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The Analysis of Mathematical Literacy Skill and Respect to Local Culture toward Pogil Learning with Ethnomathematics

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Abstract

The objective of this study is to determine the effectiveness of POGIL learning with ethnomathematics towards students' mathematical literacy skills. The population in this study were X graders students of State Senior High School 6 Cirebon in the academic year of 2015/2016. This study used quantitative methods. The sample was chosen by random sampling and it was obtained the class of X 1 as a control class with conventional learning and X 2 as an experiment class with POGIL model learning with ethnomathematics. The data collection methods were tests of mathematical literacy skills. The data analysis used was completeness test and average difference test. The results show that (1) the average mathematical literacy skill in POGIL learning with ethnomathematics has achieved classical completeness, it is at least 75% of students achieve a minimum score of 70; (2) the average class of mathematics literacy ability in POGIL learning with ethnomathematics is better than conventional learning class. From these results, it is said that POGIL learning with ethnomathematics is effective.

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INTRODUCTION

The development of human resources in a nation has a contribution to the progress of the nation. A developed nation is a nation that is supported by quality resources and can generate various creativity to support the development of the nation, but based on an international survey, it is generally known that Indonesia's human resource competitiveness is still relatively low compared to other countries. Based on the report of the Human Development Index (HDI) level report in 2010 UNDP (United Nations Development Program), Indonesia's HDI value was 0.600 and only ranked 108 of the 169 countries examined (Klugman 2010: 154). Seeing from the results of the survey above, it needs to be conducted a real effort to improve the quality of human resources so that we are not far behind other countries, one of the ways is through education.

Trends International Mathematics and Science Study (TIMSS) is a mathematics and science learning achievement assessment held every 4 years by The International for Evaluation Achievement (IEA) based in Amsterdam, the Netherlands. The mathematical skill of Indonesian students based on the TIMSS test results is still low compared to other countries. In TIMSS 2003, Indonesia was ranked 35th out of 46 countries. Whereas in 2007, Indonesia was ranked 36th out of 49 countries. The results of TIMSS in 2011 show that Indonesia's achievements are getting worse, it is the 39th rank out of 46 participating countries (IEA 2012).

The PISA survey was conducted to measure the skill of 15-year-olds in mathematics literacy, and natural science that had been conducted three periods by the OECD (Shiel 2007: 1). The purpose of PISA is to find out the child's skill to use the skills and abilities they have learned in the school in living their daily lives in a globally challenging era (Stacey 2011). Indonesia participated in the three research periods. The first in 2000 was followed by 41 countries, Indonesia ranked 39th on mathematical skills. Second, in 2003 it was attended by 40 countries, Indonesia ranked 38th in mathematical skills. Third, in 2006 followed by 57 countries, Indonesia ranked 50th in the field of mathematics. Fourth, in 2009 followed by 65 countries, Indonesia was ranked 61st in mathematics. Fifth, in 2012 followed by 65 countries, Indonesia ranked 64th in the mathematics field (OECD 2014). With regard to mathematical literacy, Indonesia's position is still relatively low.

The previous studies show that more than 50% of students do not have the skill to analyze, gather information, and make conclusions, while on the other hand, the skill to analyze, gather information, choose strategies, and make conclusions are fundamental factors in the process of solving a problem. One of the factors causing low PISA results is the habit of students in contextual problem-solving. Problems in school are generally different from PISA questions that use contextual problems (Lutfianto et al. 2013). According to Wardono & Kurniasih (2015) the ability of Indonesian students to solve questions that require the ability to study, reason, communicate effectively, and solve and interpret problems in various situations is still very low.

Generally, the students in Indonesia are less trained to solve problems with characteristics such as PISA questions that have contextual substance, demanding reasoning, argumentation, and creativity in solving them (Juhrani 2017). The learning results assessment instruments designed by mathematics teachers are generally less associated with the life context faced by students and less facilitate students in expressing the process of thinking and arguing. Therefore, this is not in line with the criteria for PISA questions.

Mathematical questions in the PISA study measure more mathematical literacy, they are the skill to reason, argue, and mathematical literacy rather than questions that measure raw technical skills related to memory and calculations. There are 3 major components in the PISA study, they are (1) the content component in the PISA study is interpreted as the content or subject matter or mathematical subject learned in school. (2) Process components in the PISA study are interpreted as things or steps a person can solve a problem can be solved, (3) the context component in the PISA study is interpreted as a situation illustrated in a problem (OECD, 2010).

