

ETHNOMATEMATIC ASSISTED PBL-BASED TEACHING MATERIALS TO IMPROVE THE PROBLEM-SOLVING SKILLS OF JUNIOR HIGH SCHOOL STUDENTS

Ridho Aji Wardana¹, Amin Suyitno², Zaenuri³,
Mathematics department, Universitas Negeri Semarang
ridhoajwardana2000@students.unnes.ac.id

ABSTRAK

Penelitian ini memiliki tujuan menganalisis efektivitas model Pembelajaran Berbasis Masalah berdasarkan etnomathematics dengan vihara dalam meningkatkan kemampuan pemecahan masalah siswa. Penelitian ini adalah penelitian desain eksperimental yang benar. Teknik pengambilan sampel dilakukan dengan menggunakan random cluster sampling. Sampel dalam penelitian ini adalah SMP sebagai kelas eksperimen dengan total 37 siswa. Pendataan dilakukan melalui metode observasi, dokumentasi, dan pengujian. Analisis data dilakukan dengan menggunakan one-sample t-test, Proportion Test, dan Independent Sample ttest. Hasil penelitian menunjukkan bahwa model PBL berdasarkan etnomathematics efektif dalam meningkatkan kemampuan pemecahan masalah siswa. Hasil ini ditunjukkan dengan skor rata-rata kemampuan pemecahan masalah siswa dalam pembelajaran menggunakan model PBL berdasarkan etnomathematics yang berada di atas Kriteria Kelengkapan Minimum (KKM) dengan KKM kemampuan pemecahan masalah 75, proporsi kelengkapan siswa kemampuan pemecahan masalah dalam model PBL berdasarkan etnomathematics di atas 75% dari kelengkapan klasik, kemampuan pemecahan masalah rata-rata siswa dalam model pembelajaran PBL berdasarkan etnomathematics lebih baik daripada kemampuan pemecahan masalah rata-rata siswa dalam model PBL. Berdasarkan hasilnya, dapat disimpulkan bahwa pemecahan masalah dalam model PBL berdasarkan etnomathematics efektif dalam meningkatkan kemampuan pemecahan masalah siswa.

Kata kunci : Bahan Ajar, Etnomatematika, PBL

ABSTRACT

This study has the purpose of analyzing the effectiveness of the Problem-Based Learning model based on ethnomathematics with Selotigo batik motifs in improving students' problem-solving abilities. This study was true experimental design research. The sampling technique was done using random cluster sampling. The sample in this study was junior high school as an experimental class with a total of 37 students. The data collection was done through observation, documentation, and test method. The data analysis was done using One-Sample t-test, Proportion Test, and Independent Sample ttest. The results showed that the PBL model based on ethnomathematics was effective in improving students' problem-solving abilities. This result was indicated by the average score of students' problem-solving ability

in the learning using PBL model based on ethnomathematics which was above the Minimum Completeness Criteria (KKM) with KKM of problem-solving abilities of 75, the proportion of students completeness of problem-solving abilities in PBL model based on ethnomathematics was above 75% of the classical completeness, the average problem-solving ability of students in the PBL learning model based on ethnomathematics is better than the average problem-solving ability of students in the PBL model. Based on the result, it can be concluded that problem-solving in a PBL model based on ethnomathematics is effective in improving the problem-solving ability of students.

Keywords : *Teaching Material, Ethnomatematics, PBL*

INTRODUCTION

Problem-solving ability is a basic skill that must be possessed by a student in living life to survive and develop themselves when dealing with a problem. Based on Permendikbud Number 21 of 2016 concerning standard content of primary and secondary education, one of the competencies that will be achieved in the process of learning mathematics is the ability to solve problems. This is in line with Nyala (2016) who stated that the fact could not be denied for problem-solving is one of the standard processes that quickly becomes the key in learning mathematics. Problem-solving is a basic component for learning and also for the acquisition of knowledge (Ayllon, 2016). Meanwhile, Santoso (2013) stated that the ability to solve problems is a basic skill that must be possessed by

someone to lead a better life.

Education is expected to help students have good problem-solving skills to be able to solve problems and questions related to subjects in particular mathematics in school.

Mathematical problems are given to students at school with a purpose to train the student's intellectual abilities in understanding, planning, doing, and obtaining solutions for every problem.

According to the observations and interviews with the classroom teacher regarding the problem solving of mathematics in grade VII at Public Junior High School , it was obtained results that the daily mathematics test shows that the students' problem-solving abilities of students were still low. Based on the results, it was found that some students still have difficulty in interpreting the problems, so that

they found difficulty in conducting the steps of problem-solving and the final results that were not good innovate.

