The Effectiveness of Model Eliciting Activities with Ethnomathematics on Students' Mathematical Communication Capabilities

Zaenuri [1], Suryandaru Prasetyo Jati [2], M. Asikin[3], Yohanes J. Kehi[4], Putik Dwinda Hapsari[5]
{zaenuri.mipa@mail.unnes.ac.id[1], suryandaru15@gmail.com[2], asikin.mat@mail.unnes.ac.id[3], kehijohanes@gmail.com[4],putikdwinda@gmail.com[5] }

F.MIPA Universitas Negeri Semarang[1,3], Postgraduate of Universitas Negeri Semarang, Semarang[2,5], Universitas Timor, Kefamenanu[4]

Abstract. The purpose of this study was to analyze the effectiveness of Model Eliciting Activities (MEAs) with Ethnomathematics on students' mathematical communication skills. This research was a quasi-experimental study. The population of this study was seventh grade students of SMP Negeri 1 Delanggu in the academic year of 2018/2019. The sample in this study were students of VII D, VII E, and VII F class. Methods of data collection in this study were observation, test, documentation, and literature studies. Data analysis used proportion test, one sample t-test and independent t-test. The results of the test indicate that students who receive MEAs learning with ethnomathematic were completed both individually and classically. The average and proportion of students who completed the ethnomathematic MEAs learning were more than the class that receives MEAs and control class. Model Eliciting Activities with Ethnomathematics based on Klaten District are effectively applied in classroom learning.

Keywords: Model Eliciting Activities, Ethnomathematics, Mathematical Communication Ability

1 Introduction

Students are required to have problem solving skill, good collaboration and communication skill. The selection of appropriate learning models and learning strategies can maximize students' potential. One of process standard in mathematics learning is communication. Mathematical communication skills are important because they are used to solve problems.

Students' mathematical communication skills still need attention. It can be seen in Colorado found that students had difficulty using the language of mathematics to express mathematical ideas on the story matter correctly [1]. Students have difficulty in expressing mathematical ideas into symbols or notations correctly in Indonesia [2] and Brunei Darrusalam [3]. Learning in the classroom will be more optimal if the problem used in the worksheet comes from the student environment, for example Ethnomathematics. In addition to students' mathematical communication skills, students' collaboration skills in groups also need to be developed to familiarize students with working in teams. One of learning models that can train team work is Model eliciting activities. Quadrangle is one type of geometry that requires mathematical communication skills. The percentage of completeness of students who answered correctly on

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the geometry material in Klaten District based on results of the National Examination in 2018 amounted to 48.70.

Ethnomathematics is often defined as research on the relationship between math with the appropriate social and cultural backgrounds [4] [5]. The object of the Ethnomathematics study object can be in the form of artifacts, traditional crafts, historical buildings, traditional foods, batik motifs and cultural activities like coastal culture [6] [7]. Students will understand more easily of mathematical concepts when they learn mathematics using examples taken from specific areas of cultural context [8] [9]. Ethnomathematic-based learning students can learn mathematics while getting to know culture [10].

Model Eliciting Activities (MEAs) is a realistic learning model that enables students to innovate, synthesize, communicate and adapt effectively in order to develop models that are solutions [11]. Model Eliciting Activities is a mathematical learning model to understand, explain, and communicate mathematical concepts contained in a problem through mathematical modeling [12]. Model Eliciting Activities consist of four main parts, namely, problem sheets, readiness questions, problems, and sharing solutions through presentation activities [13]. Mathematical connection ability of students in learning Model Eliciting Activities is better than the mathematical connection ability of students who are given expository learning [14]. Students who are given Model Eliciting Activities learning with a scientific approach have increased the ability of higher mathematical representation, than students who are given scientific approach learning [15].

The ability of students to express the alleged images on geometry material is also a mathematical communication ability [16]. Students need good mathematical communication skills to solve problems of word problem [3]. Mathematical communication is the main ability needed to formulate mathematical concepts and strategies [17].

Indicators of communication skills used in this study are: (1) The ability to connect real objects, images, and diagrams into mathematical ideas; (2) The ability to use terms, mathematical notations and the structures to present ideas in problem solving; (3) The ability to explain mathematical ideas, situations and relations verbally or written with physical objects, images, graphics and algebra; (4) The ability to express and evaluate daily events in language or mathematical symbols; (5) The ability to communicate the answers to problems in the form of conclusions [18] [19] [20].

The effectiveness of learning is measured by the achievement of learning objectives by the students [21]. The learning effectiveness criteria in this study, learning is effective if (1) the average mathematical communication skills of students who receive ethnomathematic MEAs learning based on Klaten District exceed the actual completeness limit; (2) the proportion of experimental completeness reaches 75%; (3) the average learning outcomes of students who receive ethnomathematic MEAs based on Klaten District learning models are better than MEAs or control class; (4) the proportion of students who receive ethnomathematic based on Klaten District MEAs learning is more than MEAs and control class [12] [22] [23]. The purpose of this study was analyzing the effectiveness of Model Eliciting Activities with Ethnomathematics on quadrangle material.

2 Methods

This research was a quantitative study with a quasi experimental design. The study was conducted in SMP N 1 Delanggu in the academic year of 2018/2019. The population in this

study was VII class students. The sample was chosen by simple random Sampling technique. The results of the initial grade VII test ability are homogeneous so that VII D class was as the first experimental class that received Etnomatematics based on Klaten District MEAs learning, VII F class as the second experimental class which got MEAs, and VII E class as the control class that applied the PBL model. Data collection methods used in this study were tests, documentation, observation, and literature studies. Individual completeness analysis used were one sample t-test, classical completeness with proportion test, analysis of the average difference between first experimental class, second experimental class, and control class using the independent t-test. The test used in this study was the right-hand test. Actual completeness limits in this study was $\bar{X} + 0.25\,SD$, from the initial ability test, it could be obtained that the actual completeness limit was 65

3 Result And Discussion

The results of ethnomathematic exploration in Klaten District can be used as a problem sheet in MEAs learning with ethnomathematics. Some objects that can be used as problems in MEAs learning are presented in figure 1 to 5 below.

