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The Problem Solving Ability of Students in the Cooperative Learning Simulation of Kancing Gemerincing Technique with Ethnomathematics Nuances Reviewed by the Cognitive Mode

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Abstract

This study aims to (1) test the effectiveness of the Modeling of the Kancing Gemerincing Learning technique with ethnomathematics nuances in improving students' problem solving abilities; and (2) finding students' problem solving ability models in terms of the cognitive mode that is taught with the cooperative learning simulation of the ethnomathematics Kancing Gemerincing technique. The method used is a combination method with a sequential explanatory research design. The study population was students of class VIII 1st Public Middle School of Gemawang, Temanggung. The selected classes chosen by using cluster random sampling method are, class VIIID as the experimental class and VIIIA as the control class. The technique used in quantitative data collection is by testing the problem solving skills and qualitative data collection is obtained by doing documentations, questionnaires, and interviews. Testing data used are completeness test, t test, and paired t test. The results showed that the cooperative learning of the Kancing Gemerincing technique with ethno-mathematics nuances was effective in improving students' mathematical problem solving abilities. The problem solving ability of independent field students is able to build new knowledge with other fields, be able to apply different strategies in solving problems, and be able to reflect mathematical problem solving processes. Whereas, the problem solving ability of field dependent students is able to build new knowledge with other fields, but has yet been able to apply different strategies in solving problems and reflecting mathematical problem solving processes.

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INTRODUCTION

Education acts as a benchmark for the quality of learning and it becomes very important in developing the potential and abilities possessed by students. With education, students can develop their knowledge and skills continuously to be utilized in daily life. Students who are equipped with knowledge and skills can develop their potential to get better academic and non-academic achievements. One of the existing educations in schools and in universities is the process of learning mathematics. With this learning, it is hoped that educational goals can be achieved including changes in attitudes, skills, and improving students' thinking abilities. The learning objectives of mathematics contained in Regulation of Ministry of National Education number 22 of the year 2006, concerning content standards are as follows, (1) understanding mathematical concepts, explaining the interconnectedness of the concepts and applying them flexibly, accurately, efficiently, and precisely in solving problems; (2) using reasoning on patterns and traits, carrying out mathematical manipulations in making generalizations, compiling evidence or explaining mathematical ideas and statements; (3) solving problems that include the ability to understand problems, design mathematical models, solve and interpret the solutions obtained; (4) communicating ideas with symbols, tables, and diagrams or other media used to clarify the situation or problem; and (5) has an attitude of appreciating the usefulness of mathematics in everyday life, which is having curiosity, attention and interest in studying mathematics as well as being tenacious and confident in solving problems.

One of the goals of learning mathematics is to solve mathematical problems and solve common problems in everyday life. This is consistent with Mahmudi (Geni and Hidayah, 2017) that said mathematics learning should contain problem solving as a main part of all aspects of its activities. And also according to Harahap and Surya (2017), problem solving is a complex cognitive activity, as a process to overcome a problem encountered and to solve it requires a number of strategies. It shows the need for an improvement in mathematics learning activities in schools so that the capabilities of students become more developed. These improvements can be made in the selection of methods or learning simulations that can be applied to develop problem solving skills. One of the learning methods or simulations is the Kancing Gemerincing learning. According to Sholehah (2017), the cooperative learning simulation of the Kancing Gemerincing technique is a cooperative learning technique that uses buttons or other small objects as a medium or agent for patterns of students' interaction in study groups. So that it can help the thinking process of students in solving problems, help students master the material expected, and provide students to demonstrate the potential abilities they have, including problem solving abilities.

Various problems encountered by students in the daily life can be raised as learning problems that must be sought a solution. The characteristics and culture of the environment will be interesting to devoloped in a local content of learning. Mathematical learning with the conceptual theme of local culture is known as ethnomathematics. According to Mastur and Dwidayati (2018), mathematics education actually has been integrated with the life of the community itself.

According to Suhartini and Martyanti (2017), ethno-mathematics is a science in learning and expressing the culture of surrounding communities, historical relics related to mathematics and mathematics learning. Through the application of ethno-mathematics in learning, students are expected to be able to better understand mathematics as well as understand the local culture. Therefore, with ethno-mathematics based learning students can learn mathematics as well as get to know the culture.

