An Initial Observation for Development of Learning Instruction Based on Ethnomathematic at SMP Pembangunan Padang

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Abstract. Junior high school student learning outcomes are still low, especially problem solving abilities. This happens because the existing equipment does not match the characteristics of students. Good learning instruction will lead students to have good problem solving abilities. Initial observations aim to find, analyze and explain (1) students' mathematical problem solving abilities (2) the conditions of learning tools (LKPD) used and developed by the teacher (3) as a basis for continuing ethnomatematic based development research to develop problem solving abilities of students. This is a descriptive study research with a qualitative approach. The results of the observations made at the UNP Laboratory Development Junior High School, it can be concluded that the learning tools still not connect the material with the environment and student culture, so the learning experienced by students is less meaningful. The LKPD used are still general and does not match the characteristics of students.

Keywords: Ethnomathematic, problem solving, learning tools

1. Introduction
In the era of globalization, humans are required to be individuals who are competitive, able to work together, smart, and wise. Individuals who are able to compete are those who have good problem-solving abilities, have good character and have a noble character. The influence of globalization and modernization also has a negative effect, namely the impact on the depletion of the noble values of the nation and the erosion of national cultural values. As a result, Indonesia as a cultured country is increasingly showing the fading of that culture so that it can cause the Indonesian nation to lose its identity.

Mathematics learning has a very important role for students in the era of globalization and modernization, namely as a tool to equip students with critical, logical, analytical and creative thinking skills. Based on Regulation of teh Ministry of Education and Culture (Permendikbud) No.58 of 2014, there are 8 mathematical abilities that must be mastered by students. One of these abilities is the ability to solve math problems. Problem-solving abilities are very important abilities for students to support their lives in the future, because along with the times and globalization, students are required to become individuals who can solve the problems they face and become individuals who have high competitiveness. In addition, the importance of mathematical problem solving skills is mastered by students because most of the basic components of basic mathematics require students to have problem
solving skills [1]. However, based on observations made at the UNP Laboratory Construction Junior High School, it was found that the students' mathematical problem solving abilities were still low.

According to Rismaini [2], the low ability of students to solve mathematical problems, one of which is caused by the behavior of students who always depend on other people or teachers. Under these conditions, the researcher tries to find a solution to the problem, starting with making preliminary observations and supported with relevant and appropriate theories.

In overcoming the low ability of solving mathematical problems, teachers as facilitators in schools have certainly made various efforts, one of which is by making and using student worksheets which are expected to help and guide students in improving their mathematical problem solving abilities. The student worksheets developed by the teacher was good, but some of it are not suitable for student characteristics. It is better if the problems used in these learning tools use something close to the student's environment such as the culture in the student's environment.

Majid [3] states that Student Activity Sheets (LKS) are sheets that contain instructions to complete a task that students must do. According to Trianto [4] Student Activity Sheets (LKS) are student guides used to carry out investigative or problem-solving activities, whether in the form of guides for cognitive development exercises or guidelines for developing all aspects of learning in the form of experimental or demonstration guides. So, in general the Student Worksheet is a printed media containing guides or steps to guide students in carrying out investigative activities and problem solving that students must do.

Therefore, it is necessary to compile and develop student worksheets (LKPD) which can help students to get meaningful learning and can increase student learning motivation so that learning objectives can be achieved properly. The problems used in learning must be related to culture, so that it will be easy to understand and imagine by students so that they can improve students' mathematical problem solving abilities. It is hoped that the use of problems in the form of culture in the student environment can also instill a love of culture so that later students will be able to understand more better, interpret, appreciate and realize the importance of cultural values in every activity in their life.

One that can bridge between culture and mathematic, especially in mathematics education, ethnomatematics. Ethnomatematics is a teaching method designed to connect learning according to the culture around students. Ethnomatematics-based learning tools (LKPD) are learning tools that are integrated with the culture around students. The problems given in these learning tools are cultures that are close to students.

Before further research was held on the development of ethnomatematic based mathematics learning tools, preliminary observations were made to review the process that occurred in the learning process at the Padang UNP Laboratory Development Junior High School by giving test questions of problem solving abilities and unstructured interviews with mathematics subject teachers regarding students worksheets used by the teacher.

