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Problem Solving Ability Through E- Learning With Pbl of Ethnomathematics Reviewed From Student Character In Primary School

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Abstract

The objectives of this study were to 1) determine the effectiveness of the PBL-ethnomatematics online learning model in improving students' mathematical problem-solving abilities, 2) to describe the mathematical problem-solving abilities of students using PBL-ethnomatics online learning reviewed from the student character. The research method used in this study was a mixed method with a sequential explanatory design. The data collection technique was done by using problem solving ability tests, observation, interviews, questionnaires and documentation. The quantitative research was analyzed by using the t test. The results showed that (a) the average of mathematical problem solving ability in the class with PBL-ethnomatics online learning was more than the a minimum completeness criteria of 68, (b) the mathematics problem solving ability of sudents with PBL-ethnomatematics online learning had reached 75% classical completeness, (c) the average ability of mathematical problems solving with PBL-ethnomathematics online learning is better than the average ability of mathematical problems solving with PBL online learning. Based on the analysis of mathematical problem-solving abilities reviewed from student character, the following results were obtained: concluded that students who have a disciplined character are better at solving problems than students who have a character of environmental care.

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INTRODUCTION

The development of information technology in the digital era has greatly influenced the existing learning system, as indicated by the shift in the learning from the teacher centered learning to the student centered learning. Education is an important aspect in human life and with the existence of education, humans will be more focused on becoming a human being who has good noble character and fostering a personality in accordance with the values that have been stated in the society and culture. Qualified education will create a change in life, to grow quality people who can later be useful for the country and the nation.

Technology in education is an integration of various information and communication technologies to increase the capacity of a smoother learning environment (Azzam, 2020). The system listens to the explanation of teacher in front of the class and carries out assignments if the teacher provides practice questions to students. In addition, the impact of the corona virus disease 2019 (Covid-19) outbreak cannot be separated from the world of education, including in the world of primary education. The obligation of teachers who must continue to teach in any condition, then the online model is one of the solution for the situation (Lange & Costley, 2020).

Ansari & Khan (2020) stated that education does not occur in the space between the teacher's mouth and the ears of students, but education occurs in the inner space of each other's brains. This means learning can be done anywhere, anytime and by anyone. One of the lessons that can be done with current conditions is an online model. According to Adhe (2018) the purpose of online learning is to provide qualified online learning services that are massive and open to reach more and wider enthusiasts. Certainly, this impact is a positive thing for teachers to keep up with the era of digital.

Mathematical problem solving skills as one of the learning skills in the 21st century are also very important for students to have (Zahroh, Parno, & Mufti, 2018). These skills can help students to cope with the rapid changes in the society that are supported by technological advances (Azizah, 2018). One of the advantages of problems solving in mathematics, are: connecting teaching with everyday life, able to stimulate the intellectual abilities and thinking power of students (Kurino, 2018).

Unfortunatelny, mathematics is still considered a very difficult subject to learn, less useful for everyday life and one of the most terrifying subjects. This opinion arises since most teachers only tell students to do practice questions continuously without being balanced with the correct mathematical problem-solving skills in delivering the subject matter. Several studies conducted in Indonesia have yielded information that the ability to solve math problems is still low.

The results of research conducted by Wiguna, Widiana & Sudana (2016) concluded that learning outcomes using mathematical problem solving abilities were not satisfactory, around 30.67% of the ideal score. Fitriani, Milama & Irwandi (2017) the results of the study used a small test on mathematical problem solving abilities, there were 18 students out of 40 students who still experienced similar difficulties. Research by Prabawa & Zaenuri's (2017) proved that the ability to solve mathematical problems in Wates area has not met expectations; students are less able to master the concept of mathematical notation and classify ideas to perform the mathematical problem-solving abilities.

Setiyadi, Zaenuri & Mulyono (2018) state that mathematical problem solving skills can be trained through a mathematics learning process that is followed by students and this process will certainly present a context in the form of mathematical problems. Geni & Hidayah (2017) states that mathematical problem solving skills are situations where students use mathematical knowledge and reasoning to solve problems. Murniati, Mulyono & Kharis (2017) stated that problem-based learning is active, integrated, and interrelated in problem-based learning. Students work in small groups and share responsibility for learning together.

Setiyadi, Zaenuri, & Mulyono (2018) Polya describes four steps to solve mathematical

problem solving in detail, including: 1) understanding the problem, 2) making problem solving plans, 3) implementing problem solving plans, 4) looking for (checking) again the problem solving. This does not rule out the possibility that the learning model can be used to improve students' mathematical problem solving abilities.