Mathematical literacy in PISA is defined as the skill of individuals to identify and understand the role of mathematics in the world and use mathematics in relation to the demands of life (Thomson, et al., 2013). Ojose (2011) defines literacy as knowledge to know and apply basic mathematics in our daily lives. The definition of mathematical literacy in the PISA

mathematical framework 2015 by OECD (2013) and Stacey (2012), mathematical literacy is (1) one's skill to formulate, employ, and interpret (interpret) mathematics in various contexts which are then called as the skill to process mathematics, (2) the use of mathematical reasoning and concepts, procedures, facts, and mathematical tools to describe, explain, predict phenomena, and (3) mathematical literacy can help a person to apply mathematics to the everyday life. According to Kaiser and Willander (2005), mathematical literacy is the skill to apply the knowledge and skills acquired in the schools to solve mathematical problems in various situations in real life.

The existence of learning difficulties, especially in the low ability of mathematical literacy because the students are not able to associate between new knowledge and other knowledge so that it makes misunderstanding or obscurity of a lesson. The symptoms of learning difficulties will appear when the students are no longer able to concentrate, most students get low grades, students show apathy, and most students do not master the material that the teacher has conveyed (Cahyono, et al. 2012: 1).

According to Wardono (2014), to develop students' literacy skills, a mathematics learning approach is needed that can foster literacy skills. Process Oriented Guided Inquiry Learning (POGIL) is a learning model that can provide opportunities for students to interact, appreciate, and construct their own knowledge. Self-construction of knowledge makes the process of storing knowledge memory that students take longer and can develop their thinking skills (Juhrani 2017).

The worksheets provided for POGIL learning develop high thinking and metacognition skills, communication, collaboration, and assessment (Zawadzki 2009). In line with that, Jhonson (2011) revealed that students who experience the POGIL learning model are not only master the concept but also have high-level thinking.

In its implementation, POGIL is based on five key ideas about learning that is obtained from the results of the research in cognitive science (Bransford, Brown, & Cocking 2000). In that study, it is concluded, students will learn by: (1) constructing their understanding based on prior knowledge, experience, skills, attitudes, and beliefs, (2) following a learning cycle that includes exploration of concept formation and application, (3) connecting and depicting concepts, (4) discussing and interacting with others, (5) reflecting on the developments and assessments on actions.

Mathematical learning must begin with the extraction of informal knowledge that students have absorbed from the lives of the people around their homes because mathematics grows from skills or cultural environmental activities (Bishop 1994) so that one's mathematics is influenced by its cultural background (Pinxten 1994

Several problems that are found in the students' living environment can be raised as learning problems to find solutions. Moreover, the characteristics and culture of an attractive environment will be developed as learning content (Geni 2017). It is very important that the mathematical concepts contained in cultures are now being explored so that the concept can help students in studying mathematics in the school. Cultural results such as crafts, weaving, historical buildings, dances, games can be used in mathematics learning.

Ethnomathematics that combines mathematics with culture will have a dual function if it is applied in the learning, in addition, to make the students easier to understand the subject matter can also assess the values contained in their culture. Through mathematics learning based on ethnomathematics, the teacher can study the cultures that are in the student's environment and then examine the values that exist in the culture. So, it is expected that the students do not only understand mathematics but they are more respect towards their cultures and can take the values that effect on the formation of the character of the nation which is currently being erased by the influence of modernization. This emphasis on cultural values is very important to be done by the teacher. The emphasis is on how these cultural values can be accustomed to learning so that students will become accustomed to apply these cultural values.

Based on the description of the problem, it can be concluded that the mathematical literacy skill is very important to deal with real life problems, because mathematical literacy is very closely related to its work and tasks in daily life (Stacey 2012). Besides, the life skills are also important as a stock to survive in modern life. From seeing the low cases of students

'mathematical literacy in Indonesia, especially in State Senior High School 6 Cirebon, an effort is needed to improve students' mathematical literacy skills. The efforts that can be made are conducting an innovation in the mathematics learning

From what is described, the researcher intends to conduct a research entitled The Analysis of Mathematical Literacy Skill and Respect to Local Culture toward Pogil Learning with Ethnomathematics. In this study, the researcher will look at the effectiveness of POGIL with Ethnomatics

METHOD

This research was a quantitative research type. The quantitative research methods can be interpreted as research methods based on the philosophy of positivism, used to examine certain populations or samples, the sampling techniques were generally done randomly, the data collection was by using research instruments, the data analysis was quantitative /statistical with the purpose of testing the hypothesis that has been established (Sugiyono, 2012: 14). In this study, the researcher gave a treatment by using POGIL learning with ethnomathematics in the experiment class and conventional learning in the control class.

