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The Influence of Creative Problem-Solving Learning Assisted by Ethnomathematics Nuance Modules on Problem-Solving Ability and Curiosity

Ida Fitria Kurnia *
Management, Universitas Teknologi Sumbawa, Sumbawa, 84371
idakurnia02@guru.sma.belajar.id
**Corresponding author*

Suparman
Management, Universitas Teknologi Sumbawa, Sumbawa, 84371
mansupar52@gmail.com

Topan Rahmatul Iman
Management, Universitas Teknologi Sumbawa, Sumbawa, 84371
topan.rahmatul.iman@uts.ac.id

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Abstract—Mathematics is often perceived as a complex and difficult lesson to solve, thus making students' mathematical problem-solving ability and curiosity low. This study aimed to analyze the influence of learning using the Creative Problem-Solving (CPS) method assisted by ethnomathematics nuance modules on the problem-solving ability and curiosity of class XI students at SMAN 1 Plampang. This research was a type of experimental research using a pre-experimental design with a one-group pretest–post–test design model. The data collection technique used purposive sampling to collect data as a sample of 35 students in class XI MIPA 1 from a total population of 105 students in class MIPA. The determination of the sample is based on the results of the average score in mathematics and discussion with the mathematics teacher. The results of the study showed that the influence of Creative Problem Solving (CPS) learning assisted by ethnomathematics nuance modules had a significant effect on students' problem-solving ability and students' curiosity in geometry transformation material at SMAN 1 Plampang.

Keywords —Creative Problem Solving (CPS)**,** Curiosity, Ethnomathematics**,** Problem-solving

I. INTRODUCTION

Mathematics is a basic lesson that plays an important role in the development of science and technology, even without realizing it, mathematics has become attached to and inseparable from everyday life. The main objective of mathematics learning is problem-solving, so that human resources are required to think critically, logically, creatively, and systematically in order to be able to keep up with the increasingly dynamic times (Hardiyanti et al., 2022; Mardhiyana & Sejati, 2017).

In reality, most students consider that mathematics is a difficult lesson that presents various complicated problems to solve, so it causes low student learning outcomes (Saironi & Sukestiyarno, 2017). Based on the results of tests and evaluations organized by PISA (Programme for International Student Assessment) in 2015 Indonesia get the low category in terms of mastery of mathematical material and is ranked 63 out of 70 countries with a score of 386 (Siregar, 2017). This statement is supported by the results of (Siregar, 2017) which show that as many as 45% of respondents perceive mathematics as a fairly difficult lesson and 20% consider it difficult.

Indonesia's ability to solve mathematical problems is still relatively low (Ika Nurhayati & Eko Susilo, 2022). Several studies support this statement, including the study of Syazali (2015) at MAN 2 Bandar Lampung, which found that as many as 76% of class XI science students have scores below the Minimum Completion Criteria (MCC). This is due to the low ability of students to solve mathematical problems during the learning process. A similar study also explained that Mathematical Problem - Solving Ability (MPSA) in class X students of SMA Sumur Bandung is relatively low due to students not being familiar with problem-solving, so they have difficulty solving problems (Nugraha & Zanthy, 2018). The low ability of Indonesian students to solve mathematics problems can be attributed to their lack of interest in mathematics (Barata & Sukestiyarno, 2019). As mandated in the curriculum 2013, national education aims to develop spiritual, social, curiosity, creativity, and cooperation attitudes to balance intellectual and psychomotor abilities (Falah & Utami, 2022). Thus, the aspect of the attitude that is expected of students in the learning process is curiosity. Curiosity is defined as a person's desire and needs to obtain answers to a question or things that cause deep curiosity. This attitude is able to stimulate students to participate in learning activities that build knowledge and practice skills. In learning, curiosity is indispensable to generate interest and creativity in solving a problem (Mardhiyana & Sejati, 2017). This linkage has been explained by (Widiastuti et al., 2014) showed that curiosity improves students' problem-solving abilities.

Among the learning models that can improve problem-solving skills and curiosity in students, one of them is the Creative Problem Solving (CPS) learning

model. The creative problem-solving learning model is one of the problem-based learning models, existing problems are solved using systematic and organized techniques to produce creative solution ideas from students. Creative problem solving is a design of learning Problem-solving with systematically applied science Organize creative ideas to solve problems (Maliya & Sukestiyarno, 2018). In other words, students can not only memorize without thinking but also expand the thought process (Yuliastuti et al., 2019).

