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Cooperative learning model with ethnomathematics nuances to improve the love of local culture and ability of problem solving

Zaenuri^{1*}, Mukeriyanto¹, and Mulyono¹

¹Mathematics Department FMIPA Universitas Negeri Semarang, Indonesia

*Corresponding author: zaenuri.mipa@mail.unnes.ac.id

Abstract. This research aimed to find out the effectiveness of cooperative learning model with ethnomathematics nuances to improve local culture love and problem solving skill. This experimental research took population from VIII graders of SMP N 1 Gemawang, Temanggung in academic year 2018/2019. The sample was taken by random cluster sampling. The sample consisted of VIII D students as experimental group and VIII A as control group. The technique of collecting data consisted of observation, test, documentation, and questionnaire. The data was analyzed by z-test, independent t-test, and paired sample test. The findings showed that 28 students of experimental group reached the passing grade with average 77.5 while 28 students of control group reached the passing grade with average score 67.5. The hypothesis test showed that students taught by cooperative learning with ethnomathematics nuances classically reached the passing grade. The average obtained by experimental group was higher than the control group. Improvement of local culture love and problem solving skill of experimental group was better than control group.

1. Introduction

One of school educations is learning mathematics process. It demands students to have critical, creative, and innovative thinking ability as well as problem solving skill to compete in 21st century era. Good learning is a learning which can expose students' potencies. Thus, by selecting an appropriate learning method or model, it can improve students' achievements. One of process standard in learning mathematics is problem solving.

Mathematics problem solving skill still gets a lot of attention. It can be seen from researches that students are feeling difficulties during solving a problem because of a lack of confidence and their dependency to other people [1]. Other findings showed that students had difficulties in expressing mathematics ideas into symbols or notation correctly [2]. Learning in the class will be more optimum when the problem is taken from surrounding environment, as for example ethnomathematics. Besides that, during learning process in the class, to make active situation, students need habituation to learn collectively or collaboratively in a team. One of appropriate methods to train this skill in a group is cooperative learning. It is important because trigonometry is a geometrical material which needs problem solving skill.

Ethnomathematics is used to introduce students to culture to more easily solve problems [3]. Kucuk [4] noted the concept of geometry has a close relationship with building houses. Ethnomathematics is



a learning model correlated to cultures [5]. Ethnomathematics learning can make students active in the process of learning mathematics [6]. Thus, several studies concluded that by having an ethnomathematics based study, students could learn mathematics and recognize their cultures. It can develop their love toward their own – surrounding cultures [7-8].

Cooperative learning model is a learning model requiring small grouping during its learning process. It is purposed to solve problems in a team. It is in line that cooperative learning model is a learning model where students learn in a small group whose various skills. During solving problem, each member cooperates and helps each other to understand the learning material. Cooperative learning model is a method to develop confidence and activeness in learning because it emphasizes peer interaction existence as a team in solving a given problem. Cooperative learning demands students to develop independently and communicate effectively with their friends. The findings stated that problem solving skill of students taught by STAD typed cooperative learning with entrepreneurship content and probability material on experimental group reached the minimum passing grade [9].

The findings showed that mathematics problems solving skills needed several stages of mathematics understanding, reasoning, and instruments integrated in problem solving process. Problem solving is an important part of learning process or in the solution since the students could get experience by using their knowledge and skill. Thus, it can be stated that problem solving skill is the purpose of learning mathematics and must be achieved by students.

Based on the explanation, the problem formulation was how effectiveness of cooperative learning model with ethnomathematics nuances to improve the love of local culture and ability of problem solving of the students? This research aimed to analyze the effectiveness of cooperative learning model with ethnomathematics nuances to improve the love of local culture and ability of problem solving of the students.

2. Method

This quantitative research used experimental design was conducted at SMP N 1 Gemawang, Temanggung, in academic year 2018/2019. The population was taken from VIII graders. The samples were selected randomly, resulting to VIII D students as experimental group and VIII A students as control group. The data collection techniques were observation, test, documentation, and questionnaire. The analysis of classical passing grade used z-test [10]. The analysis of variance used independent t-test. The analysis of problem solving improvement skills used independent t-test. The analysis of local culture love used paired sample test.