When solving the problems, each individual has different characteristics, which are not shared by other individuals. The different characteristics of each individual in responding to information, is called the cognitive mode of the individual concerned. According to Messick (Amirulmukminin, 2017) cognitive mode is a stable or consistent characteristic in remembering, thinking and solving problems. Witkin (1977) adds that the cognitive mode in learning mathematics is divided into two fields, namely the field independent and field dependent. The field independent is an individual who is free and can separate a part of a unity. Field dependent is an individual who cannot separate a part from a unity. Field dependent individuals tend to accept dominant parts or contexts and tend to be in groups. In line with Vendiagrys, Junaedi, and

Masrukan (2015) that stated independent field subjects tend to be analytical in processing information obtained from problems, so they can find important parts that can be used to solve problems.

This study aims to test (1) the effectiveness of the simulation of the Kancing Gemerincing learning technique with ethno-mathematics nuances in improving students' problem solving abilities; and (2) the students' problem solving abilities in terms of the cognitive mode that is taught by the cooperative learning simulation of the ethnomathematical nuance Kancing Gemerincing technique.

METHODS

This research is a combination of quantitative and qualitative research. The combination method used in this study is a sequential explanatory design. The populations in this study were students of SMP 1st Public Middle School of Gemawang, Temanggung in the 2018/2019 school year. From class VIII, 2 classes were chosen randomly using the cluster random sampling technique. The selected class is class VIIID as an experimental class and VIIIA as a control class. Both classes study the material in the form of flat side spaces related to surface area and volume. And then in the experimental class, 3 students who have independent field cognitive styles and 3 students who have field dependent cognitive styles who will see the ability to solve the problems are selected.

Sources of data in this study are cognitive mode tests, problem-solving ability tests, and local culture love questionnaire sheets and additional data, such as the results of student interviews. Before the learning process was carried out using a cooperative learning simulation with ethnomathematics nuances, the experimental class students were also given an initial problem solving ability test as a comparison of how the students' problem solving abilities were before being treated. Data collection techniques used in this study was documentation, test, questionnaire, and interview techniques. Test techniques are used to obtain data about problem solving skills, while interview techniques are used to obtain data credibility.

At the end of the learning process by using the cooperative learning simulation of the ethnomathematics nuance technique, students were again given the problem solving questions of the final problem. The results of the final problem solving ability test done by students will be triangulated together with the six qualitative research subjects. Quantitative data were tested using normality test, homogeneity test, average similarity test, completeness test, average difference test, enhancement test, and paired sample t test, while qualitative data were analyzed by means of data validity, data reduction, data presentation, and drawing conclusions.

RESULT AND DISCUSSION

Problem-solving ability tests are carried out twice, namely before learning is given pretest and after learning is given post-test, and the increasing problem-solving skills can be seen after learning by using cooperative learning simulations with ethnomathematics nuanced Kancing Gemerincing techniques. Table 1 describes the improvement of students' problem solving abilities.

Table 1. The improvement of students' problem solving ability

Class	N	Mean Pretest	Mean Posttest	Gain Score
Experiment	28	10.53	77.50	66.96
Control	28	10.28	67.50	57.21

Based on Table 1 above, it can be seen that the average difference in the test of problem solving abilities in experimental class learning is 66.96 and the average difference in the test of students' problem solving abilities in control class learning is 57.21.

From the classical completeness test, the value of $Z_{count} = 1.75 > Z_{(0.45)} = 1.64$, which means that the proportion of students in learning the cooperative learning simulation of ethno-mathematical nuance rattling button techniques that meet the KKM has reached by 75%. Based on the average difference test in SPSS using independent t test, the value of $t_{count} = 4.122 > t_{table} = 0.201$ with a significance value of $0.000 < 0.05$, means that the ability of students in learning experimental class is more than the ability of students in learning control class. Based on an increase test in SPSS using the independent t test, the

value of t_{count} = 3.913 with a significance value of 0.000 < 0.05, which means that the improvement of students' problem solving abilities in experimental class learning is better than the improvement of students' problem solving skills in control class learning. Based on the t-test paired students 'local cultural love questionnaire after using cooperative learning models with ethno-mathematics nuance technique obtained by t_{count} = 45.336 with a significance value of 0.000 < 0.05, which means that there is an improvement in students' local cultural love after cooperative learning with ethno-mathematics nuanced rattling button technique.