Various research studies have discussed the use of creative problem-solving learning models to increase the positive attitudes of students. CPS learning affects critical thinking skills and student learning outcomes (Pramestika et al., 2020). There is an influence of the creative problem-solving learning model accompanied by vee diagram techniques on the creative thinking skills of students on fungi material at MAN 2 Bandar Lampung (Puspita et al., 2018). The result study explained that the application of creative problem-solving learning models affects mathematical problem-solving skills with the help of Maple 11 (Syazali, 2015).

The results of the initial survey at SMAN 1 Plampang most of the students experienced problems understanding the material of geometric transformations. The results of the evaluation of class XI students showed errors in solving geometric transformation problems. when viewed from the ability and difficulty standpoints, namely not understanding the information contained in the questions, not practicing doing non-routine questions, not being able to distinguish the concepts of types of geometric transformations, not mastering the prerequisite material related to the material, and not being thorough.

The fact that the teaching materials from the package book used at SMAN 1 Plampang already present contextual material, but do not cover the surrounding culture makes it difficult for students to understand the material. Seeing these conditions, CPS learning modules combined with ethnomathematics need to be developed to attract students' curiosity and problem-solving abilities. Mathematical symbols and emblems that are rigid in the material of transformation geometry can be integrated with the local culture that develops in the surrounding environment. Ethnomathematics is an approach that can be used to explain the reality of the relationship between culture and mathematics as a family of sciences (Paramartha et al., 2020). The result study explains that ethnomathematics learning can increase activity and develop student creativity in learning geometric transformation (Agusta, 2021).

The presence of ethnomathematics in the process of learning mathematics gives a new nuance that mathematics is not a lesson synonymous with memorizing formulas without meaning. Ethnomathematics invites students to build concepts of knowledge based on scientific facts starting with observing activities. Relevant to the learning situation of geometry transformation material at SMAN 1 Plampang previously, researchers were interested in applying the learning model of Creative Problem Solving. To support the application of the CPS model, it is necessary for teachers to compile teaching material to facilitate the learning process. The intended teaching materials are in the form of ethnomathematics nuanced modules. According (Subekti, 2016) An instructional module is an attempt to organize individual instruction to allow the learner to master one unit of a subject before proceeding to the next unit. This character-filled module is designed to help students solve math problems and improve their problem-solving skills. The character of this learning module is character of independence. Students using this character-packed module are expected to foster independence in their learning. This is expected to be able to create curiosity and encourage the ability to solve mathematical problems faced by students. As the results study show that problem-solving skills after creative problem-solving and module-assisted self-study increased by 94.5% and 97.2% (Maliya & Sukestiyarno, 2019).

Based on the description of the background above, various previous studies have only explained separately the application of CPS and ethnomathematics learning to students' problem-solving abilities or curiosity. However, there has been no research that discusses the combination of CSP learning with ethnomathematics to be implemented in the learning process. Therefore, researchers are interested in researching the implementation of the combination of Creative Problem-Solving (CSP) and ethnomathematics through the preparation of a module, which is then used to see its effect on the problem-solving ability and curiosity of SMA Negeri 1 Plampang student.

II. LITERATURE REVIEW

A. Creative Problem-solving

CPS is a problem-solving model that emphasizes: the discovery of various alternative ideas or ideas to determine a solution in the form of the most efficient solutions to problems with divergent thought processes and converged (Yuliastuti et al., 2019). In other definition, CPS is a learning model that emphasizes creativity as a fundamental ability for students to solve problems (Ginting et al., 2019). CPS can be defined as a learning model that focuses on teaching and problem-solving skills, followed by strengthening skills (Barata & Sukestiyarno, 2019). In addition to creative problem-solving, independent learning can increase student self-rule in learning. Independent learning is one of the lessons that individuals learn on their own, and the greatest learning outcomes occur when students are seen as learning at their own pace and actively performing a variety of learning tasks. is obtained.

A Creative Problem-Solving structure has six main steps (Maliya & Sukestiyarno, 2019):

1. Students are branched into several heterogeneous groups
2. Learning begins with real problems from this book. subject by verbal question and answer

3. Students in groups will identify available questions on group worksheets (including modules in this study) in their chosen focus
4. Students identify thoughts in groups and generate original ideas to find Solution
5. Presentation by the representative student
6. Group discussion at the end of the submitted research.

