Product assessment of mathematical representation ability viewed from student’s cognitif style

Masrukan* and M Khairunnisa
Department of Mathematics, Faculty of Mathematics and Natural Science, Universitas Negeri Semarang, Indonesia
*Corresponding author: masrukan@mail.unnes.ac.id

Abstract. The mathematical representation ability in Junior High School 1 Bojong, Pekalongan, Central Java is still not optimal. For this reason, one of the methods that can be used to increase the ability of mathematical representation is cooperative learning type Two Stay Two Stray with product assessment. This research aims to obtain the effectiveness of the learning and analysing students' mathematical representation abilities in terms of the reflective-impulsive cognitive style. This research used Mixed Methods with Explanatory Sequential Design. The population in this study was class VIII Junior High School 1 Bojong with research samples namely classes VIII A and VIII C which were selected using cluster sampling techniques. The subjects of this study were 4 students of class VIII C. Data collection techniques used include: observation, documentation, tests, and interviews. The results showed that: (1) Two Stay Two Stray learning with product assessment on the achievement of students' mathematical representation abilities is effective, namely achieving classical completeness, the average mathematical representation ability of experimental class students is better than the control class, and there is a positive influence of style cognitive ability of students' mathematical representation; (2) description of the ability of mathematical representation in terms of the reflective-impulsive cognitive style is as follows: a) reflective students are able to make geometry drawings well and translate images to clarify problems well, can make mathematical models well and solve them by involving mathematical expressions properly, and are able to write concluding steps in a concise and clear manner and answer questions with words correctly; b) impulsive students are able to make geometry drawings well and translate images to clarify problems well, but sometimes make mistakes, can make mathematical models well and solve them by involving mathematical expressions correctly, but sometimes make mistakes, and are able to write steps a concise and clear solution and answer questions with words correctly, but sometimes make mistakes.

1. Introduction
Mathematical representation deserves to be emphasized and raised in the process of teaching mathematics in schools. The ability of mathematical representation supports students to learn to translate mathematical concepts in solving a problem. In studying geometry, students need to understand a concept of geometric shapes. This shows that the ability of good Mathematical representation is needed so that students can understand geometry optimally. The percentage of absorptive capacity of the 2018 National Examination of Junior High School 1 Bojong, Pekalongan, Central Java on Geometry and measurement material is 51.07%.

The percentage shows that the ability of students related to geometry is still relatively low. The results of interviews with mathematics teachers in class VIII of Junior High School 1 Bojong conducted on
January 14, 2019 also showed that the ability of student representation, both visual, symbolic, and verbal is less developed. The mathematical representation indicators that will be observed in this study refer to the various mathematical representation indicators proposed by Mudzakir, there are: (1) Visual representation, sketching cubes and beams to explain problems and facilitate resolution; (2) Symbolic representation, making equations or mathematical models of problems and solving problems involving mathematical expressions; and (3) Verbal representations, write steps for solving mathematical problems with words and answer questions using written words or text.

The ability of representation of each student is different from one another because each student has a different way of receiving learning material. There are students who are quick to respond to learning material, there are students who are slow to respond to learning material. Fast or slow response given by students is called the tempo of student. Differences in students' cognitive styles lead to different ways of solving their mathematical problems and the differences will trigger differences in students' representation processes. The students with impulsive cognitive styles check the answers in a hurry and cannot provide solutions to the answers at the end of the answers. Therefore we need a learning model that takes into account the cognitive style of each student. Two Stay Two Stray learning can provide opportunities, especially for impulsive students, to check answers by visiting other groups (Strays). Conversely, reflective students stay in their groups (Stay) to explain their findings to students who visit. It is hoped that both reflective and impulsive students can understand mathematical concepts and are able to solve mathematical problems well. So, this research will use cooperative Two Stay Two Stray as a learning model.

In addition to the use of learning models, the assessment of students also needs to be considered, because one important aspect in the learning process is the aspect of assessment or assessment. One form of assessment that is appropriate for use in learning mathematics in geometry material is product assessment. Product assessment (product assessment) is one type of authentic assessment where students make a product according to the competency of the object being assessed is the work of students in the form of an object like of cloth, paper, metal, wood, ceramic plastics, and works of art such as paintings, drawings and sculptures. The product assessment can be used by teachers to assess student skills and assess the level of competency students have mastered.

Based on the description above, the problems faced in this study are: (1) The effectiveness of Two Stay Two Stray learning with product assessment on the achievement of students' mathematical representation abilities, namely achieving classical completeness, the average mathematical representation ability of experimental class students is better than the control class, and there is a positive influence of a cognitive style of students' mathematical representation; (2) the ability of mathematical representation in terms of a reflective-impulsive cognitive style.