The cognitive mode test was carried out by giving a GEFT instrument sheet to students of class VIIID of 1st Public Middle School of Gemawang, Temanggung, totaling 28 students. The provision of the GEFT instrument aims to find out the cognitive mode of students and is also used for the selection of subjects to be interviewed in depth about their problem solving abilities.

Problem solving ability for independent field subjects is able to build new mathematical knowledge through problem solving, able to solve problems that arise in mathematics and other fields, able to apply different strategies in solving problems and reflect mathematical problem solving processes. The ability of problem solving for field dependent subjects is able to build new mathematical knowledge through problem solving, able to solve problems that arise in mathematics and other fields, but it has yet been able to apply different strategies in solving problems and has not been able to reflect the process of mathematical problem solving. During the learning process in the cooperative learning simulation of the Kancing Gemerincing technique with ethnomathematics nuanced, we discovered the problem at the orientation stage where the field dependent students are slow in understanding the problems that exist in teaching materials. At the discussion stage field dependent students rarely give questions or responses to the results of the answers presented by other groups.

The implementation of cooperative based learning has a positive impact on students, because students become more active in learning. Cooperative based learning can help students' thinking process in solving problems, help students master the material, and provide students to demonstrate potential abilities they have, including problem solving abilities. The creativity possessed by the students is able to explore their potential in creating creativity, finding ideas and understanding of the problems they face by involving the problem solving process in groups of students. Students in the cooperative learning simulation of the Kancing Gemerincing techniques can improve problem solving skills, because in the learning process students are formed into small groups to solve mathematical problems by collaborating with their respective groups. This can help students in solving mathematical problems. Sholehah's research results (2017) shows that the cooperative learning model of the Kancing Gemerincing technique is an effective learning simulation for learning in class, so students become active while learning in groups in solving problems. In line with Afianti, Sulastri, and Alimin (2017) that the Simulation of the Kancing Gemerincing cooperative learning technique is a cooperative learning simulation that uses a student centered approach, where group members have the same opportunity to contribute in a discussion with his/her group members.

The average results of students' local cultural love before and after being taught using the cooperative learning simulation of the Kancing Gemerincing with ethnomathematics nuanced technique has improved. Before being taught using the simulation technique, students were less familiar with the culture in Temanggung. For example shown in Figure 1 as follows:

Figure 1. The temple of Pringapus

There are many who do not know about the term culture and they also do not know many types of gamelan in Temanggung. In line with the research of Suhartini and Martyanti (2017) that ethnomathematics can express the culture of surrounding communities, historical relics related to

mathematics and mathematics learning. According to Wahyuni (2013), ethno-mathematics is a bridge of mathematics and culture. So ethnomathematics is a learning system that links mathematical material with the surrounding culture.

Subjects with field dependent cognitive styles are able to use Polya's problem solving stages quite well and are able to understand problems by writing and explaining the elements that are known and asked of problems in everyday sentences. According to Goodenough (1986), the cognitive mode characteristics of independent and field dependent cognitive fields are individuals who lack or cannot separate a part of a unity and tend to directly accept the dominant part or context.

CONCLUSIONS AND SUGGESTIONS

The conclusions of this study are (1) the application of the simulation of the learning of the Kancing Gemerincing technique which has an ethno-mathematics nuance effectively improving students' problem solving abilities; and (2) the implementation of the mentioned simulation improves the students' problem solving abilities in terms of cognitive mode. The problem solving ability of independent field students is able to build new knowledge with other fields, be able to apply different strategies in solving problems, and be able to reflect mathematical problem solving processes. The problem solving ability of field dependent students is able to build new knowledge with other fields, but has yet to be able to apply different strategies in solving problems and reflecting mathematical problem solving processes.

Because field independent students and field dependent students learn in one class, it is suggested (1) that independent field students can be helped by given more challenging problem exercises, so that independent field students can develop their problem solving abilities with a variety of strategies they have; and (2) field dependent students can be helped by giving more practice exercises, so that the simulation can train field dependent students to find strategies in solving problems.

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