2. Research Methods
This is a descriptive study research with a qualitative approach. The data collection techniques used were observation, semi-structured interviews and documentation which aims to review the learning tools used by the teacher, as well as the ability to solve mathematical problems. Data analysis was carried out by following the steps proposed by Miles & Huberman [5], namely the data reduction stage, the data exposure stage and the conclusion stage. Furthermore, at the decomposition stage the problem were describes by researchers. The conclusions is the result of research that answers the focus of research based on the data analysis, so that the final conclusions can be obtained according to the expected objectives. In this case, the researcher made observations by studying and collecting data and files or events related to learning at the SMP UNP Laboratory Construction, Padang.
3. Result dan Discussion
From the observations conducted at the Laboratory Development Junior High School, data were obtained in the form of learning tools (LKPD) and the results of the students' mathematical problem solving abilities. Based on the preliminary observations that have been made, it seems that students tend to like routine questions. When students are given routine questions, they are enthusiastic about doing them and when given non-routine questions only some students do it seriously. Most of them are lazy to read, let alone understand the questions given. When they don't understand, they tend to do things outside the context of learning with friends beside them. From there we can also see that their curiosity and motivation to solve non-routine problems is still very low. This was supported by the results of observations in the form of a test of mathematical problem solving abilities of students IX in Padang Laboratory Development Junior High School which was conducted in August 2020. The test was conducted in one class with 30 students. To see the mathematical problem solving abilities of the class IX students, several questions were given to test the mathematical problem solving abilities of students with grade material. In the following, the researcher describes one of the mathematical problem-solving abilities that the researcher has provided, namely: "The research team from the Health Office of an area in Eastern Indonesia examined an outbreak that was developing in Village X". The research team found that the developing outbreak was caused by a virus that was developing in China. The results showed that the virus can develop by dividing into 3 viruses every half hour and attacking the immune system. How much virus is in the human body after 6 hours?

Based on the analysis of the preliminary observational data that the researcher conducted on question 1, only 5 out of 30 students answered correctly. In other words, as many as 83.3% of students answered incorrectly. Here are some of the students' answers to the first question:

![Figure 1. Students’ A and B answers for the first question.](image)

From figure 1, the researcher concludes that some indicators of students' problem solving abilities have not been reached, including students who are less able to understand and organize cannot understand problems and organize data and select relevant information in identifying problems with good, because students cannot describe the elements they know correctly and completely. Even though someone has presented the information that is known and asked, they have not been able to meet the next indicator, namely to present the problem mathematically. It can be seen from the students' answers that the problem should be presented in the form of $3$ to the power of $12$, they instead immediately multiply $3$ and $12$. So that when carrying the plan, the students cannot do it properly because they do not understand and organize data on the problem correctly and do not present
problems in mathematical form appropriately. Because the prior indicators were not reached and they did not take the steps to solve the problem correctly, so the further indicators of solving mathematical problems were not fulfilled and caused the low final results obtained by students.

With different questions, it can also be seen that students of SMP UNP Padang Laboratory Development has low mathematical problem solving ability. The following is question 2 that the researcher gave about the rank material.

"In one study, it is known that an amoeba S reproduces by dividing 2 times every 15 minutes.

a. How many S amoebae in one day if in an observation there are 4 S amoebae?
b. What is the initial number of S amoebae so that in 1 hour there is a minimum of 1,000 S amoebae?"

One student's answer is:

![Figure 2. Student A's Answers in Part A Test.](image)

Figure 2 is the student's answer which reveals the low ability of students to solve mathematical problems. From the picture, it can be seen that students have not understood the problem because they have not been able to organize data and identify relevant information in the problem. It can be seen in the picture that students should have answered a lot of bacteria in 1 hour, which is 4 times 2 times 4, but students multiply 2 by 4. So, we can say that the students cannot understand the problem. Likewise students' answers to part b, as seen in Image 3 below:

![Figure 3. Student A's Answers in Part B Test.](image)

Based on the picture of the answer to part b above, it also appears that students do not understand the problem given. So thus, none of the problem solving indicators can be met by students. Overall, in question no 2 only 7 out of 30 students answered correctly. In other words 76.7% of students answered incorrectly. Based on the results and discussion of the 2 problem solving abilities described above by measuring problem solving indicators according to Permendikbud No. 58 of 2014. The indicators of problem-solving abilities used are limited to the indicators of understanding problems, organizing data and selecting relevant information in identifying problem, presents a formulation of a problem systematically in various forms, choosing the right approach and strategy to solve the problem.