B. Ethnomathrmatics

Ethnomathematics is an approach that can be used for explaining the reality of interrelationships between cultures' local knowledge and mathematics as a science knowledge in the learning (Alsalamah et al., 2022). The purpose of using ethnomathematics is to familiarize students with thinking mathematically through their culture and help them learn mathematics more easily through their surrounding culture. As such, indirect learning using ethnomus nuances culture through learning stored in the classroom. Ethnomatics is the study of how people of a particular culture understand, articulate, and use concepts and practices that describe mathematical things (Nasryah & Rahman, 2020). Application of ethnomathematics as a means of stimulating and overcoming student boredom and bringing new nuances to mathematics learning.

III. METHODOLOGY

This research is a type of experimental research. research design in the form of a pre-experimental design with the model one group pre-test and post-test design. The group pretest-posttest design research model is an experimental study that is only carried out on one group without using a control group (Rizqiyana et al., 2021). One group pretest research model – posttest design, able to measure an influence on the group during before and after treatment (Hastjarjo, 2019).

The research was conducted at SMA Negeri 1 Plampang for the 2022/2023 Academic Year. The population in this study was class XI MIPA of 105 students. The sampling uses purposive sampling, which is the determination of samples using certain criteria after discussions with class XI mathematics teachers. As a result of the determination, the research sample using class XI MIPA 1 totaled 35 students on the grounds that the average math score of the class was the lowest among other class XI MIPA classes.

In this study, there were two variables, namely independent variables and dependent variables. The dependent variables are problem-solving ability and curiosity, and the independent variable is ethnomathematics module-assisted CPS Learning models.

The data collection methods used are tests, questionnaires, interviews, and observations while analyzing data using the help of Statistical Package for Social Science (SPSS) 26.0 for Windows software. This research uses a test method in the form of a description for students' *pre-test* and post-test questions in solving problems. The questionnaire and observation methods are used to see students' curiosity, while interview techniques are used to collect data from mathematics teachers in class XI MIPA.

IV. RESULTS AND DISCUSSION

A. Validity Test

Response questionnaires used as instruments to measure student curiosity must first be validated before being used by students as a measuring tool to see student curiosity. The instrument is validated by one validator by assessing the response questionnaire and filling out the assessment on the validation sheet in accordance with the assessment aspects listed on the validation sheet.

The observation sheet used in this study to assess the teaching and learning process experienced by students is validated first before being filled out and assessed by the observer. The observation sheet of students in this study was validated by one validator by assessing the observation sheet and filling out the assessment on the validation sheet in accordance with the assessment aspects listed on the validation sheet, namely aspects of purpose, clarity and language.

Table 1 Result of Validity Test

	Assessment	Value
Validity of Student Curiosity Questionnaire	Goals	100%
	Clarity	90%
	Language	90%
Average		93,33%
Validity of Student Observation Sheets	Goals	100%
	Clarity	85%
	Bahasa	100%
Average		95%
Validity *Pretest* and *Posttest* Questions	Goals	100%
	Clarity	85%
	Language	100%
Average		95%
Sheet Validity of Learning Implementation Plan	Formulation of the Learner's Goals	3,30
	Content	3,40
	Language	3,70
Average		3,47

Based on table 1 the results of the validation questionnaire instrument to measure student curiosity showed an average score of all aspects obtained by 93.33%, in other words, the overall validity was very valid. This assessment is in accordance with the theory that the questionnaire instrument can be said to be very valid if it is in the range of 85% $\leqslant$ P $\leqslant$ 100% (Akbar, 2013). Based on the results of this analysis, the curiosity questionnaire instrument is feasible to use without any revision from the validator.

The results of the validation analysis of student observation sheets in Table 1 showed that the average score for all aspects of the assessment was 95%, with the

overall validity criteria being very valid. Thus, the instrument of the learner's observation sheet is feasible to use. The results of the validation analysis of pre-test and *post-test* questions of students showed that the average score for all aspects obtained was 95% with overall validity criteria that are very valid.

The ethnomathematics-inspired module-assisted CPS learning plan prepared by the researcher is used as a guideline for researchers to carry out learning activities. The instrument is validated by one validator who assesses the Learning Implementation Plan on the validation sheet in accordance with the assessment aspects listed on the sheet, namely the formulation of learning objectives, content, and language.

Based on table 1, the average score for all aspects of the assessment was obtained at 3.47 with very good overall validity criteria. The assessment is in accordance with the states that the instrument of the Learning Implementation Plan sheet can be said very good if it is at an interval of $3.25 < \leqslant 4$. $\bar{X}$ (Widoyoko, 2014).