The study was conducted at State Senior High School 6 Cirebon in the academic year of 2015/2016. The population in this study were X graders students with research samples of X1 class, and X2 class. The sampling in this study was conducted by cluster random sampling technique with X1 class as a control class, and X2 class as an experiment class. The statistical tests are used to find out the classical completeness of the mathematics literacy skill test by using the right-tail proportion test (z test) and the difference in the average score of mathematical literacy skills by using the t-test.

The data collection methods in this study were written test methods. The test was a tool or procedure used to find out or measure something in a nuance, by means and rules that have been determined (Arikunto, 2013: 67). The instrument used in this study was a mathematical literacy test questions. Before the test was used, first, it was conducted the try-out of the mathematical literacy skills test questions and then it was tested for the validity, reliability test, difficulty level, and discriminating power. Then the questions that fulfill the criteria were taken.

The data processing stage included the activities of processing the test scores of mathematical literacy skills, analyzing, and discussing the results of processing research data, and drawing conclusions based on the results of the research obtained to answer the formulation of research problems. The analysis of test results data was conducted to determine the effectiveness of POGIL learning with ethnomathematics, they are if (1) the average of mathematical literacy skill in POGIL learning with ethnomathematics achieved classical completeness , it was at least 80% of students with a minimum score of 70, (2) average of mathematical literacy skill in the class which was treated by POGIL learning with ethnomathematics is better than conventional learning class. The criteria are determined that at least 75% of students participate in learning achieve certain criteria (KKM), learning for the next competency is continued. This limitation is a minimal limitation, assuming that student incompleteness exceeding 25% will burden the teacher in doing remedial teaching or corrective learning (Masrukan 2014).

RESULT AND DISCUSSION

Result

Based on the results of the tests of mathematical literacy skills, the completeness test, and the average difference test. The classical completeness test is conducted to find out the proportion of students who fulfill Minimum Mastery Criteria. Based on the results of calculating the completeness of learning in the class with POGIL learning with ethnomathematic by using the right-side proportion test, it is obtained that $z_{count} = 2{,}91$. $Z_{table} = Z0, 45 = 1.64$ is obtained. Because $Z_{count} > Z_{table}$, Ho is rejected and H1 is accepted (Sukestiyarno, 2013: 119). So, based on the results of the study, it can be concluded that the students' literacy skills in the class with POGIL learning with ethnomathematics that have reached the minimum completeness criteria are 70, it reaches more than 80%.

The average difference test is carried out to find out which class is better in their mathematical literacy skills between classes that use POGIL learning models with ethnomathematics or classes that use conventional learning. The average difference test used is the t-test.

In the SPSS output, the Independent Sample Test table in the column t-test for Equality of Means and equal variance assumed row, it can be seen in the sig (2-tailed) value = 0,000 <0.05. Thus H_0 is rejected, which means the average literacy skill between students with the POGIL model learning with ethnomathematics is better than students which are using the conventional learning.

Discussion

Based on the results of the completeness test and the average difference test, it is found that with the application of the POGIL learning model with ethnomathematics, the students can achieve mastery learning and the average of the students' mathematical literacy skill is better than the class which is using conventional learning.

There are differences in the students' mathematical literacy skills in both classes because of differences in treatment or implementation of learning in the two classes. The learning activities in the POGIL class with ethnomathematics are more interactive because in the learning process the students are involved in the process of concept formation. The students are directed in finding a basic mathematical concept through the Student Worksheet, then presenting the material in front of the class. The learning activities are conducted through group discussions with teachers as a class discussion companion. This makes students more enthusiastic. The cooperation in groups gives the opportunity for each student to actively exchange opinions in the process of constructing a concept (Afiati 2012). In the learning process, the material presented with ethnomathematics, it is a cultural context in the students' living environment, so that the implementation of mathematics is very close to the students.