2. Methods
The research method used in this study is a combination method (mixed methods) sequential explanatory design. The quantitative research design uses Quasi Experimental Design in the form of The Non-equivalent Post-test Only Control Group Design. The population in this study were 8th grade students of Junior High School 1 Bojong in the 2018/2019 school year. The sample in this study was students of class VIII C as an experimental group who were given treatment in the form of learning Two Stay Two Stray with a product assessment and a control group of students of class VIII A. The sampling was based on random sampling area (cluster) techniques. The selection of research subjects is based on a purposive sampling technique.

Students are given a cognitive style test that is the MFFT (Matching Familiar Figure Test) made by Jerome Kagan and has been modified by Warli (2010). The research subjects were 4 students, namely 2 students with reflective cognitive styles and 2 students with cognitive abilities. Data collection methods in this study are the method of documentation, tests, observations, and interviews. The purpose of the interview is to find out the mathematical representation ability of students who have reflective and impulsive cognitive style.
Analysis of the data in this study is the analysis of quantitative data and qualitative data. Quantitative data analysis is a prerequisite test analysis of preliminary data that to find out that both classes had the same initial ability and analysis of test results for mathematical representation capabilities is for answer the first problem formulation that is Two Stay Two Stray learning with effective product assessment on the achievement of students' mathematical representation abilities, namely achieving classical completeness that using a proportion test, the average mathematical representation ability of experimental class students is better than the control class that using two difference test average, and there is a positive influence of style cognitive ability of students' mathematical representation which tested by simple regression analysis. Then the qualitative data analysis technique in this study was the analysis during the Miles and Huberman Model field, namely data reduction, data display, and conclusion: drawing / verification.

3. Results and Discussion

Learning is carried out with the TSTS model using a scientific approach and product assessment. The syntax of the TSTS learning model is Class Presentation, Grouping, Team Working, Two Stay, Two Stray, and Report Team. The scientific approach stage is observing, questioning, gathering information, associating, and communicating. The Product Assessment stage is the last stage. At this stage the teacher is also assessed for skills. The first meeting's product is sketching a cube / block in accordance, this task trains students' visual representation abilities. Next, the product that students must produce at the second meeting is to make a simple bulletin board that must contain material for decreasing the surface area of a cube / beam, as well as an example of the surface area of a cube / beam, in which the size of the ribcage is adjusted to the object carried by the student (cube / beam). The answers in the sample problem section should write down the work steps and involve mathematical expressions, as well as write the final answer in words. This is in accordance with indicators of mathematical representation, namely symbolic representation and verbal representation. At the last meeting, the student's task is to make a unit cube and then arrange it according to instructions and questions on the assignment sheet.

3.1. Cognitive Style's Classification

Data analysis on the results of MFFT was carried out accordance with the instrument instructions that had been developed by Warli (2010) from the adaptation of Jerome Kagan. The results of grouping students based on cognitive styles are 37.50% of students had reflective cognitive style, 40.63% impulsive cognitive style, 9.38% of students were fast accurate, 6.25% of students were slow inaccurate and 6.25% of students had a double tendency (2 children are reflective and slow are not accurate. Reflective and impulsive students have a proportion of 78.125% greater than the proportion of students who are fast accurate, slow-inaccurate and double tendency is 21.875%. Then 2 children were chosen each with reflective and impulsive cognitive styles to be the research subjects by the certain conditions.

3.2. The Completeness of Students' Mathematical Representation Ability in Two Stay Two Stray Learning with Product Assessment

Based on the test results of students' mathematical representation ability, completeness presentation in the experimental class was 90.625% and in the control class was 64.516%. Furthermore, quantitative data on the results of the VIII C class mathematical representation ability will be analysed through hypothesis 1 test, namely the classical completeness test using the proportion test (one party, right side) and included in parametric statistics where the population is normally distributed. So before this test is done prerequisite normality test.

The normality test was carried out by the Kolmogorov Smirnov test with SPSS 18.0. In the normality test the Sig (2-Tailed) value in the experimental class column is 0.917 > 0.05 = α and for the control class column is 0.940 > α, so H₀ is accepted. So the data from the experimental and control classes come from normally distributed populations.

Then the completeness test is carried out with a proportion test (one party, right party). This test is carried out to find out that TSTS learning with product assessment achieves completeness in students'
mathematical representation abilities. Classical completeness in this study is if more than 75% of students obtain a minimum score of minimum criteria of mastery learning 70. The hypothesis in this study is the percentage of mastery learning classically tests the ability of mathematical representation in the classroom using TSTS learning with a product assessment of more than 75%. The calculation results obtained \( z_{\text{count}} = 2.04142 \) and \( z_{\text{table}} = z_{0.05} = 1.645 \). Because \( z_{\text{count}} = 2.04142 > 1.645 = z_{0.05} \) then \( H_0 \) is rejected. So the proportion of the number of students who have achieved mastery learning outcomes on the surface area and volume of the cubes and beams is more than 75% of all students in the experimental class.

3.3. Comparison of Students’ Mathematical Representation Ability in Two Stay Two Stray Learning with Product Assessment with learning in the control class.

