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Learning of Scale and Comparison Based on Ethnomatematics of Salt Production Process

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ABSTRACT
This study is a research with a quantitative approach which aims to determine: 1) whether there is a difference in mathematical ability before and after learning mathematics based on ethnomathematics in the salt production process, 2) student activities during the learning process, and 3) whether there is an increase in students' knowledge related to the salt production process. Data collection techniques used were tests, observations and questionnaires. Data were analyzed by using inferential statistics: Wilcoxon Signed Rank Test and descriptive statistics. The results of the study were: 1) the interpretation of the results of the Test Statistics is known as Asymp.Sig. (2-tailed) = 0.002 < 0.05, so that Ha is accepted, meaning that there is a difference between the pre-test and post-test scores of UPTD SDN Lembung students, this means that there is an impact on the learning mathematic based on ethnomathematics of the salt production process at the UPTD SDN Lembung, 2) the results of observations student activities on comparison and scale materials, it was obtained that each had a percentage of 90%, this shows the enthusiasm of students in participating in learning mathematic based on ethnomathematical of the salt production process, and 3) result of the questionnaire on the salt production process, it is known that there is an increase in knowledge before and after learning ie from 10% to 32%, this can be taken into consideration for conducting learning mathematic based on ethnomathematical, especially the ethnomathematics of the salt production process for students in the salt pond area.

Keywords: *Learning mathematics, Ethnomathematics, Salt production*

1. INTRODUCTION

Farming—one of which is salt farming, is one of what people do for living in society in Indonesia. This is not surprising because of the condition of the geographical area of Indonesia, which is an archipelagic country where the territory is a sea with a coastline of 95,181 km [1]. Madura is one of the regions in Indonesia where most of the people make a living as salt farmers. This condition can be used as a potential to overcome problems related to increasing human resources of the Madurese community, especially salt farmers. From the previous study, it was said that salt farmers needed competency skills and knowledge to make salt [2]. However, this is in contradiction with the character of the Madurese community who highly respects honor and self-respect [3]—which has an impact on limited information or new knowledge to enter, for example on how to produce salt so that it will produce salt with good quality and in large number of quantity [4].

One solution is through formal education in primary schools. New information or knowledge related to the salt production process can be integrated into subjects—students learn the subject matter as well as learn the salt production process. One of the subjects that can be integrated into the salt production process is mathematics. Mathematics can be a bridge or link between formal concepts and problems that exist in everyday life (local wisdom). The study of science that studies these two things is ethnomathematics—a science that studies the art of mathematics in various human cultural activities[5]. The definition of ethnomathematics as the study of science is taken from the definition put forward by W. D. Barton in his thesis that ethnomatics is defined as a study of knowledge carried out to examine the way a group of people in a particular culture understand, express, and use concepts and practices in culture described by researchers as something mathematical [6].

In cultural life, people have unwittingly carried out various activities that use basic mathematical concepts—designing, locating, measuring, counting, playing, explaining [7]. From the results of research by Umi Hanik, et al on ethnomathematical exploration in the Madura salt production process, several mathematical activities were obtained in the salt production process including 1) designing: making salt pond land designs, 2) locating: determining the position of the plots needed in the process of salt production, 3) measuring: measuring the concentration of salt water, 4) counting: calculating profit and loss and labor wages, 5) playing: making decisions to harvest salt or not due to weather, and 6) explaining: the ability to explain from generation to generation in salt-making and windmills [8]. The results of these explorations can then be used as a source of learning mathematics.

Mathematics learning based on ethnomathematic the salt production process is important for the following reasons: 1) it can provide new information and knowledge about the correct salt production process or using modern technology to students from an early age – which is difficult to give to salt farmers through training or socialization from the concerned relevant service [2], 2) provide insight into the world of salt at home and abroad including about the salt production process so that students are motivated to learn more deeply now and in the future—for example, related to innovations in the salt production process. , and 3) mathematics learning based on the salt production process can help teachers by providing contextual and realistic learning—especially in schools near salt ponds. Realistic and contextual learning helps students to be actively involved in learning [9]. Active student involvement in learning helps students understand mathematical concepts [10]. Students will find it easier to reason, communicate and even solve problems. This accommodates learning conditions in Indonesia that have not directed students to the process of reasoning, communicating, problem solving, and mathematical literacy [11].

Based on the explanation above, it can be concluded that it is important to conduct ethnomathematics-based mathematics learning—especially in the salt pond area by utilizing the salt production process as a learning resource. As a form of planning, it is necessary to analyze the material on the Core Competencies and Basic Competencies in Permendikbud No. 37 of 2018 [12]. One of the Basic Competencies that can be integrated into the salt production process material is Scale and Comparison. In this material, there are many fundamental mathematical activities related to the salt production process. This research was conducted to find out the application of mathematics learning in Scale and Comparison material based on the ethnomathematics of the salt production process. In addition, this study wanted to know the students' knowledge related to the salt production process.