POGIL learning model with ethnomathematics facilitates students in finding basic concepts or in solving a mathematical problem, the students do not necessarily independently find and even solve a problem, however, with their group, the students are directed step by step in finding a basic concept or even solving a mathematical problem through Students' Worksheet and through teacher guidance. This is in line with Kartono's (2010) statement that students are given the freedom to construct thoughts and findings during activities so that students do themselves without burden, fun and high motivation. The students have more time to discuss and work on mathematical literacy questions.

In the conventional learning, it is still teacher-centered. This makes learning less attractive, therefore, the students are less enthusiastic in the learning, the students are less actively involved in the learning so that their creativity to bring new ideas in problem-solving is still low (Suryati 2013). Sanjaya (2011) added that in conventional learning, the students are not required to find the material, as if the subject matter has already been made. This will limit students to reasoning on a mathematical concept.

The mathematical literacy skill in the POGIL learning model with ethnomathematics can improve because the students are given the opportunity to work together to build understanding and knowledge. In addition, the learning with ethnomathematics will help the students to understand mathematics in their daily applications (Hartoyo 2012). The following is one of the results of the work of students of high local cultural characters in answering TKLM questions.

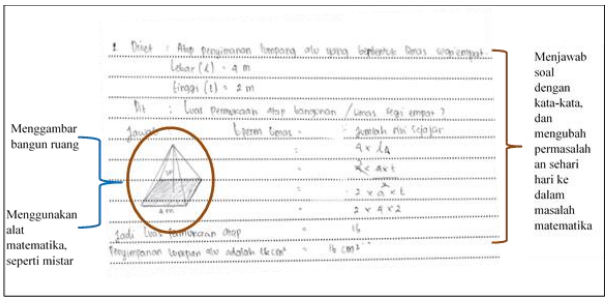

Figure 1. The results of students' work on local cultural characters are high at TKLM number 1

In the POGIL learning model with ethnomathematics, the students work and learn together in a learning team, hence, they will learn more, understand more, and remember more, and they have better feelings about themselves, class, and class climate. The students more often practice working on mathematics literacy questions both individually and in discussion groups. The following

is one of the results of the work of the students of the local cultural character who are answering the TKLM questions.

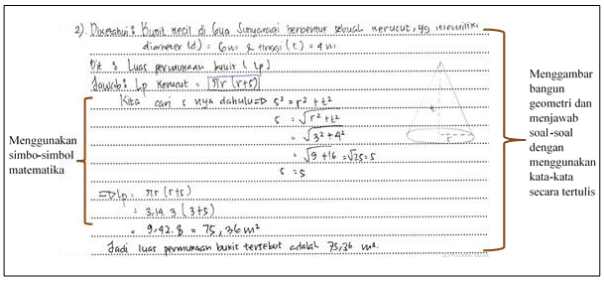

Figure 2. The results of the work of local cultural character students are at TKLM number 2

Mathematical literacy skills in the POGIL learning model with ethnomathematics can be improved through rediscovering mathematical concepts. The principle of rediscovering means that the students are given the opportunity to discover their own mathematical concepts by solving various contextual questions. Based on the questions given, the students build a model of a problem situation then compile a mathematical model for completing to get formal knowledge of mathematics. The following is one of the results of the work of students of low local cultural characters in answering TKLM questions.

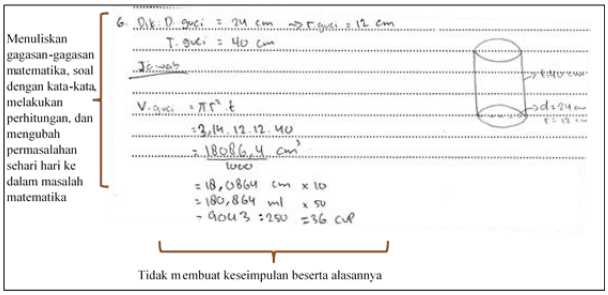

Figure 3. The results of students' work on local cultural characters are low at TKLM number 6

CONCLUSION

Based on the results of the study and discussion of the analysis of mathematical literacy skills in the POGIL learning model with ethnomathematics, it can be concluded that: the average of mathematics literacy skill in the POGIL learning with ethnomathematics has achieved classical completeness, it is the minimum of 80% of students with a minimum score of 70; (2) the class average of mathematical literacy skill in POGIL learning with ethnomathematics is better than conventional learning class. From these results, it is said that POGIL learning with ethnomathematics is effective.

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