Based on the test results of the mathematical representation ability of the experimental class (VIII C) the highest value is 96.43, the lowest value obtained is 59.53, and the average is 80.358. While the test results of the mathematical representation ability of the control class (VIII A), the highest value is 91.67, the lowest value obtained is 50, and the average is 74.145. The average mathematical representation ability of students in the TSTS learning model with product assessment is higher than the control class that uses the Discovery Learning model.

In this study two different mean tests were used. The average two different test (one party, right party) was conducted to test whether the mathematical representation ability of students who took part in TSTS learning with a product assessment was better than the mathematical representation ability of students in the control class or not. The hypothesis in this study is the average value of the test of mathematical representation ability of students who take the TSTS learning with product assessment is more than the average value of the test of mathematical representation ability of students who take learning in the control class.

The variance similarity test used in this study is the Levene test. In the Levene test the sig value obtained in the Test of Homogeneity of Variance is 0.171 where \( \alpha = 0.05 \). Because the value of Sig = 0.171 > \( \alpha \), then \( H_0 \) is accepted. So the data from both sample groups have same variance. Because the two variances are the same, test statistic used in the one-party average test is the t test. The calculation results obtained \( t_{\text{count}} = 2.483 \) and the value of \( t_{1-\alpha} = t_{1-0.05} = t_{0.95} = 1.66980 \). Because \( t = 2.483 > 1.66980 = t_{0.95} \) then \( H_0 \) is rejected. So, the average mathematical representation ability of students who take TSTS learning with product assessment is better than the ability of students' mathematical representation in the control class.

3.4. The Effect of Cognitive Style on Mathematical Representation Ability in Two Stay Two Stray Learning with Product Assessment.

Based on the results of regression analysis using SPSS 18.0, the regression equation \( \hat{Y} = 74.669 + 0.021X \) was obtained. From the results of the analysis obtained the fact that cognitive style has a positive influence on the ability of students' mathematical representation in learning TSTS with a preliminary assessment of 14.4%. Learning is done at the time the research takes place using the TSTS model with product assessments, researchers apply strategies so that students with reflective and impulsive cognitive styles can be more optimal in learning. One of them is by division of groups. The division of groups here is done so that each group has a diverse cognitive style. This means that impulsive cognitive style students are not accustomed to solving problems in a hurry and students with reflective cognitive style will help impulsive students to be more careful in solving a problem so that later they will get maximum results. With the implementation of this strategy, as many as 90.625% of students in the experimental class were obtained for all types of cognitive styles. Although in this study there are still indicators not fully mastered by students so that further research is needed.

3.5. Ability of Mathematical Representation Judging from the Reflective-Impulsive Cognitive Style in the TSTS Learning Model with Product Assessment.
The results of students’ mathematical representation ability tests were analysed by taking into account indicators of aspects of mathematical representation ability, including: (1) visual representation, namely sketching cubes and blocks to explain problems and facilitate resolution; (2) symbolic representations, i.e. make equations or mathematical models of problems and solve problems involving mathematical expressions; and (3) verbal representations, i.e., writing steps for solving mathematical problems with words and answering questions using words.

Four research subjects were selected: 2 students with a reflexive cognitive style and 2 students with an impulsive cognitive style and then conducted interviews with 4 of the research subjects related to mathematical representation indicators. The ability of mathematical representation in students with reflective cognitive styles is almost the same. The difference between reflective students E-09 and reflective students E-24 lies in the symbolic representation indicator 1, which is writing a mathematical model. E-24 reflective students write what they know is more complete than E-09 subjects. Conversely, the ability of mathematical representation in students with impulsive cognitive styles is almost always different.

The ability of mathematical representation of students with reflective cognitive style is better than the ability of representation of students with impulsive cognitive style. Mistakes that are often made by students with impulsive cognitive style are errors in counting. In interviews, students with impulsive styles also mentioned that they often did not re-make corrections when they were about to collect the results of tests, so that when there was an error in contacting, they did not correct it. Errors in counting are also caused by students who are too hasty in answering questions so the calculations are missed and the results are not right. Nevertheless there are still students with impulsive cognitive styles who have mathematical representation abilities that are almost the same as students with reflective cognitive styles. Therefore, in learning teachers should pay attention to the cognitive style of students.

4. Conclusion
Base on the results, Two Stay Two Stray learning with effective product assessment on the achievement of students' mathematical representation abilities, namely achieving classical completeness, the average mathematical representation ability of experimental class students is better than the control class, and there is a positive influence of style cognitive ability of students' mathematical representation. Description of the ability of mathematical representation in terms of the cognitive style is: a) reflective students are able to make geometry drawings well and translate images to clarify problems well, can make mathematical models well and solve them by involving mathematical expressions properly, and are able write concluding steps in a concise and clear manner and answer questions with words correctly; b) impulsive students are able to make geometry drawings well and translate images to clarify problems well, but sometimes make mistakes, can make mathematical models well and solve them by involving mathematical expressions correctly, but sometimes make mistakes, and are able to write steps a concise and clear solution and answer questions with words correctly, but sometimes make mistakes.

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