B. Normality Test

The normality test in this study used the Kolmogorov-Smirnov test. The result of normality test showed in Table 2 and Table 3 :

Table 2 Problem Solving Capability Normality Test Results

	Statistic	*df*	*Sig*
Pre-test	*.147*	*35*	*.052*
Post-test	*.107*	*35*	*.200*

In Table 2, the significance value of students' problem-solving ability in the *pretest* was 0.052 while the student's problem-solving ability in the *posttest* was 0.200. The significance value in the pretest and posttest obtained has a value of >0.05 indicating that *the pre-test* and *post-test* carried out by students are normally distributed (Santoso, 2018).

Table 3. Student Curiosity Normality Test Results

	Statistic	*df*	*Sig*
Pre-test	*.151*	*35*	*.052*
Post-test	*.231*	*35*	*.000*

The first stage carried out before the hypothesis test (t test) is to test the normality of the pre-test questionnaire score and the student curiosity post-test. The test was carried out using SPSS with a significance value that can be seen in Table 3 of the significance value of the curiosity questionnaire at the time of the pre-test 0.052 while the significance value of the questionnaire at the time of the *post-test* was 0.000. The significance value of the questionnaire on the pretest and posttest obtained has a value of > 0.05 which indicates that the *pretest* and *post-test* carried out by students are normally distributed (Santoso, 2018).

C. The Effect of Creative Problem-Solving Learning Assisted by Etnomatematica Nuance Module on Problem-Solving Ability

Students' problem-solving ability is seen from the test results given at the beginning before treatment. The test is in the form of a description of 4 questions, each of which has a different score weight. The student's problem-solving ability is obtained by examining the student's answers and is subsequently given the weight of the assessment. Based on the *pre-test* results in picture 1, it shows that students' problem-solving ability obtained the highest score at the stage of understanding the problem and the lowest score at the stage of rechecking all the steps that have been done.

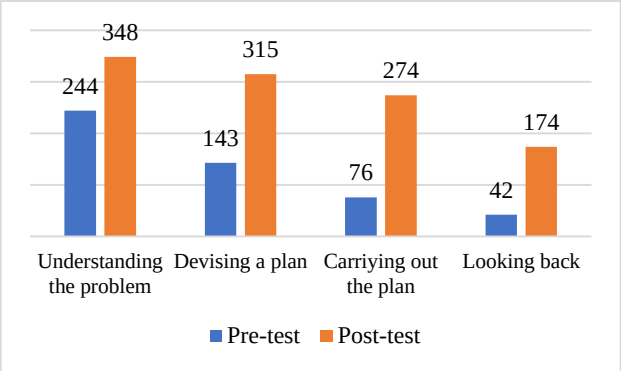

Figure 1. Problem Solving Ability Test Score Results

Based on Figure 1 which presents the results of the posttest and pretest, it shows that there is an increase in the score between the *pre-test* and *post-test* done by the students. However, to see the influence of ethnomathematics module-assisted CPS learning on problem-solving ability scores, a T-statistics test was carried out using the help of SPSS 26.0 for windows software. This test aims to see significant differences based on probability.

Based on Figure 1, information on the problem-solving ability of class XI MIPA 1 student in solving pretest questions at the stage of understanding the problem obtained a score of 244, in the stage of planning a completion obtained a score of 143, at the stage of solving problems according to plan obtained a score of 76, and at the stage of re-checking the answers got a score of 42. When compared to the ideal maximum score of problem-solving ability aspects of 420, the percentage of achievement of each aspect of problem solving successively is 58%, 34%, 18%, and 10%, as researchers this data is used as a reference to compile a Learning Implementation Planning (LPP) for research implementation at the second and third meetings.

At the fourth meeting, a post-test was carried out to find out the results of students' problem-solving abilities after being given treatment. Based on figure 1, information on the problem-solving ability of class XI MIPA 1 student was obtained after treatment in solving post-test questions at the stage of understanding the problem obtained a score of 348, in the stage of planning completion obtained a score of 315, at the stage of

solving problems according to plan obtained a score of 274, and at the stage of re-checking the answers got a score of 174. When compared to the ideal maximum score of problem-solving ability aspects of 420, the percentage of achievement of each aspect of problem-solving respectively is 82%, 75%, 65% and 41%.

Based on the scores of student test results during the *pre-test* and *post-test*, it can be seen that there is an increase in problem-solving skills in every aspect of problem-solving. From the results of the analysis of statistical problem ability test data using the t-test, it was obtained that the statistical value of the output (t_{count}) obtained was 17.310 with a probability / significance level of 0.000 < 0.05. So it can be concluded that there is an influence of learning CPS assisted by ethnomathematics nuanced modules on students' problem-solving ability on geometry transformation material at SMAN 1 Plampang.