The low ability of students to solve mathematical problems at SMP UNP Laboratory Construction can occur because of the influence of the learning tools developed by the teacher. The tools developed by the teacher are good but have not been able to increase student interest and motivation, so that it has an impact on students 'mathematical abilities, especially students' mathematical problem solving abilities. When the observation shows that the teacher has tried to improve the mathematical abilities of students by designing learning tools that facilitate students in the teaching and learning process. However, the problems developed in the learning tools (LKPD) owned by the teacher are still general and not too close to the environment or student culture.
The Student Worksheet used by the teacher contains a summary of the material and practice questions in the form of routine questions and non-routine questions that are less close to the environment and student culture. It would be better if the given LKPD contains problems around students or in accordance with student culture. In addition, the problems given are also expected to be able to support the achievement of indicators from students' mathematical problem solving ecology. Image 4 below is the result of preliminary observations that have been made on class IX teachers in Laboratory Construction Junior High School, namely the sample LKPD and student books used.

From figure 4, it can be seen that the LKPD used shows that the questions used are still not too contextual, let alone related to things that are close to students or close to student culture. The specific approach used in the LKPD is not yet visible. This can affect the interest and motivation of students in the learning process, so that it will affect students' mathematical problem solving abilities and result in low learning outcomes of students.

Meanwhile, based on the results of an interview with one of the mathematics teachers of the UNP Laboratory Development Middle School, it was found that the learning resources used by the teacher were only from printed books published by the Ministry of Education and Culture and there were no teachers who developed LKPD based on the student's environmental conditions or student culture. The LKPD used by the teacher is a collection of questions summarized from several books and the internet. Based on interviews and reviewing the tools used by the teacher, it can be concluded that the tools used by the teacher are still not able to support students to build their own knowledge and the problems used are still not contextual. Therefore, it results in low student ability to solve problems.

The solution to encounter these problems is formulating and developing LKPD that can help teachers and students reach learning objectives. LKPD is also expected to support the implementation of fun and meaningful learning by linking the concept of lessons with real problems in everyday life that are close to the student environment, namely in the form of culture. Therefore, the problems used in learning mathematics must be related to students' real situations, so that students can solve problems completely and improve their mathematical problem solving abilities.

The learning method that can link learning material with everyday life and can facilitate students to have meaningful learning as well as an agent for instilling cultural values is ethnomathematics. Ethno-mathematics is a slice of three disciplinary disciplines, namely, mathematics, cultural anthropology and mathematical modeling [6]. Ethnomatic learning can be divided into 3 types, namely learning about culture, learning with culture, and learning through culture [7]. Ethnomathematics provides the contextual meaning needed for many abstract mathematical concepts, forms of mathematical community activity that are arithmetic operations that are practiced and
developed in society such as ways of adding, subtracting, counting, measuring, determining locations, designing shapes, types games practiced by children and the language spoken [8]. Ethnomathematics has the potential to demonstrate a multicultural view of students' mathematics, as well as to help students develop a greater interest in mathematics [9]. In addition, Ethnomathematics is able to create a useful learning environment in the classroom as well as enable increased student participation and higher levels of cognitive involvement [10]. The main reasons for the use of ethnomathematics in learning are 1) to reduce the assumption that mathematics is final, permanent, observational, and unique 2) to illustrate the intellectual development of various cultures, professions, gender, and others [11]. Learning tools with the nuances of local wisdom (ethnomathematics) are a possible solution to help students understand mathematics and help improve learning outcomes and mathematical abilities of students [12] - [14] and improve students' problem solving abilities [15] - [19].

The problems in the preliminary observations that have been described above will be followed by developing mathematics learning instruction based on ethnomatics to develop students’ problem solving abilities in junior high school.

4. Conclusion
Prior observations made in junior high school revealed that the teacher learning instruction were not integrated with the student environment and culture. So that learning is less meaningful and results in the mathematics problem solving ability of junior high school students in learning is still low. It is necessary to take further action in the form of research on developing mathematics learning tools based on ethno-mathematics to improve students' mathematical problem solving abilities in junior high schools and to instill cultural values in students from an early age.