Agustina (2017) states that the PBL model is a good learning model to improve the learning outcomes in math problem solving abilities. PBL is an innovative learning model that is applied to develop the thinking skills of students in solving a problem (Nugraha, Suyitno & Sulilaningsih, 2017). PBL learning provides opportunities for students to work in groups or individually to identify what is known and learn to solve math problems (Fatchurrohmah, Sarwi & Utsman, 2017).

Setiyadi, Zaenuri, & Mulyono (2018) the steps of the PBL learning model, are (1) orienting students to problems, (2) organizing students to learn, (3) guiding individual and group investigations, (4) developing and presenting work, and (5) analyzing and evaluating the problem-solving process.

According to Amalia, Widodo & Ami (2018), mathematics is a branch of science that has a close bond in life in the environment around students, besides that there are many objects that can be related to mathematics learning that can be used as examples to be applied in the classroom. According to Noor & Mulyono (2017) mathematics is a tool for developing ways of thinking, is abstract, reasoning is deductive and deals with structured ideas whose relationships are arranged logically.

Mathematics is still considered a subject that is very difficult to learn, less useful for everyday life and a scary subject. This opinion arises since most teachers only tell students to do practice questions continuously without being balanced with the correct problem-solving skills in delivering the subject matter.

Various ways can be used in conveying mathematics material, one of which is the culture in the students' own environment. Learning from a problem in the environment will make students better understand the solutions used to overcome the problem. This is related to culture-based mathematics which is called ethnomatematics.

Ethnomatematics is mathematics that grows and develops in certain cultures (Geni & Hidayah, 2017). This culture refers to a set of general norms or rules that applied in the society, the beliefs and values that are recognized by groups of people who are in the same ethnic group or national group, which are embedded early in students. The form of cultural results is not only the norms or rules that apply in the society, one of which is the historical building used which is located in a certain area and is a legacy of colonialism.

Shirley in Marsigit (2016) argues that currently the field of ethnomatematics, namely mathematics that grows and develops in society and is in accordance with local culture, can be used as a center for the learning process and teaching methods, although it is still relatively new in the world of education. According to Darmayasa (2018), ethno-mathematics learning in mathematics education is essentially a social and cultural activity with a mission to equip young people with the ability to think logically. Hardiarti (2017) states that mathematics and culture are something that cannot be avoided in everyday life, since culture is a complete and comprehensive unity, applies in a society while mathematics is knowledge that humans use in solving daily problems.

The location of the school in the middle of the city of Semarang which is filled with modern life makes students live well. Modern life has eroded several cultural aspects in the city of Semarang. One of them is the historical buildings and places such as Lawang Sewu, Semarang Post Office, and Simpang Lima. The following Figure 1 shows the Semarang City Lawang Sewu, Figure 2 shows the Semarang City Post Office and Figure 3 shows the Semarang City Simpang Lima.

Figure 1. Lawang Sewu Semarang City

Figure 2. Post Office Semarang City

Figure 3. Simpang Lima Semarang City

The results of interviews of students in grade V SD Negeri Karangtempel about historical places resulted in several statements, such as 1) Students were only limited to knowing the location of historical places, without understanding the history of the old building. 2) Students think of it as a place of recreation without understanding the shape and function of the historical buildings. 3) Students are more interested in more modern places such as supermarkets and restaurants. This proves that students are less interested in culture and historical places in the city of Semarang. Therefore, there is a need for online PBL-ethnomatematics learning to foster a sense of keeping and preserving culture in the city of Semarang.

SD Negeri Karangtempel as an experimental class is one of the schools that has implemented the Character Education Strengthening System (PPK) in the city of Semarang. The characters that are highlighted are discipline and care for the environment. According to Marzuki (2017) discipline is an important character that must be familiarized with students in various ways and is facilitated by rules and continuously motivated. Discipline can help teachers build the trusting relationships necessary for all students to learn and develop their academic and moral abilities.

According to Tarmidzi & Sugiarti (2019), the character of caring for the environment is an attitude and action that seeks to prevent damage to the natural surroundings and develop efforts to repair the natural damage that has occurred. Based on observations of the application of character in SD Negeri Karangtempel, it was carried out by rewarding students who have outstanding achievement by giving them a pin from the teacher. The character of discipline was evidenced by participating in the flag ceremony every Monday and Saturday, holding a joint rally. The ceremonial officers always took turns starting from grade IV to grade VI and every time they entered the class, the students had to line up first.