2. RESEARCH METHOD

The research was conducted in an elementary school located in the salt pond area of Pamekasan Regency, namely UPTD SDN Lembung with 16 students. This research is a research with a quantitative approach [13] [14]—which aims to determine: 1) whether there are differences in mathematical abilities before and after learning mathematics based on ethnomathematics in the salt production process, 2) student activities during the learning process, and 3) whether there are any increasing students' knowledge regarding the salt production process.

Research data retrieval was carried out by: 1) tests, namely learning outcomes tests, 2) observations, namely observations of student activity and 3) questionnaires, namely questionnaires on knowledge of the salt production process. The data were analyzed by using: 1) inferential statistical analysis, to analyze learning outcomes data, and 2) descriptive statistical analysis, to analyze student activity data and the results of the salt production process knowledge questionnaire [14].

The research design used was One-group Pretest-posttest Research Design [13], by comparing the results of the pretest conducted at the beginning of the study and the posttest given at the end of the study.

The inferential statistical analysis used was non-parametric statistics, namely the Wicoxon test [13][15][16], with the underlying reasons: 1) the number of samples is small, and 2) the data population is not normally distributed. The inferential statistical analysis was assisted by using IBM SPSS software [13][17].

While the formula for analyzing student activity data and the results of the questionnaire is as follows.

Percentage of knowledge of salt production process =

$$\frac{\text{Number of score item obtained}}{\text{Number of total score}} \times 100\% \quad (1)$$

3. RESULTS AND DISCUSSION

3.1 Research result

The results of the study were the results of the pretest, posttest, observation of student activity and the results of a knowledge questionnaire about the salt production process.

3.1.1 Pretest and Posttest Results

From the pretest conducted at the beginning of the study, the average students' initial ability on the scale and comparison material was 5 out of a maximum score of 100. Meanwhile, from the posttest conducted when the research was completed, the average learning outcome was 11 out of a maximum score of 100. If it was seen from the Minimum Completeness Criteria (KKM), UPTD SDN Lembung—which is 70, then the results achieved by students are not complete. Meanwhile, the statistical test, namely the Wilcoxon Test (Wilcoxon Signed Rank Test)—to determine whether or not there is a difference between the results of the pretest and posttest is in Table 1 and Table 2 as follows.

Tabel 1. Rank of Wilcoxon Signed Rank Test

Type	Rank	N	Mean Rank	Sum of Ranks
Wilcoxon Signed Rank Test	Negative rank Positive rank Ties Total	0[a] 12[b] 0[c] 12	0.00 6.50	0.00 78.00

Table description:
a. Postest < Pretest
b. Postest > Pretest
c. Postest = Pretest

The interpretation of the results of the Wilcoxon Signed Ranks test data above are: first, Negative Ranks or the negative difference between Pretest and Posttest is 0 on N, Mean Rank and Sum of Ranks. This 0 value means that there is no decrease/reduction from the pretest to posttest scores.

Second, positive ranks or positive difference between pretest and posttest. It is known that there are 12 positive data, N = 12, which means the 12 students have increased from pretest scores to posttest scores. The mean ranks or average increase is 6.50 while the number of positive rankings or Sum of Ranks is 78.00.

Third, ties is the similarity of pretest and posttest scores. The ties value = 0 which means that there is no equal value between the pretest and posttest scores

Table 2. Test statistic

	Pretest – Posttest
Z Asymp. Sig.(2-tailed)	-3.072[b] 0.002

Meanwhile, the interpretation of the results of the Test Statistics is known as Asymp.Sig. (2-tailed) = 0.002 < 0.05, so that Ha is accepted, meaning that there is a difference between the pre-test and post-test scores of UPTD SDN Lembung students. This means that there is an impact on the learning mathematic based on ethnomathematics of the salt production process at the UPTD SDN Lembung.

3.1.2 Student Activity Results

The items of observation of student activity in the core activities include: 1) observing the drawing of the salt pond design in the textbook, 2) answering the questions asked by the teacher, 3) reading the meaning of comparison and scale, 4) listening to the teacher's explanation, 5) asking the teacher explanation which has not been understood about comparisons and scales, 6) doing practice questions, 7) going to the front of the class to write down the results of the work, 8) starting to discuss comparisons and scales, 9) presenting and explaining the results of discussions about comparisons and scales, 10) listening to justifications (corrections) from the teacher.

Of the ten observations made to students in the ethnomathematics-based learning process of salt production in comparison material, only one observation point where students do not appear to be doing the activity, that is item number four—asking the teacher explanation which has not been understood about comparisons and scales. Quantitatively, the percentage of student activity in comparative material is 90%.

While on the scale material, from ten observation points there is one observation item where students do not appear to be doing the activity, that is item number four—listening to the teacher's explanation. Quantitatively, the percentage of student activity in scale material is 90%.

From the results of observing the student activities, it shows that students are enthusiastic in learning activities based on ethnomathematical of the salt production process in comparison and scale material.