References
[1] M. L. Nasution, Y. Yerizon, and R. Gusmiyanti, “Students’ Mathematical Problem-Solving Abilities Through the Application of Learning Models Problem Based Learning,” in IOP Conference Series: Materials Science and Engineering, 2018, doi: 10.1088/1757-899X/335/1/012117.
[2] L. Rismaini, “Pengaruh Model Learning Cycle terhadap Kemampuan Pencapaian Masalah Matematis Siswa Kelas VIII SMP,” J. Pelangi, 2016, doi: 10.22202/jp.2016.v9i1.1859.
[3] A. Majid, Perencanaan Pembelajaran Mengembangkan Kompetensi Guru. 2013.
[4] Trianto, “Mendesain Model Pembelajaran Inovatif-Progressif Konsep, Landasan dan Implementasinya pada KTSP,” in Jakarta: Kencana., 2012.
[5] M. B. Miles and A. M. Huberman, Analisis Data Kualitatif Buku Sumber Tentang Metode-Metode Baru (Terjemahan). 2007.
[6] D. Orey and M. Rosa, “Ethnomathematics: cultural assertions and challenges towards pedagogical action.,” vol. 1, 2006.
[7] M. Goldberg, Arts and Learning: An Integrated Approach to Teaching and Learning in Multicultural and Multilingual Settings. 1997.
[8] S. Indriyani, “Ekplorasi Etnomatematika Pada Aksara Lampung,” UNIVERSITAS ISLAM NEGERI RADEN INTAN, 2017.
[9] A. Brandt and E. Chernoff, “The Importance of Ethnomathematics in the Math Class,” no. 71, pp. 31–36, 2015.
[10] C. Stathopoulou, P. Kotarinou, and P. Appelbaum, “Ethnomathematical research and drama in education techniques: developing a dialogue in a geometry class of 10th grade students,” Rev. Latinoam. Etnomatemaática, vol. 8, no. 2, pp. 105–135, 2015.
[11] M. A. Sunandar, “Pembelajaran Matematika SMK Bernuansa Etnomatematika,” 2016, pp. 95–105.
[12] Z. Wijayanto, “Pengembangan Perangkat Pembelajaran Matematika Berbasis Etnomatematika Pada Keraton Yogyakarta,” *SOSIOHUMANIORA J. Ilm. Ilmu Sos. dan Hum.*, vol. 3, no. 1, 2017, doi: 10.30738/sosio.v3i1.1527.

[13] M. Yulianti, Marsigit, and E. Retnowati, “Pengembangan perangkat pembelajaran berbasis etnomatematika dengan pendekatan saintifik untuk pembelajaran matematika pada materi geometri smk bidang teknolgi,” *Univ. Negeri Yogyakarta*, 2016.

[14] Marsigit, D. S. Setiana, and S. Hardiarti, “Pengembangan Pembelajaran Matematika Berbasis Etnomatematika,” *Jurnal UNY Prosiding Seminar Nasional Etnomatnesia*. pp. 1–38, 2018.

[15] N. Cahyaningrum and Y. Sukestiyarno, “PEMBELAJARAN REACT BERBANTUAN MODUL ETNOMATEMATIKA MENINGKATKAN KEMAMPUAN PEMECAHAN MASALAH Abstrak,” *Unnes J. Math. Educ. Res.*, vol. 5, no. 1, pp. 50–59, 2016.

[16] S. M. Kiptiyah, “Model PBL Berbasis Etnomatematika Berbantuan ICT untuk Meningkatkan Kemampuan Pemecahan Masalah Siswa Kelas VII Materi Bangun Datar,” pp. 273–279, 2016.

[17] M. Ratuanik and F. Nay, “Study of Project Based Learning With Scientific Approach of Ethnomathematic To Improve Problem,” *Proc. 2017 Int. Conf. Res. Educ. - Sanata Dharma Univ.*, pp. 241–256, 2017.

[18] R. E. Utami, A. A. Nugroho, I. Dwijyanti, and A. Sukarno, “Pengembangan E-Modul Berbasis Etnomatematika Untuk Meningkatkan Kemampuan Pemecahan Masalah,” *JNPM (Jurnal Nas. Pendidik. Mat.*), vol. 2, no. 2, p. 268, 2018, doi: 10.33603/jnpm.v2i2.1458.

[19] W. Widada, D. Herawaty, and A. N. M. T. Lubis, “Realistic mathematics learning based on the ethnomathematics in Bengkulu to improve students’ cognitive level,” *J. Phys. Conf. Ser.*, vol. 1088, 2018, doi: 10.1088/1742-6596/1088/1/012028.