The definition of caring for the environment is the attitude and actions that always try to prevent damage to the natural environment around it, and develop efforts to repair natural damage that has occurred. The application of the character of caring for the environment in schools such as 1) At the beginning of the school year each student brings one ornamental plant. 2) Every Friday, clean Friday activities are held. 3) Students have responsibility for the plants in the school. 4) The class picket team always checks the cleanliness of the classroom and school grounds.

Desfandi (2016), in his research produced activities in schools such as planting and caring for plants, sorting and disposing of waste, saving water, electricity and paper usage. Each character

in the students certainly has an impact on how to learn and solve problems in their daily life. Therefore, it is necessary for conducting research on problem-solving abilities reviewed from the student character, like discipline and care for the environment.

The purpose of this study were to 1) determine the effectiveness of the PBL-ethnomatematics online learning model in improving the problem-solving abilities of students, 2) to describe the problem-solving abilities through PBL-ethnomatics online learning reviewed from the character of discipline and care for the environment.

The benefit of this research is that the results of this research become a scientific study to develop theories and concepts related to problem-solving skills through PBL-ethnomatics online learning reviewed from the character of the discipline and care for the environment.

METHODS

This study used a mixed method research method with a sequential explanatory design. The population used in this study were the fifth grade students in Anggrek Cluster in Semarang City, and the selected samples were SDN Karangtempel and SD Negeri Bugangan 01 in the 2020/2021 academic year. Sampling in this study was conducted by using simple random sampling. The data collection technique was carried out by using tests of problem-solving abilities, observation, interviews, student character questionnaires and documentation. The quantitative research used was a quasi experimental design. The design chosen was the pretest-posttest control design and there were two groups randomly selected which are presented in Table 1.

Table 1. Design of the Study

Grade	Treatment		
Experimental Class	T1	Online Learning with PBL ethnomatematics	T2
Control Class	T1	Online Learning with PBL	T2

Explanations:

T1 : Pretest Problem Solving Ability.

T2 : Postest Problem Solving Ability.

The next stage is the prerequisite test results, it can be seen in Table 2.

Table 2. Result of Prerequisite Test

Prerequisite Test	Score	Sig.	Int.
Normality Test	0.168	0.05	Data is normally distributed
Homogeneity Test	0.200	0.05	Data is homogeneus
Average Similarity Test	0.601	0.05	Population has the same ability

RESULTS AND DISCUSSION

The final data on the score of the problem-solving ability of the two classes from the experimental class and the control class can be seen in Table 3.

Table 3. Results of Mathematical Problem Solving Ability

Grade	N	Mean	Max	Min	Completed
E	33	87.36	100	73	100%
K	33	78.28	100	67	100%

Explanations:
E : Experiment
K : Control

Based on the results of Table 3, it can be concluded that the two classes completed 100%, and the average for the experimental class was 87.36, and the average for the control class was 78.28. Then the results of quantitative research analysis can be seen in Table 4.

Table 4. Results of Quantitative Analysis

Test	Sig. 2 tailed/ z_{count}	$\boldsymbol{\alpha = 0,05}$ / z_{table}	Info
Average Test	0.000	0.05	$\boldsymbol{H_0}$ Rejected
Classical Completeness Test	$\mathbf{3,316}$	0.3264	$\boldsymbol{H_0}$ Rejected
Average Different Test	0.000	0.05	$\boldsymbol{H_0}$ Rejected

Based on Table 4, it can be described as follows. (1) The average test in the class using the online learning with PBL-ethnomatic model has an average of 87.36 with a minimum completeness criteria of 68 showing a significance value of 0.000 <0.05, this means that H0 is rejected, which means that the average ability to solve the mathematical problems using online learning with PBL ethnomatematics is more than minimum completeness criteria, namely 68. (2) Classical completeness test shows = 3.316. Rejection area H0 = zcount ≥ (0.5-0.05).

Based on the zvalue of the standard normal distribution list, it can be concluded that 3.316> 0.3264, then H0 is rejected, which means that the mathematical problems solving ability using online learning with PBL ethno-mathematical nuances has reached 75% classical completeness. (3) The results of the average difference test using the independent sample t-test with a significance of 0.05 in the table independent sample test column sig. (2-tailed) of 0.001 <0.05, this means that H0 is rejected, meaning that the average mathematical problems solving ability using online learning with PBL ethno-mathematical nuances is better than the average of mathematical problem solving ability using PBL online learning.