3. Results and Discussion

Ethnomathematics was taken from geometrical shapes around Temanggung community. The shapes were local cultures in Temanggung. This cultural addition could improve local culture's love of the students. Besides that, the realization of local culture was used as an example in learning process while using cooperative learning model with ethnomathematics nuances. Several objects in the form of local culture things used for example in the classroom with such nuances are presented on figure 1 until 5.



Figure 1. Candi Pringapus



Figure 2. Goa Sigrowong



Figure 3. Gamelan Slenthem



Figure 4. Prasasti Gondosuli

Figure 1 until 4 are realizations of ethnomathematics taken from Temanggung society. The first figure is Candi Pringapus. It has a cubic arch. Figure 2 is Sigrowong cave in which each level has cubic forms. Figure 3 is Gamelan Slenthem (Traditional Musical Instrument) in the form of bars. Figure 4 is a Gondosuli epigraph in the form of stone bar. Based on the figures, the students could study surficial area of cubes and bars plus their volumes.



Figure 5. Leather Puppet Show

Leather puppet show is one of cultures existing in Temanggung. It is located in Tlogowungu hamlet, Muncar village, Gemawang district, Temanggung. There, the show is held three times a year based on Javanese calendar, *sura*, *mulud*, and *jum'at kliwon* (Friday – kliwon). The figure also shows a puppet box in the form of bar. From the figure, students could learn surficial area and volume of bar.

The average score of students' problem solving skill for both groups can be seen below.

Table 1. Average Score of the Problem Solving Skill

Groups	Average	Numbers of Students
Experimental	77,5	28 Students
Control	67,5	28 Students

Based on z-test, it showed that $z_{count} = 1.75$ and $z_{0,45} = 1.64$. Since $z_{count} > z_{table}$ then H_0 was denied. Thus, the proportion of students taught by cooperative learning with ethnomathematics nuances reached 75%. The independent t-test showed that $t_{count} = 4.122$ dan $t_{table} = 0.201$ with a significant score $0.000 < 0.005$. Thus, H_0 was denied. The average score of the students' problem solving skill taught by cooperative learning model with ethnomathematics nuances of experimental group was better. The improvement test done by variance test through independent t-test showed that $t_{count} = 3.913$ and $t_{table} = 0.201$ with significant score $0.000 < 0.005$. Thus, H_0 was denied. The improvement of the students' problem solving skill taught by cooperative learning model with ethnomathematics nuance for experimental group was better than control group.

The average score of local culture love of experimental group, before and after the intervention, is shown in Table 2.

Table 2. Average Score of Local Culture Love

Experimental Group	Average	Numbers of Students
Before	64,7	28 Students
After	90,2	28 Students

The data analysis result of local culture love was tested by paired sample test. It showed that $t_{count} = 45.336$ with significant score $0.000 < 0.005$. Therefore, H_0 was denied. The average score of local culture love of the students after the intervention was better than before being intervened by cooperative learning model with ethnomathematics nuances.

The findings showed that cooperative learning model with ethnomathematics nuances was effective. It was supported by previous study that ARIAS based ethnomathematics toward problem solving skill was effective in learning. It also happened in peer tutorial learning to problem solving skill [11-13]. The previous findings also showed that PjBL model with ethnomathematics materials of two-dimensional figure materials was valid and effective [14]. The findings also showed that local culture love of the XI graders of SHS students taught by problem based learning with ethnomathematics nuances had improvements [7, 15].

Cooperative learning model with ethnomathematics was effective to improve local culture love and problem solving skill of students because: (1) the students taught by the model had more chance to ask or have questions from the problems which were correlated to ethnomathematics figures; (2) students taught by the learning model was active to discuss in group while being given mathematics problems which were correlated to ethnomathematics figures; (3) students taught by the model were active to ask question during having un-mastered materials in the group. As for example, when they were asked to find volume puppet box (figure 5) when it was known the surficial area, width, and its height; (4) when they were given a problem, the students taught by the model were active to share opinion within the group so that problems would be easier to solve.

4. Conclusion

The implementation of cooperative learning model with ethnomathematics nuances was effective in improving local culture love and problem solving skill of the students. It could be seen on the classical passing grade. Besides that, the average problem solving skill of students taught by the cooperative learning model was better than the control group. Their improvement, the experimental group students, was also better than control group. It could be seen from the average score of local culture love of the students after being taught by cooperative learning model with ethnomathematics nuances. It was higher than when they had not been taught by the cooperative learning model.

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