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Analysis of Problem Solving Ability in Quadrilateral Topic on Model Eliciting Activities Learning Containing Ethnomathematics

Kharisma Ilyyana✉, Rochmad

Universitas Negeri Semarang, Indonesia

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Abstract

The low ability to solve mathematics problems and the character of local cultural love is due to lack of habituation in problem-solving that is associated with everyday life situation and the learning model used is not in accordance with local cultural values. This study aims to analyze the validity, the practicality, the effectiveness of the learning tools implementation, and the characteristics of the problem-solving ability of learners on the learning of MEA with ethnomathematics. The research method used was mixed method of concurrent embedded model. At the beginning of the study was given an initial problem-solving test in experiment and control classes as well as giving a questionnaire of the love of local culture in the experimental class, then the experimental MEA learning was carried out on the experimental class and the PBL learning in the control class. At the end of the study, final tests on the problem-solving ability was conducted in experimental and control classes as well as giving a local love questionnaire in the experimental class. The results showed that the MEA learning containing ethnomathematics on quadrilateral topics is valid, practical, and effective. The results of the characteristics of the problem-solving abilities analysis of the upper group, students have been able to solve the problem properly according to Polya's steps, the problem-solving ability of students in the middle group is still difficult in the step of calculating, while the students in the lower group have difficulty in planning a solution.

✉Correspondence:
Kampus Pascasarjana Unnes, Jl. Kelud Utara III Semarang 50237, Indonesia
E-mail: kharisma.ilyyana@gmail.com

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INTRODUCTION

Mathematics is one branch of science that underlies the development of modern technology. In line with the opinion (Salma & Amin, 2014; Wibowo, 2017) which reveals that mathematics as one of the basic sciences that has a great role to the development of other sciences, both in the social, economic, and natural science. Therefore, mathematics is taught in every level of education. This is because everyone uses mathematics in everyday life such as measuring and counting.

According to the National Council of Theories of Mathematics (NCTM) there are 5 (five) process standards in obtaining and using knowledge (NCTM, 2000). These five process standards are problem-solving, reasoning and proof, communication, connections, and representations. Krulik and Rudnik, as cited by Carson (2007), define problem-solving as individuals who use their knowledge, abilities and understanding to meet a demand from an unusual situation. Students must use what they have learned and apply it to new and different situations. According to Posamentier & Stepelmen (1990), problem-solving is very important because with this ability learners will be easier to read math problems, develop their confidence, and become more critical and analytical. According to Polya (1973), the solution to problem-solving involves four steps of completion phase: understanding the problem, planning a plan, carrying out the plan, and evaluating the settlement that has been obtained (look back).

Based on the results of interviews with mathematics teachers at SMP N 1 Pucakwangi in Pati district, learners have difficulty in solving problems, especially problems related to the rectangular area of the story related to real life. Teachers often give routine problems rather than non-routine, so learners are poorly trained to solve problems and learners tend to be passive. In addition, the results of interviews also indicate that rectangular material is actually quite easy material, just that learners often forget the formulas that exist in quadrilateral material in teaching and learning activities because learners rely on formula memorization. Learners also consider mathematics a difficult lesson. This is in line with opinion (Murwaningsih, et al, 2014; Saironi & Sukestiyarno, 2017) which says that students assume that mathematics is a difficult and often problematic lesson. Mariya, et al. (2013) also said that problem solving was considered as a difficult material in mathematics although the information on the problem was clear and complete but students still had difficulty in solving it. This is because the mathematics is abstract and most learners in learning just memorize the concept of quadrilateral and less able to use the concept to solve real-life problems related to the concept. According to Mundilarto (2004), these constraints resulted in learners not being able to relate the concepts learned in the classroom with their application to solve real problems encountered outside the classroom.