Efforts are made to find solutions by developing learning that uses models, strategies, and methods, and techniques that can improve students' mathematical problem-solving abilities. In this case, it will develop a learning tool that can facilitate the formation of problem-solving abilities. The factors that influence the ability to solve mathematical problems (Pimta, 2009) are; direct and indirect, direct factors are attitudes toward mathematics, self-esteem, and teacher teaching behavior. Meanwhile, indirect factors are motivation and self-efficacy.

From the above problems, it can be assumed that the Problem-Based Learning (PBL) model is one of the good learning models for improving learning outcomes in problem solving ability. This is in line with the results of research by Hendriana (2018), who stated that the PBL model is better than the conventional learning viewed from the ability to solve the mathematical problems. Siritwat & Katwibun (2017) stated that the Problem-Based Learning (PBL) model is an

educational approach where learning is driven from problems in the real world. Meanwhile, according to Widyatiningtyas (2015) ProblemBased Learning (PBL) model is a challenging learning approach for students to learn problemsolving done in groups.

It is expected that through the ProblemBased Learning (PBL) model, students can analyze themselves and criticize a given problem so that later students can solve various problems encountered. The Problem-Based Learning (PBL) model is expected to be able to encourage students to understand the many problems, then think about how students can carry out authentic investigations and also investigations that require real solutions to real problems. Besides being able to enhance students to think creatively, learning using Problem-Based Learning (PBL) models focuses on the problem-solving process.

Currently, students learn mathematics with problems that are not suitable in their daily lives, so that they find it difficult to solve problems in mathematics. So that mathematics learning becomes easier to understand and

meaningful, learning can use the problems that exist in the environment around students, especially the local culture that is in the place of residence. The students will not get bored in following the learning mathematics process.

A culture that is directly related to mathematical concepts is usually called ethnomathematics, in which cultural elements in the student's residence can be used as a source of learning with the hope that learning takes place more meaningfully. In line with Abdullah, Mastur, and Sutarto (2015) states that the application of ethnomathematics as a means of motivating and stimulating students can overcome boredom and learning difficulties which in turn can improve the learning outcome of students in mathematics. Rosa & Orey (2011) found that the application of ethnomathematics to the curriculum in schools helped in developing students' intellectual, social, emotional, and political learning by using their unique cultural references in imparting knowledge, skills, and attitudes. According to Geni, Hidayah, & Zaenuri (2017) stated that ethnomathematics is mathematics applied by certain cultural groups,

groups of workers and professionals, children from certain class communities, indigenous tribes, and others.

Ethnomathematics is the study of mathematical techniques used and can be identified through cultural groups in understanding, explaining, and managing problems and activities that arise within themselves (Yusuf, 2010). Through the application of ethnomathematics in learning, students are expected to better understand mathematics while understanding their culture, and later it will be easier to instill cultural values in students' daily lives. The widespread use of mathematical concepts in ethnomathematics related to various mathematical activities, including grouping, counting, measuring, designing buildings or playing equipment, determining locations, and other things. So with ethnomathematics based learning students can learn mathematics and get to know the culture.

Based on the above background that has been described, the formulation of the problems examined in this study was whether the average score of students' problem-solving abilities in the learning using Problem-Based

Learning (PBL) models based on ethnomathematics above the Minimum Completeness Criteria (KKM) with KKM problem-solving abilities of 75, whether the proportion of completeness of students' problem solving abilities with Problem-Based Learning (PBL) models based on ethnomathematics above the classical completeness of 75%, whether the average ability of students' problem-solving in Problem Based Learning (PBL) learning models based on ethnomathematics is better than the average of students problem-solving ability in Problem-Based Learning (PBL) model.

The purpose of this study was to determine whether: the average score of students' problem solving abilities in learning using Problem-Based

Learning (PBL) model based on ethnomathematics nuances above the Minimum Completeness Criteria (KKM) with KKM problem solving abilities of 75, the proportion of completeness of problem solving abilities of students in Problem-Based Learning (PBL) model based on ethnomathematics above the classical completeness of 75%. The average problem-solving

ability of students in ProblemBased Learning (PBL) learning model based on ethnomathematics is better than the average of students' problem-solving ability in the PBL model.

With regard to the problem of mathematics education in Indonesia, transformational efforts are needed to bring mathematics closer to the reality and culture of students. In this regard, Ethnomatematics, conceived by (Rosa et al., 2017) and based on its concern with the conditions of mechanistic mathematics education, away from the reality and culture of students, could be a solution. Instead, in the second posture, the basic thinking is that appreciating other cultural ideas implies the discovery of other ways that cultural groups develop to survive and transcend[2]. Here, the idea of the existence of different mathematics is emphasized; the focus is more on differences, strongly based on the philosophical foundation of cultural relativism that expresses the contemporary existence of different types of mathematics.

