusion: (1) Mathematical connection ability students of grade VII on Creative Problem Solving with ethnomathematics nuance learning model achieve classical completeness. (2) The average of mathematical connection ability using Creative Problem Solving with ethnomathematics nuance learning model of grade VII better than Direct Instruction learning model. (3) The attitude of love of local culture affected mathematical connection ability of 60.2%.

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