Based on National Exam processing report in the ability to solve problems related to wake up in the Year 2012/2013 for SMP N 1 Pucakwangi Pati obtained the school-level absorption of 52.79, the absorption rate of the city / district of 58.20, the absorption the provincial level of 50.12, and the national absorption rate of 54.95. 2013/2014 Academic Year for SMP N 1 Pucakwangi Pati obtained school level absorption capacity of 50.93, city / district level absorption capacity of 62.87, provincial level absorption of 59.93, and national absorption capacity of 62.42. This result is still relatively less when compared with the ability of learners on other materials. In addition, mathematics learning at SMP N 1 Pucakwangi in its application has not been linked to local culture .

Lenggo Geni, et al (2017) said that various problems encountered in the living environment of students can be raised as learning problems to find solutions. According to Junaedi & Asikin (2012), conceptual understanding of mathematics can be built through problem solving, reasoning and argumentation. According to Samo (2017), measuring the ability to solve mathematical problems can be done by presenting problems of contextual problem-solving. The problem of contextual problem solving can be in the form of general contextual problems as well as contextual problems that raise local cultural wisdom. Concerning the cultural context in this study is rectangular material associated with local culture in Pati.

According to Wahyudi (2016), one of the real problems that can be used is culture. While Shirley (1995) argues that today the field of ethnomathematics, namely mathematics that arises and develops in society and is in accordance with local culture, is the center of the learning process and

teaching methods. This opens up a pedagogical potential that takes into account the learners' knowledge gained from learning outside the classroom. Learning that links material to the cultural environment can help learners understand and make connections between concepts they have with real-life applications.

According to Shirley as quoted by Hartoyo (2012), the field of mathematics that arises and develops in society and in accordance with local culture, is a process of learning and learning methods. According to Orey & Rossa (2006), the concept of learning containing ethnomathematics is a contextual learning by developing aspects chosen from the experience of learners or from their own environment because as a paradigm of culture, whereas according to Knijnik (1994), mathematics is a growing cultural knowledge and growing to connect human needs, known as ethnomathematics. From this explanation, ethnomathematics is one of the ideas of combining mathematics learning with local culture, so that meaningful learning will be created and students' understanding can be maximized because it is linked to the real world.

In this study, the elements of culture that will be used as a medium of learning, especially related to the quadrilateral shape to reinforce the concept of material class quadrilateral VII. Mathematical concepts that exist in real life related to culture combined with mathematical concepts that have been known to learners so that learners are not saturated learn math, more familiar with the culture around it and can preserve it so that learning will be more meaningful for learners. This is in line with the results of research Sirate (2012) which reveals that the application of ethnomathematics as a means to motivate and stimulate learners in overcoming the saturation and difficulty learning math.

As a special study of ethnography-filled learning in the learning process of mathematics owned by Pati urban community and collaborated with rectangular materials, such as relics of historical buildings, tourism objects, daily livelihoods, Pati traditional meals, and others can be used as learning resources in classroom learning. One example of historical heritage in Pati can be seen in Figure 1.

Figure 1. Tugu Tani

Tani Monument at the Pati Bakorwil T-junction is one of the cultural math activities in Pati. Part of the monument is rectangular, namely paralellogram. It can be used as a learning resource on the rectangular material.

According to S., et. al (2014) the quality of education, particularly mathematics education, is affected by the role of teahers who interacted directly with the learners. Paryatun, et al (2016) states that the success of a learning process is influenced by goals, materials, methods or models of learning, media, teachers, and students. Samuelsson (2008) states that the right learning model will affect the learning outcomes obtained by students. Learning models that teachers can apply vary widely. One learning model that enhances problem-solving abilities is Model-Eliciting Activities (MEA). This is in line with the results of Yu & Chang's (2009) study, stating that this MEA is used to improve students' problem-solving abilities. Chamberlin & Moon (2008) states that the creation of a mathematical model requires a powerful concept of understanding the problem so as to help learners express their ideas. Learning MEA familiarizes learners with the cyclical process of modeling: stating, testing, and reviewing. Permana & Sumarmo (2007) explains that the Model-Eliciting Activities (MEA) provides an enormous opportunity for learners to explore their knowledge in learning math, so as to enable learners to change their view that math is an easy lesson and learners are able to learn math. Miranti, et al (2015) stated that MEA learning makes students interested and likes to solve problems.