Education and culture are something that cannot be avoided in everyday life, because culture is a

whole and complete unity, applicable in a society and education is a fundamental need for every individual in society. Through the 2013 curriculum documentation study activities obtained problems, namely: in the achievement of KI 3 established: "understand knowledge (factual, conceptual, and procedural) based on curiosity about science, technology, art, culture related to phenomena and events visible to the eye". One that can bridge between culture and education is ethnomatematics. Ethnomatematics is a learning approach that is influenced or culturally based. Through the application of ethnomatematics in education, especially mathematics education, it is hoped that later students can master targeted mathematical skills without leaving their cultural values.

Learning using ethnomatematics-based teaching materials is expected to improve problem solving so that it will produce good learning achievements. This research aims to develop ethnomatematics-based teaching materials that are able to contribute to problem-solving skills without leaving their cultural values. Skills or abilities that have a

good impact on the teaching materials developed are students easier, solving problems related to the material of building curved side spaces in our surroundings as an example of one of them is in Watugong Temple, especially at the top of the pagoda and some ornaments around it. So that it has a good impact for students in solving everyday problems related to building curved side spaces.

The main reasons for bringing ethnomatematics to school are for (D'Ambrosio & Rosa, 2017):

1. Demystify school mathematics as the final, permanent, absolute, and unique form of knowledge. There is a misperception today in society, very damaging, that those who perform well in mathematics are smarter, indeed excelling in their relationships with others. This erroneous impression is given by traditional forms of teaching easily extrapolated to religious, ideological, political, and racial beliefs.
2. Describes the intellectual achievements of various civilizations, cultures, nations, professions, and genders. Western mathematics is completely integrated with the

conquests and colonialism that dominate the entire world. Acceptance, forced or voluntary, western mathematics and western knowledge in general leads to the acceptance of behavior and values, such ideas as winners are the best, the losers must be discarded. More than any other form of knowledge, mathematics is identified with winners. This is true in history, in the profession, in everyday life, in the family, and in school. The only possibility of building a planetary civilization depends on restoring the dignity of losers and both winners and losers, moving together towards a new one. It requires respect for each other. Otherwise, the loser will direct his efforts to become a winner and the winner will do their best to protect themselves from the loser, thus resulting in a confrontation.

Based on the background of this research, I formulated several problems, among others. How is the process of developing ethnomatematic teaching materials in the construction of curved side spaces that are often found in

Watugong Monastery? How is the application of this teaching material to the development of middle school students' problem-solving skills? From some of the problems that have been formulated, I will write down the purpose of this research, namely to develop ethnomatematics-based teaching materials in the building of curved side spaces that are often found in Watugong Buddhist Monastery and to apply these teaching materials to the development of problem-solving skills of junior high school students / MTs class IX.

DISCUSSION

The results showed that the average score of lecturer and teacher validators was 86.36% and the average score from UNNES mathematics education student validators was 86%. So that the overall average achievement is 86.18%. The following will be discussed the results of validation of ethnomatematics teaching materials.

Cultural Description studied in ethnomatematics-based teaching materials. According to the literature review obtained, as follows:

Watugong Buddhist Temple

is one of the Buddhist places of worship located in Pudukpayung, Banyumanik, Semarang Central Java. The exact location is in front of kodam IV / Diponegoro Headquarters. The Watugong Temple Complex consists of two main main buildings, namely the Avalokitesvara Pagoda and Dhammasala as well as several other buildings. Avalokitesvara Pagoda is a building that has a high artistic value, with a height of 45 meters and is designated as the tallest pagoda in Indonesia. Inside is a statue of Dewi Kwan Im with a height of five meters. While Dhammasala consists of two floors where the ground floor is used as a multipurpose hall room for meeting activities and the upper floor is used for religious ceremonies containing a statue of the Buddha. Other buildings contained in the monastery are Watugong, ashoka monument and Borobudur Plaza.

After the fall of the Majapahit Kingdom, this was the first monastery to spread Buddhism on the island of Java. Avalokitesvara Pagoda is the tallest pagoda in the Monastery. The first part of this octagonal Pagoda has a side length of 15 meters. In the middle of this room there is a statue of Dewi

Kwan Im as high as 5.1 meters. Mathematics teaching and learning activities that introduce one building (as well as other similar buildings) will encourage students to appreciate cultural buildings more. This in turn will lead students to love the existing local culture more. Students' deeper love for local culture can be seen from the intensity of student attraction, loyalty, concern and appreciation for the existing local culture.

Tourist attractions located in the Watugong Buddhist Temple area consist of physical cultural attractions / buildings and cultural attractions. As for building attractions such as the Avalokitesvara Pagoda, which is a stupa with Chinese characteristics in which there is a statue of bodhisattva Avalokitesvara or commonly known as Dewi Kwan Sie Im Po Sat or Goddess of Compassion; Dharmasala is the core or center building of the Watugong Buddhist Temple complex consisting of 2 (two) floors, where the ground floor is used for a fairly spacious multipurpose hall space, while the second floor is used for religious spaces, such as filial worship, meditation, Bikkhu and samanera

cultivation, and others. The uniqueness of this parking lot can be seen through the shape of the area made to resemble the shape of Plaza Borobudur / Mandala Borobudur Temple, Magelang.