The results of this study are in line with the results of (Setyadi et al., 2018) that the Problem-Based Learning (PBL) model with ethnomathematics nuances using traditional games is effective in improving students' problem-solving abilities in grade IV elementary school. The average mathematical problem-solving ability using the ethnomathematics-nuanced PBL model is better than the average mathematical problem-solving ability of students using expository models.

This result is also supported by the research of (Ika Nurhayati & Eko Susilo, 2022) the results of the study show that ethnomathematics learning can effectively help develop students' problem-solving skills and the character of love for local culture, its implementation is used as an approach attached to learning models and learning media.

D. *The Effect of Creative Problem-Solving Learning Assisted Ethnomathematics Nuance Modules Students' Curiosity Abilities*

The questionnaire of curiosity that has been validated, is then given to students of class XI MIPA 1 at SMAN 1 Plampang. The process of filling out student curiosity questionnaire is filled by selecting the Likert scale contained in 10 questions that are shared with each student. Questionnaire sheets are filled out by students before and after treatment with the same questions. The results of filling in the curiosity questionnaire carried out by students, before participating in learning activities using the CPS model assisted by modules with ethnomathematics nuances.

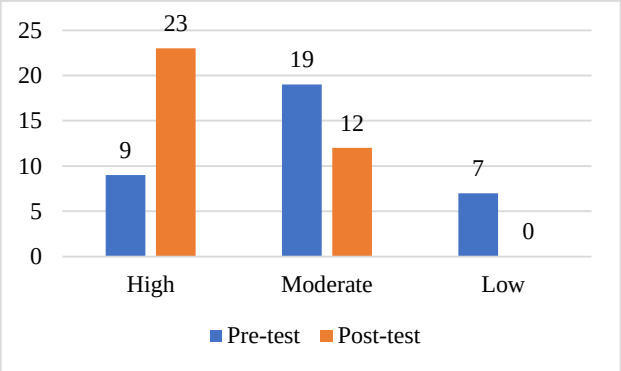

Figure 2. Student Curiosity Questionnaire Results

Based on Figure 2, it can be concluded that the difference in the results of the level of curiosity from 35 students who took the *pre-test* and *post-test*. Before the treatment, the number of students who had high curiosity was 9 students, for students who had a moderate level of curiosity as many as 19 students and students who had low curiosity as many as 7 students. Different results after treatment, there were 23 students who had high curiosity, 12 students with moderate curiosity category, and 0 students who had low curiosity. Based on the pretest results, it was found that student's curiosity was in the moderate category, but after being given treatment, there was an increase in students' curiosity in the high category. Based on the results of the Gain test, a score of 0.31 was obtained with a moderate category.

The second stage carried out is the T-test (*paired sample t-test)*. This test aims to see significant differences based on probability. The results of the analysis of the T-test obtained using SPSS the statistical value of the output (t_{count}) obtained was 8.603 with a probability or significance level of 0.000 < 0.05, this can be concluded that the CPS learning model assisted by the ethnomathematics nuance module on the geometric transformation material has an influence on student curiosity.

The results of this study are in line with the results of the research described by (Mardhiyana & Sejati, 2017) that the problem-based learning model is an alternative to developing creative thinking skills and curiosity in solving the problems faced. Similar results are also explained by (Barata & Sukestiyarno, 2019) that students who have high curiosity also have better problem-solving abilities than students with moderate or low curiosity. The results of the study show that the average student in the category of low and moderate curiosity is unable to complete the execution of the plan well, while students who have high curiosity are able to complete all stages of problem-solving.

V. CONCLUSION

The application of the Creative Problem Solving (CPS) method learning model assisted by the ethnomathematics nuance module on the problem-solving ability and curiosity of class XI students at SMA Negeri 1 Plampang shows the results that this method affects

students' problem-solving ability in solving problems related to geometric transformations. The results of the pretest and post-test scores of the highest scores lie in the aspect of the stage of understanding the problem, which is then followed by the stage of planning and compiling a problem-solving plan, while the statistical test view of this method shows a significant influence on mathematical problem-solving ability. The results of other studies found that the Creative Problem Solving (CPS) method assisted by ethnomathematics nuance modules had a significant effect on students' curiosity. The results of the questionnaire and observation of the pre-test and *post-test* showed an increase in the category of student curiosity which became high.

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