Based on the previous exposure, it is necessary to conduct a research to analyze the validity and effectiveness of learning tools of MEAs containing

ethnomathematics in rectangular materials, as well as the characteristics of problem-solving ability of learners.

The purpose of this study was to analyze the validity, practicality, and effectiveness of learning devices with MEA containing ethnomathematics on the quadrilateral material, and to analyze the characteristics of students' problem-solving abilities.

METHODS

This study is a type of research mixed methods model concurrent embedded (a mixture that is not balanced) by combining the quantitative methods into the primary and qualitative methods to be secondary by mixing the two methods are not balanced. The study was conducted at SMP N 1 Pucakwangi Pati in class VII with the learning of MEA geometry subject matter, especially the broad material and rectangular circumference. The population in this study is all students of class VII SMP N 1 Pucakwangi academic year 2014/2015. Determination of sample in this research by cluster random sampling technique. One class as an experimental group treated with MEA learning ethnomathematics charged while the other classes ask control group treated PBL learning. The study begins by composing a valid learning tool, and then do initial capability test problem-solving in the experimental class and control as well as giving a local love questionnaire in the experimental class. After that, ethnomathematics-charged MEA learning was conducted in the experimental class and PBL learning in the control class. Followed by a final test of problem-solving abilitys in the experimental and control classes as well as giving a local love questionnaire in the experimental class. Every learning is always done observation ability process of learners and followed by the in-depth interview with 6 selected learners.

Quantitative analysis is used to analyze the validity, practicality and the effectiveness of MEA learning containing ethnomathematics in quadrilateral material. Effectiveness of the learning instructional tools was measured by students' problem solving ability in MEA containing ethnomatematics learning achieve the minimum criteria; the average score of students' problem solving in experimental class is better than in the control class; the average score of students' skill process in experimental class is better than in the control class; and there is an increase of love on local culture of students of experimental class. Quantitative analysis carried out included completeness test with one sample t-test, comparative test with independent t-test, and improvement test with t-test and normalized gain. The data used are the value of the initial test and the end of problem-solving abilities, the value of the questionnaire of early and late local culture love, as well as the value of observing the abilitys of the learner's process. Qualitative analysis is done by reducing data, exposing data, and drawing conclusions from the data that has been collected and verifying the conclusions.

RESULT AND DISCUSSIONS

The validation result of learning device development can be seen in table 1.

Table 1. The result of Learning Device Validation

Recapitulation	Validator			Average	Criteria
	VI	V2	V3		
Syllabus	4.33	4.25	4.50	4.36	Very good
Lesson Plan	4.47	4.53	4.42	4.47	Very good
Textbooks	4.10	4.10	4.70	4.30	Very good
Worksheet	4.20	4.10	4.70	4.33	Very good
Test of Problem Solving Ability	4.44	4.22	4.56	4.41	Very good

Of the three validators, the learning tools validation including syllabus, RPP, Students' book, students' worksheet, problem-solving ability test scored on very good criteria. Thus, the instructional tools of MEA containing ethnomathematics is valid and is on very good criteria as well as it can be used in mathematics learning in class VII on the rectangular material.

Practicality test was measured by using instructional tools utilization based on teacher's observation which scoring 4.45 on very good criteria and by students' responses scoring 4,32 which showed the positive response toward the instructional tools used.

The ability of problem-solving learners in learning MEA achieve individual mastery if the learners its value. Based on calculations obtained t arithmetic = 5.346 and t table = 1.71 because t count > of t table is 5.345> 1.71 means rejected and be

accepted. Thus, the average completeness score of the problem-solving ability of learners reaches more than 67 in the MEA learning is charged with ethnomathematics. Based on the calculations obtained z count = 1.897 and z table = 1.64 because z count > z table is 1.897> 1.64, then rejected and be accepted. Thus, the classical mastery of the problem-solving ability of learners on ethnomathematics MEA learning exceeds 75%. This means that the problem-solving ability of learners in the AA learning has a rectangular material ethnomathematics achieving individual and classical completeness.