3.1.3 Questionnaire Results

The questionnaire about salt production was conducted to determine students' knowledge regarding the salt production process before and after learning. The questions in the questionnaire about of the salt production process include: 1) how to produce Madura salt, 2) how to produce salt abroad, 3) the swath needed in the Madura salt production process, 4) a tool to measure salinity of salt (Baumeter), and 5) benefits of windmills in salt ponds. The results of the questionnaire about of the salt production process are shown in Table 1.

Table 3. Questionnaire Results of Salt Production Process

Questionnaire Items	Total of Answers of Students Who Know Related Knowledge (%)	
	Before Learning	After Learning
How to produce	12	14

Madura salt		
How to produce salt abroad	13	7
The swath needed in the Madura salt production process	13	36
A tool to measure salt content (Baumeter)	6	50
Benefits of windmills in salt ponds	6	50
Average	10	32

The results of the questionnaire on the salt production process showed an increase in knowledge related to the salt production process. Although most of the parents work as salt farmers, which is around 75%, the average knowledge related to the salt production process before learning is only 10%. However, after learning, the average knowledge of the salt production process is 32%.

3.2 Discussion

When viewed from the average pretest and posttest scores, ethnomathematical learning based on the salt production process has not provided a significant increase because it is still far from the minimum completeness value set, which is 70, although inferential statistical analysis shows that there are differences in pretest and posttest scores. There is even a mean ranks or an average increase in the pretest score to the posttest score. One of the contributing factors is the weakness in the prerequisite skills and supporting materials for scale and comparison. This causes students to be unable to solve the problems given by the teacher. The explanation is of course a reflection in learning that it is very important to know the students' initial abilities. This is in line with the opinion of De Cecco in H. Nashir [18], initial behavior has characteristics that are a necessary prerequisite for following the next lesson—having a connection that is relevant to the goals achieved.

Apart from discussing about the results of students' abilities as seen from the pretest and posttest scores, student learning activities showed the maximum activity of the 10 items of observed learning activities. This is because learning uses contextual problems. Learning using contextual problems is called contextual learning—by definition is learning with an approach that emphasizes the process of full student involvement to find the material being studied and relate it to real life situations so as to encourage students to apply it to their lives [19]. Further, Johnson describes the notion of contextual learning by "The CTL system is an educational process that aims help student's see meaning in the academic material they are studying by connecting academic subjects with the context of their daily lives, that is, with the context of their personal, social, and cultural circumstance" [20]. The quote provides an affirmation that contextual learning is a holistic educational process and aims to help students to see the meaning and subject matter they are learning by relating the material to the context of their daily lives (personal, social and cultural contexts), so that students have the knowledge Skills that can be flexibly applied from one problem to another.

Meanwhile, the results of the questionnaire on the salt production process showed an increase in students' knowledge of the salt production process. So that this can be a consideration for conducting lessons that aim to provide certain information or knowledge by integrating it in one particular subject—for example, mathematics [21]. With this integration, several things related to the salt production process can be conveyed to students, including: 1) knowledge about the concentration level of reserve water in the harvesting plot which is ready to be flowed in the crystal table plot—which should be 25-290Be but usually farmers only reach a concentration of 22-250Be, 2) knowledge of modern salt production process technology that has been carried out by developed countries, 3) construction of salt ponds, 4) methods of measuring the concentration of salt water, and 5) procedures for making salt using the Madurese technique [8].

From the results of the questionnaire, it can be concluded that learning with ethnomathematical-based teaching materials in the salt production process can increase students' knowledge of the salt production process both domestically and abroad. The long-term impact is that by knowing various information about salt, especially the salt production process, students have great curiosity so that they are motivated to learn more deeply and broadly. The further impact is that by having superior Human Resources (HR) in the field of salt, it is hoped that Indonesia will become a country that produces abundant salt with good quality.

4. CONCLUSION

From the analysis of the pretest and posttest scores, it is known that Ha is accepted, meaning that there is a difference between the pretest and posttest scores of the students of UPTD SDN Lembung. This means that there is an impact of learning mathematics based on ethnomathematics in the salt production process at the UPTD SDN Lembung, although there are differences. From the results of observations of student activities on comparison and scale materials, it was obtained that each had a percentage of 90%. This shows the enthusiasm of students in participating in learning mathematic based on ethnomathematical of the salt production process. Meanwhile, from the questionnaire on the salt production process, it is known that there is an increase in knowledge before and after learning, ie from 10% to 32%. This can be taken into consideration for conducting learning mathematic based on ethnomathematical, especially the ethnomathematics of the salt production process for students in the salt pond area.

AUTHORS' CONTRIBUTIONS

Umi Hanik conducted ethnomathematics-based learning of the salt production process and participates in writing. Mahmud did a statistical analysis. Parrisca Indra Perdana assisted in data collection in the field. All authors read and approved the final manuscript.

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