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THE EFFECT OF APTITUDE TREATMENT INTERACTION LEARNING MODEL ON MATHEMATICAL CREATIVE THINKING SKILLS

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Abstract

The study aimed to determine the effect of the implementation of the Aptitude Treatment Interaction learning model and itseffectiveness on the mathematical thinking skills of SMPN 1 Ajibarang students on the topic of Opportunity, between the ATI(Aptitude Treatment Interaction) experimental class and the control class with the cooperative learning model. This type of research was a quasi-experimental design with two control experiment groups, a pre- test and a post-test design. The results showed differences in student learning outcomes between the two classes, as evidenced by the results of the t-test (2 parties), where the significance value was 0.009 0.025. Thus, there was an average difference between the experimental and the control classes. So, the application of the ATI (Aptitude Treatment Interaction) learning model in the experimental class affects the creative thinking ability of SMP for eighth grader students on the subject of opportunity compared to the control class.

Keywords: Aptitude Treatment Interaction, Creative Thinking Skill

INTRODUCTION

To improve the quality of human resources, mathematics is one of the efforts applied or studied in schools. The state provides views on learning mathematics in schools in RI Law no. 20 of 2003 concerning National Education System (National Education System) Article 37 that mathematics is a compulsory subject at the elementary to high school/vocational school levels. Then it was reaffirmed regarding the goals of mathematics education through Permendikbud Number 22 (2016) on the first point. Namely, students understand mathematical concepts and are precise in solving problems. Apply concepts or algorithms flexibly, accurately, and efficiently and explain the interrelationships between concepts. In the 21st century, learning mathematics has one goal: to think creatively and mathematically (Arifin, 2017). Therefore, the ability to think creatively is an ability in mathematics that needs to be possessed by students to fulfill the mathematics goals set by the state and meet the needs of the times.

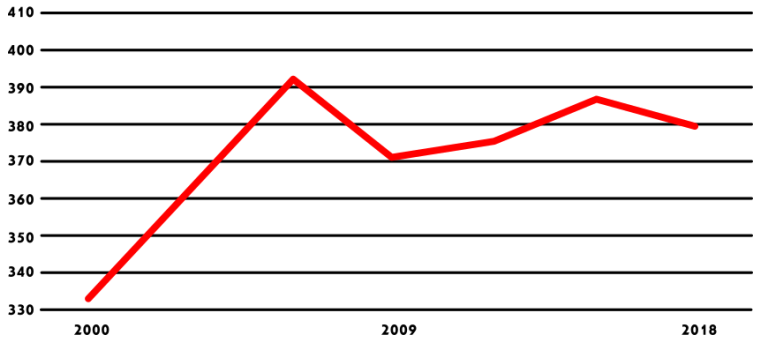

Figure 1. Indonesia's PISA score 2000-2018 (Jayani, 2019)

From Figure 1, it can be seen that students' mathematics scores in 2009-2018 tend to be flat, indicating no significant development in that period. Mathematics requires mathematical ability, where mathematical knowledge says NCTM (Ernawati, 2016), one of which consists of creative mathematical thinking. In dealing with and solving problems in learning mathematics, students need to have the ability to think creatively (Machromah et al., 2015). Not only in the field of mathematics but in everyday life, creative thinking becomes helpful in solving problems in life. Nonetheless, creative thinking is one of the elements in mathematics teaching that receives less attention (Siswono, 2004).

Based on the results of interviews with math teachers who teach at SMP Negeri 1 Ajibarang. Where students often work on problems or solve math problems in a textbook. In other words, students only work on math problems or problems based on what is in the book or the method the teacher has taught. If the questions are modified from the forms in the book or those the teacher has taught, students will need help finding or solving new ideas. Teachers usually use group learning for students in the teaching and learning activities. Therefore, efforts are needed in learning that can improve students' creative thinking abilities.

An effective and efficient learning model is needed to improve students' mathematical creative thinking skills, one of which is the Aptitude Treatment Interaction (ATI) learning model. Because Aptitude Treatment Interaction learning is a learning model that determines the effective treatment used according to students' abilities (Yenti, 2020). Several studies have found that ATI learning affects students' mathematical abilities (Pamungkas & Afriansyah, 2016; Yenti, 2020). Based on the background above, this research was carried out to determine the effectiveness of the Aptitude Treatment Interaction learning model in improving students' mathematical creative thinking abilities.