The average difference TKPM test outcomes learners are conducted to determine whether the use of MEA charged ethnomathematics learning better than classes taught by PBL models or not. The average difference test in this study uses the SPSS 16 application, namely the Independent Sample T-Test . Based on the results of the output of the Independent Sample t-Test obtained the value of t count = 2.380 with the degree of freedom (df) = 58 with a significance level of 5% obtained t table = t (58; 0.05) = 2.0017 it is clear that the value of t count > t table is 2,380> 2,0017 then, H 0 is rejected which means the mean value of pretest difference and posttest of problem-solving ability of classroom learners who are taught by MEA learning has an ethnomathematics load better than average pretest and posttest difference of problem-solving ability students who are taught with the PBL model.

The comparative test was used to determine the difference in mean scores of observations of learners' process abilitys taught by ethnomathematics MEA studies with a scoring score of learner ability process that was taught by PBL learning. Based on the output table result of Independent Sample t-Test obtained t value = 2.041 with degrees of freedom (df) = 58 with significant level 5% obtained t table = t (58,05) = 2,0017 it is clear that the value of t arithmetic > t table is 2.041 > 2.0017 then, H 0 is rejected, which means the average of the problem-solving abilitys of students learning class taught by MEA charged ethnomathematics morethan both of learners who are taught by PBL models.

The comparative test of one paired sample was carried out to find out whether there was an increase in the average love of local culture for students of class VII before and after learning in the learning of MEA with ethnomathematics content. According to the table 4:11 obtained significant value = 0.00 <0.05, mean H 0 is rejected and H 1 accepted. It can be concluded that the average love of local culture after being taught with the learning of MEA with ethnomathematics is better than before being taught by learning MEA with ethnomathematics content. Thus, there is an increase in the love of local cultures of learners in the learning of MEAs with ethnomathematics.

Learning MEAs are ethnomathematical rectangular material effective. This is because it meets the criteria, (1) the problem-solving ability of learners on the learning of ethnomathematical charged MEA achieves individual and classical completeness, (2) problem-solving ability of rectangle subject matter in MEA lesson learning is ethnomathematics better than problem-solving ability of rectangle material learners in PBL learning, (3) the average abilitys of the process of the local materials in the learning of the MEA are ethnomathematical better than the average of students' quadrangle material abilitys in PBL learning, (4) there is an increase in the love of the local culture of the students of class VII SMP N 1 Pucakwangi on MEA learning is charged with ethnomathematics.

The results of this study support the results of previous research, among others, conducted by Diefes-Dux & Salim (2009) implemented three MEAs in the first year of engineering faculty. They suggest paying more attention to the selection of words and information that will be included in the problem. Research Rachmawati (2012) showed that without learning mathematical concepts, sidoarjo society has applied mathematical concepts in everyday life using ethnomathematics. Proven mathematical concepts contained in the building of temples and inscriptions, a local community of sidoarjo, the geometric shape of traditional pottery, batik cloth motifs and border, and the traditional game sidoarjo society. The results of Kaselin's research, et al (2013) show that the subject matter that links real problems in daily life based on the culture around us is very helpful to find ideas.

The process of learning MEAs containing ethnomathematics trains the abilitys of the learner's process that can improve the love attitudes of local culture and the problem-solving ability of learners. This is due to the students accustomed to discussions, active in learning and is enthusiastic about the ideas communication taken them because of problems in learning activities is a matter of their own culture. This is in line with Samo, et al (2018) who stated that

contextual culture-based learning in mathematics learning can improve students' problem-solving abilities. Hanifah (2015) mentions that learning process using MEA becomes meaningful because learners can relate concepts learned with the familiar concept and emphasize learners to learn actively. Other than that, Dede, et al (2017) said that the role of group members and the principles that relate to others in MEA learning can enhance and develop the role of students in learning.