Fig. 1 Plaosan Relief

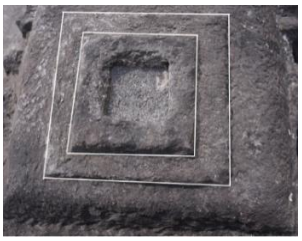

Fig. 2 Sojiwan Relief

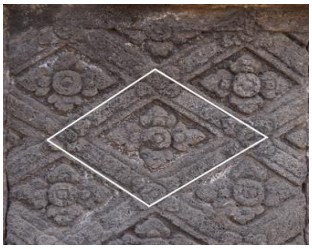

Fig. 3 Plaosan Relief

Fig. 4 Sojiwan Relief

Figures 1 through **Figures 4** are reliefs of Plaosan and Sojiwan Temple. Plaosan and Sojiwan Temple is located in Prambanan District, Klaten District. Students can learn the area and circumference of rectangles through **Figure 1**. Students can learn the area and circumference of a square through **Figure 2**, the area and circumference of rhombus through **Figure 3**, and the area and circumference of the trapezoid through **Figure 4**.

Fig. 5 Yaqowiu Tower

Yaqowiyu is a traditional festival held in Jatinom, Klaten, which is held every month in Sapar, the second month of the Javanese calendar. **Figure 5** is a tower where Yaqowiyu's apem spreads. Students can learn the area and circumference of the trapezoid and square from the roof and the base of the tower.

Average mathematical communication skills and students who scored above the Actual Completion Limit is presented in the following **Table 1**.

Table 1. Average Student Communication Skills

Class	Average	Students who scored above the Actual Completion Limit
Experimental I	79.34	30 student
Experimental II	72.22	23 student
Control	66.56	16 student

Individual completeness test results with one sample t-test obtained values t_{count} 8.75 and $t_{0,95}$ with dk 31 1.70. So the average mathematical communication ability of students who receive ethnomathematic-MEAs learning models reach actual completeness limit. Based on **Table 1**, the results of the classical completeness test with the proportion test obtained values z_{count} 2.45 and $z_{0.45}$ 1.64, so the proportion of completeness of students in class taught with ethnomathematic-MEAs learning models exceed 75% . The summary of independent t-test between classes is presented in the following **Table 2**.

Table 2. Independent t-test

Class	t_{count}	Decision
Experimental I and Experimental II	2.93	H_0 rejected
Experimental I and Control	4.73	H_0 rejected
Experimental II and Control	2.02	H_0 rejected

Value of $t_{0.95}$ dk 62 with interpolation obtained values t_{table} 1.67. Based on Table 2 results of the independent t-test of first experimental class and second experimental class concluded that the average mathematical communication abilities of students using ethnomathematic MEAs learning were more than the average mathematical communication skills of students with MEAs and control class.

A summary test of proportions between classes is presented in the following **Table 3**.

Table 3 Proportion Test

Class	z_{Count}	Decision
Experimental I and Control	2.32	H_0 rejected
Experimental II and Control	3.89	H_0 rejected
Experimental I and Experimental II	1.88	H_0 rejected

Value of $z_{table}0.5 - \alpha$ earned value of z_{table} 1.64. Based on **Table 3**, the results of the proportion test of first experimental class and second experimental class concluded that the proportion of mathematical communication skills of students who received learning with ethnomathematic MEAs was more than the proportion of students' mathematical communication skills in MEAs and control class.

The results showed that the learning of ethnomathematic based on Klaten District MEAs was effective. The results of this study are supported MEAs learning that contains Ethnomathematics is effective in learning and student'problem solving ability [24]. The ability of the mathematical communication of students who use REACT based Ethnomathematics learning strategies is better than the expository model [25].

Model Eliciting Activities Learning Model with Ethnomathematics based on Klaten District are effective because of several things as follows: (1) Ethnomatematic MEAs learning make students enthusiastic because learning links quadrangle material with ethnomatematics in

Klaten. Ethnomathematics MEAs learning makes students not feel bored because students are presented with ethnomathematic images. Ethnomatematics can provide new nuances, overcome saturation and stimulate students [26]; (2) Students in learning ethnomatemics MEAs receive more questions and test on problem sheets and students' books on Ethnomathematics are more varied than MEAs and control classes. There are variations of questions given by the teacher, for example students are asked to calculate the minimum area of fabric needed to make five batik motifs according to **Figure 1**; (3) Student learning ethnomathematic MEAs ask the teacher more actively if there is a material that can not be mastered in group than MEAs and control classes. For example students are asked to look for the long side of the parallel side of the Yaqowiu stage roof, see **Figure 5** if it is known the height of the roof and the length of the sloping roof; and (4) In the presentation stage students in ethnomathematic MEAs learning are more active in responding to groups that are presenting in front of class so that if there are differences in answers, they can immediately find out where the error is.

4 Conclusion

Model Eliciting Activities with ethnomatematics are effectively applied in classroom learning. Indicators of success can be seen from the fulfilled of classical and individual completeness. Another indicator of effectiveness is the average and proportion of mathematical communication skills students who get ethnomatematic MEAs learning are more than students who have MEAs and PBL learning. The learning of ethnomatematic MEAs is effective when accompanied by students who are active in group activities and students are active in finding solutions to each problem given.

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