Based on the results above, it can be concluded that: (1) the ability to solve math problems in classes using online learning with PBL-ethnomatics is more than the minimum completeness criteria of 68. (2) the ability to solve mathematical problems using the online learning with PBL-ethnomatic model has reached 75% classical completeness (3) the ability to solve mathematical problems using online learning with PBL ethno-mathematics is better than the ability to solve mathematical problems using the online learning with PBL model, therefore, it can be concluded that the online learning with PBL-ethnomatics model is effective in improving the mathematical problem solving abilities of students.

The effectiveness of the online PBL-ethnomatematics model in improving mathematical problem solving abilities, students in solving problems not only answering problems, but also re-checking what students have answered so that they can get the right answer based on the correct concept. Murniati, Mulyono & Kharis (2017) stated that the approach to solving mathematical problems, students are required to identify mathematical problems, be able to analyze a problem contained in the problem solving process, and in the end students are able to apply the concepts that have been obtained to other cases or examples, including activity of completing the practice questions.

Learning is done online with a Microsoft Sway application and Google Classroom. Kuntarto (2017) states that online learning is learning that brings together students and teachers in cyberspace using internet technology and networks. Ardian, Hasanah & Rana (2020) stated that the sway application is not software that must be installed on a computer or laptop device but is a web-based application. Based on the observation sheet, the teacher has carried out learning in accordance with the steps of the PBL-ethnomathematic online model. Learning begins with a pre test of the material of "scale". The learning is carried out slowly because the stimulation of problem-solving abilities has never been done in the classroom. Students still feel awkward, since the teaching materials used are different and need adaptation to understand them. Ardian, Hasanah & Rana (2020), one of the obstacles faced when online learning is that students are unable to use applications used by teachers to provide the learning material online.

At this stage, students understand problem solving in Microsoft Sway with the material on understanding scales and plans. Students are introduced to ethnomatematics in the form of buildings in the City of Semarang such as Lawang Sewu, the Post Office and Simpang Lima. This makes students interested since the Microsoft Sway used is easy to use and students are enthusiastic about learning the material.

Various difficulties arise, such as the unpreparedness of students in the activity 2, material of calculating the scale on a map or plan, such as students find it difficult to imagine problems into the mathematical sentences, and students find it difficult to check the correctness of their answers. The alternative that the teacher did was by giving students the opportunity to ask their parents or older siblings or by asking the teacher, in this case the researcher through google classroom.

The material presented was calculating the distance with a scale. Before students work on activity 3, students were given the opportunity to understand the video about Lawang Sewu for 15 minutes. The purpose of understanding the video about Lawang Sewu is to provide motivation for students to be ready for the learning. Sudarmoyo (2018) states that by adding text, images, documents, videos, charts, or other types of content, sway will make it look good in a few easy steps. Activity 3 was given to each group by containing the problem, namely calculating the distance on a scale.

Students begin to get used to the steps of problem solving; there were some students who are correct in applying step four of their mathematical problem-solving abilities. The average score of learning also increased from the second meeting so that the third meeting of students was easier in accepting the concept of the material since the researcher gave an ethnomatic video in the form of a building packaged in the Microsoft Sway to be used in the material. Activity 4 and work on problem-solving problems according to Polya's steps. In the last 30 minutes, a post test was conducted to measure the success of the online learning with PBL ethnomatematics.

The effectiveness of online PBL with ethno-mathematical nuances in improving problem-solving abilities, students in solving problems not only answering problems, but also re-checking what students have answered so that they can get the right answer based on the correct concept. This needs to be done to ensure that the correctness of answers written, and students can understand and solve the problems faced in everyday life.

Shanti & Agus (2016), stated that the problem-solving ability approach, students are required to identify mathematical problems, be able to analyze a problem contained in the problem-solving process, and in the end students are able to apply the concepts that have been obtained to other cases or examples, including the activity in completing the practice questions. The PBL-ethnomatics online learning process is important since students will learn the problems they encounter every day, like some ethnomatics videos in the form of snacks packaged in Microsoft Sway which will be used in the material. The results of problem solving abilities reviewed from the student character can be seen in Table 4.