"Goddess Kwan Im, may I ask?" the phrase is often spoken in the ritual of burning incense. The burning of incense should be accompanied by worship according to the religion of someone who wants to ask. The mention of the name, age, and question to be asked is also done in this stage, of course, all of them are spoken in the heart. The ritual continues by throwing Poa Pwee, two semicircular pieces of wood that have two different sides. If poa pwee falls with two different sides, the person throwing it is allowed to continue the ritual. But if the open side is the same, it means that Dewi Kwan Im does not allow him to ask. "Krek.. ccreech. krek..." Loudly there was the sound of bamboo pieces touching each other. The answer to the question asked can be obtained by shaking some bamboo contained in a container. One falling bamboo stick is the answer to the question asked. However, errors are still possible in this stage. So to be sure, you have to ask Dewi Kwan Im again by

throwing Poa Pwee. If the answer obtained is indeed the answer from Dewi Kwan Im, then Poa Pwee will fall by showing two opposite sides. A bamboo stick in a Ciamsi ritual has various meanings expressed by a soft Sanskrit verse. This verse has been translated in Indonesian and has various meanings according to the question asked, both questions about sustenance, age, and soul mate.

Based on the results of the analysis at pretest through the Kolmogorov-Smirnov test with a 5% significance level using SPSS 22, it was found that the significance value of $0.191 > 0.05$ indicates that the samples in the study were normally distributed and through the data of homogeneity test in the output table Test of Homogeneity of Variance with a significance level of 5% obtained that the value of $0.128 > 0.05$ which has the same or homogeneous variance. Thus, it means that the sample comes from the same variance and conditions.

Based on the calculation of student learning outcomes in the experimental and control classes, the results of the quantitative analysis can be summarized in Table 2.

Results of the post-test data obtained from the score of problem-solving ability in the two classes used in the study are presented in Table 3.

Table 2. Results of Quantitative Analysis

Test	tvalue OR Zvalue	ttable OR Ztable	Interpretation
Average test	9.849	1.68	H ₁ accepted
Classical completeness test	2.66	0.3264	H ₁ accepted
Average different test	3.309	1.67	H ₁ accepted

Table 3. Results of Test of Problem Solving Ability

Class	N	Mean	Maximum	Minimum	Complete	Incomplete	Proportion (%)
Experiment	37	86	100	71	35	2	94
Control	37	80	100	66	26	11	70

After the two classes were given a different treatment, then to find out whether the Problem Based Learning (PBL) model based on ethnomathematics is effective on the ability of problem-solving. Then, the final test was given as an evaluation of problem-solving abilities.

After obtaining a different learning that is using Problem-Based Learning (PBL) model based on ethnomathematics for the experimental class, and the learning using the Problem-Based Learning (PBL) model for the control class, it can be seen that the average test results of the problem-solving abilities of the experimental class students was 86, and the control

class was 80.

CONCLUSION

Based on the process of developing teaching materials using modifications to the development of 4-D model devices (*four D models*) that have been carried out, it can be concluded that the process of developing ethnomatematics-based Mathematics teaching materials starts from the defining stage where data is found that most of the teaching materials circulating in the community use content that is less useful regarding culture, so students do not have a broad knowledge of local culture. Teaching materials that have been compiled Draft 1 ethnomatematics-based teaching materials that use local cultural

content in the religious area of Watugong Buddhist Temple. Cultural elements presented in teaching materials include: Other buildings contained in the monastery are Watugong, Tugu Ashoka and Plaza Borobudur. Then the development stage is carried out, namely by expert validation to revise draft 1 into draft 2 and readability test to revise draft 2 into draft 3, namely the teaching material for mathematics learning class IX elementary school based on ethnomatematics that has been tested valid with the average value of lecturer and teacher validators which is 86.36% and the average value of unnes mathematics education student validators is 86%. While the results of students' response to teaching materials are very well used when learning in the classroom. Based on the results of research on Problem-Based

Learning (PBL) model based on ethnomatematics towards the problem solving ability of mathematics learning on the circumferential and flat area or geometry material, it can be concluded that Problem Based

Learning (PBL) model based on ethnomatematics can be effectively used in the learning of mathematics, particularly geometry material. This result is due to several things such as the average score of students' problem solving abilities in the learning using the Problem Based

Learning (PBL) model based on ethnomatematics exceeds the Minimum Completeness Criteria (KKM) with KKM problem solving abilities of 75, the proportion of completeness of problem solving abilities student

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