The problem-solving abilitys of the learners are analyzed based on Polya's steps, that is understanding the problem, planning the settlement, solving the problem as planned, and re-examining the results. Students of the upper group have been able to solve the problem well according to Polya step. The results of the work of upper group learners can be seen in Figure 2.

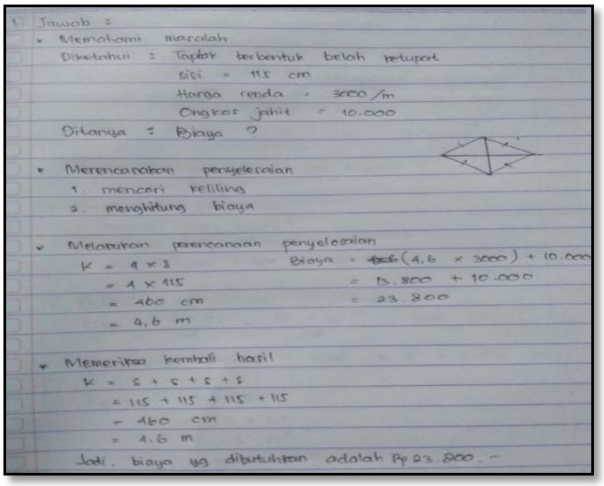

Figure 2. Problem Solving Abilities of Upper Group Students

The problem-solving ability of students in the middle group has been able to solve the problem properly according to Polya's steps, namely understanding the problem, planning a solution, performing calculations, and checking again, but they still have difficulty in calculating. The result of the upper group work can be seen in Figure 3.

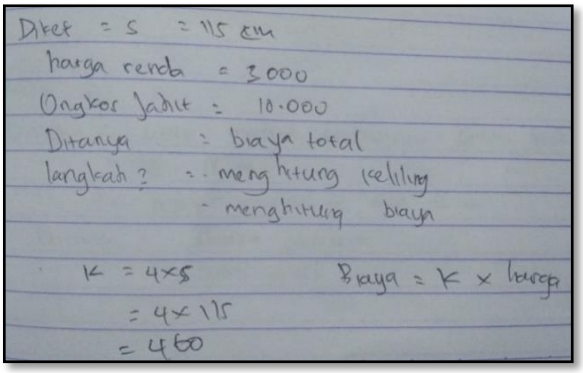

Figure 3. Problem-solving ability of the Middle Group Students

Learners have been able to make a plan of completion in accordance with the procedure but have not led to the results of the correct solution because the calculation has not been done to completion.

The problem-solving ability of students in the lower group has not been able to solve the problem properly according to Polya's steps. They are still having difficulties in planning the settlement. The results of the work of upper group learners can be seen in Figure 4.

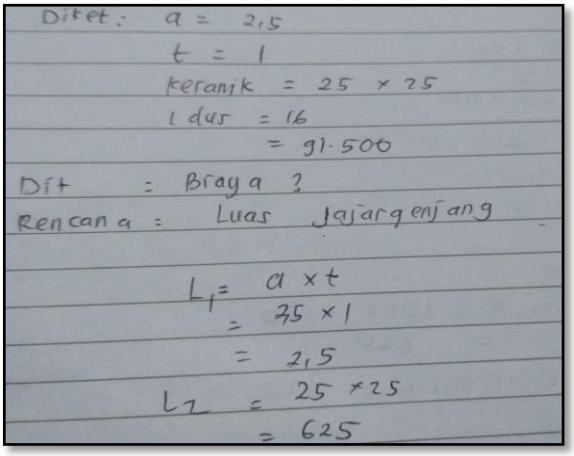

Figure 4. Student Problem Solving Abilities

Learners in planning the settlement have not written down the steps to find the solution is not complete, so at the calculation, stage has not been resolved correctly.

CONCLUSION

In this study, it can be concluded that MEA containing ethnomathematic instructional tools on rectangular material is valid, practical and effective.

The characteristics of problem-solving abilities the students are: upper group students have been able to solve the problem properly according to Polya's steps, middle group students are still having difficulties in planning solving steps, while the lower group students have difficulties in understanding the problem.

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