Table 4. Results of math problem solving abilities reviewed from student character

No	Character	Stages PBA			
		1	2	3	4
1	D	A	A	A	A
2	PL	A	A	A	NA

Explanation:
D: Dicipline
PL : Environmental Care
A: Able
NA : Not Able
PBA : Problem Solving Ability

Based on Table 4, it can be concluded as that; the first stage in the mathematical problem-solving skills is the understanding of the problem. The experimental class used microsft sway with ethnomatematic nuances, such as videos about Lawang Sewu, the Post Office, and Simpang Lima. This stage is an introduction to the understanding about the typical buildings of the City of Semarang. This attracts the attention of students, since the microsft sway is easy to use and attracts students' attention, causing students to be active in asking questions about information that they do not already know.

Dewi, Khoiri & Kaltsum (2017), state that the process of solving math problems helps students integrate the knowledge they have previously acquired with the problems or information obtained to be able to offer various alternative solutions. Different conditions experienced by the control class. Teacher assistance in providing stimulation to explore student knowledge is the main point, so that teachers need the right technique in exploring student knowledge..

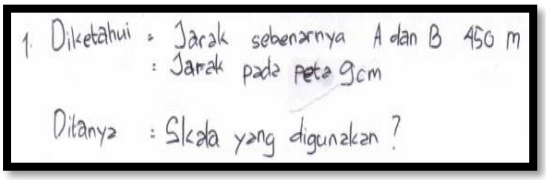

Figure 4. The First Stage from Responden D

Figure 4, respondent D in the first stage, understanding the problem, students were able to absorb information appropriately. All the information of respondents was able to process information through their observations in the learning according to the rules given by the teacher. This is in line with Marzuki & Basariah (2017) which states that to teach responsibility, students must be well disciplined by complying with the applicable regulations.

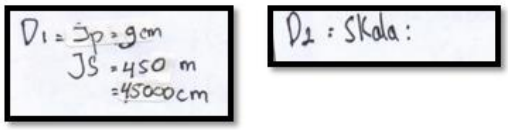

Figure 5. The First Stage From Responden PL

The PL respondent, at the first stage, was also able to understand the problem, since at working in groups, students who cared about the environment were more dominant, since with the care and sensitivity of students in understanding the material in the surrounding environment, the learning environment was more comfortable to discuss problems and obtain solutions. Purwati (2017) states that character education of caring for the environment can be a benchmark for students in caring and sensitivity to the environment, a healthy and comfortable teaching and learning environment so that it can increase achievement and creativity of students.

The second stage was to make a problem-solving plan. Lintang, Masrukan & Wardani (2017), stated that at this stage, students can write the right formula in solving problems. Students in the experimental class were able to calculate the scale on a map or floor plan. Students were able to determine the correct formula. The three respondents D were able to write the formula correctly to answer the questions being asked.

Figure 6. The Second Stage From Responden D

Can be see Figure 6, respondent D in the step of making plans or rules in answering question was able to find the right formula in solving the problem, since the respondent understands a coherent presentation. Purwati (2017), stated that with the existence of a clear rule is the most important role in disciplining students so that learning objectives can be maximally achieved.

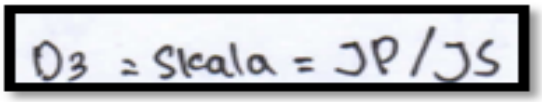

Figure 7. The Second Stage From Responden PL

Can be see Figure 7, PL respondents were also capable of making plans, by finding the right formula to solve problems. Respondents were always active in the learning so that when working on a problem, they can easily determine the right solution. This is in line with the theory of cognitive development which states that a person is not only actively determined by the individual himself/ herself, but also by an active social environment. PL respondents were also capable of making plans, which is finding the right formula to solve problems. Respondents in their own sentences write a plan that will be used in solving thw existing problems.

The third stage is implementing the problem-solving plan. Here, students were able to solve problems with plans that have been made in the previous stage well. In this stage, students usually replace the mathematical sentences with formulas used to solve problems with numbers available on the matter that has been found. Setiyadi, Zaenuri & Mulyono (2018) stated that students in the control class at this stage still show many mistakes in writing the mathematical sentences and make some errors in multiplying numbers and units in length. This condition happened since students are accustomed to listen to the explanation of the teacher and they sometimes do not pay attention to the information provided by the teacher.

At this stage, respondent D was able to carry out a problem-solving plan with an existing plan, the respondent used the existing plan to solve the existing problem and can be see figure 8. This is in line with Marzuki & Basariah (2017) who states that learning that involves students making the existing plans increases curiosity and high discipline since they already know the path to be followed.

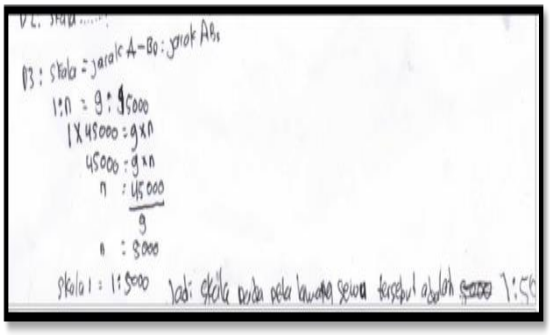

Figure 8. The third stage in Responden D

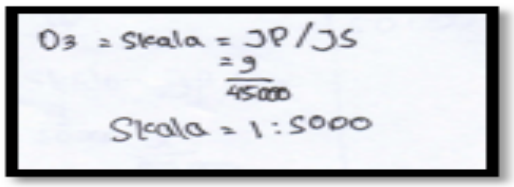

Figure 9. The third stage in Responden PL

Can be see Figure 9, PL respondents were able to translate the problems given in the form of mathematical sentences, solve problems with predetermined strategies and take decisions and actions by determining and communicating the conclusions correctly. This is in accordance with the opinion of Desfandi (2016) regarding the emphasis on the environment, one of which is for strategies to change, when facing environmental problems. This means that the character who cares about the environment will quickly find the right strategy in dealing with the current conditions.

The fourth stage is to look for (check) again the problem solving. At this stage, students were able to provide parables to the matter found in the problem to be asked and vice versa or used other formulas in solving problems. Students in the experimental class at this stage feel a little confused since they were not used to checking their own answers and can be see Figure 10.

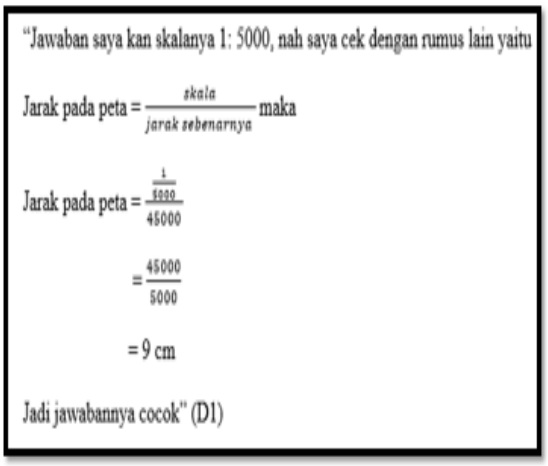

Figure 10. Last Stage in Responden D

This is not far different from the control class students, at this stage, they still feel confused due to the problems they often face until the third stage, namely solving problems without checking the answers again so that there is still a possibility that the answers may have errors and will have an impact on the learning achievement. In this case, the students may not get the maximum score.

Respondent D was capable of this stage, since by checking again or re-checking with another formula, and the answer remains the same, the respondent was sure that the written solution was correct. Respondent D was also able to provide examples of problems that were similar to the problems provided appropriately. Meanwhile, the PL respondents were unable to check again with other formulas. Respondents have tried at this stage, but respondents find it difficult to calculate multiplication and mathematical sentences in the problem.

The use of learning models that are easy to apply and appropriate to the material will make students better understand the material presented by the teacher, and the cultural habits of students can make a problem in the mathematics to find the right solution. Marsigit (2016) states that with the application of an ethnomatematic based learning model, the material taught is more easily accepted by students and the learning that occurs is more meaningful due to the daily life problems, such as cultural-related problems that exist in the students.

CONCLUSION

Based on the results of analysis in this study, it can be concluded that online learning with PBL-ethnomatematics is effective in improving the problem-solving abilities of students. This can be concluded from the results of hypothesis testing showing that fulfilling the indicators of the effectiveness of this research model are as follows, (1) the ability to solve math problems in classes using online learning with PBL-ethnomatics is more than the minimum standard criteria (KKM), (2) the mathematical problem solving abilities of students on PBL-ethnomatematics have achieved classical completeness, (3) the ability to solve mathematical problems using online learning with PBL- ethnomatematics is better than the ability to solve mathematical problems using online with PBL. Based on the analysis of problem-solving abilities reviewed from student character, obtained result that: students with disciplined characters tended to have better problem-solving abilities than the character of students who cared about the environment..

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