LITERATURE REVIEW

Aptitude Treatment Interaction Model

The ATI (Aptitude Treatment Interaction) learning model is a learning model that has several learning strategies (treatments) that are effectively used for specific individuals according to the abilities of each learner (Dazrullisa, 2016). Meanwhile, Snow and Cronbach (Yenti, 2020) explain that ATI is a concept that includes a series of effective learning strategies for specific students, depending on the characteristics of their abilities, and is based on optimizing understanding of mathematical

concepts which aims to adjust treatment to different ability of students. Regarding the understanding of ATI learning that has been explained, the ATI learning model is a model that uses several different learning strategies as a treatment for students based on the level of ability that has been measured previously.

In implementing learning in the Aptitude Treatment Interaction model using a tool, namely Student Worksheets (LKPD). LKPD, according to Majid (Sutrimo et al., 2019), Worksheets (LK) or assignment sheets (LT) are intended to trigger and help students carry out learning activities in order to master an understanding. The use of LKPD is expected to help teachers be more effective and efficient in delivering material and create a learning environment and learning process that can stimulate students' creativity. The success of Aptitude Treatment Interaction learning can be achieved if applying it meets the principles put forward by Snow (Nugroho, 2018). That is, a structured learning environment is suitable for students with low abilities, while a less structured (flexible) learning environment is more suitable for students with high abilities.

The guidelines for the Aptitude Treatment Interaction (ATI) learning model, according to Dazrullisa (2016), are as follows:

Table 1. Stages in the Aptitude Treatment Interaction Learning Model (ATI)

Stages	Description
Aptitude test	The grouping of students based on the aptitude test results into three categories: students with low, medium, and high abilities.
Student Grouping	Classify students according to the results of the aptitude test. Students in the class are divided into three groups of high, medium, and low ability.
Treatment	Each group is given a treatment that is considered according to its characteristics. Students with "higher" abilities receive treatment through self-taught modules. Students with "normal" abilities receive regular classes. At the same time, the group of students with "lower" abilities received intensive tutorial treatment during the learning process.
Achievement test	It aims to measure students' abilities after getting treatment according to their abilities.

Based on Table 1 above, the Aptitude Treatment Interaction learning steps that will be applied in this study are as follows: 1) The teacher divides students into three groups based on the aptitude test results. The grouping of students is labeled high, medium, and low. 2) The teacher gives treatment (treatment) to each group (high, medium, and low) in learning. 3) The teacher gives worksheets as

material for activities in learning. 4) For groups of students with high aptitude, the treatment given is self-learning in the library to find relevant information from existing sources. 5) For groups of students with moderate and low abilities, re-teaching lessons regarding the material to be delivered are given in class. 6) For groups of students with low abilities are given treatment, namely tutorial learning in working on worksheets. 7) For groups of students who are in groups, they are given treatment, namely asking questions about problems found in working on worksheets. 8) Students are allowed to present their work.

Creative Thinking Skill

Through thinking, humans can solve the problems they face in life. One of the thinking abilities humans possess is the ability to think creatively. Creative thinking is an activity to compile and produce new ideas or ideas and find possible solutions to a problem based on the available information (Siswono, 2010). Meanwhile, according to Nitano (2019), creative thinking is a unit of divergent and logical thinking. Prasetiyo and Mubarokah (2014) argues that creative mathematical thinking is the ability that can produce several answers and generate many ideas to solve a problem based on the information obtained. *Mathematical creative thinking* in the school context is defined as a process level that produces new solutions that can be given to problems (Aizikovitsh, 2014). *Mathematical creative thinking* is an ability that produces a variety of new solutions (Nitano, 2010). Mathematical creative thinking combines logical and divergent thinking, which can produce new and various answers or solutions.

There are four stages of the creative thinking process based on Wallas' theory (Masitoh et al., 2019): preparation, incubation, illumination, and verification. These stages are explained as follows (1) At this preparatory stage, students collect relevant information to solve problems, (2) at the incubation stage, students will think consciously, (3) at the illumination stage, students get ideas or ideas that appear in the incubation stage, and (4) in the verification stage students test the stage or check the results of the answers.

Indicators are used to measure the ability to think creatively in mathematics. There are three indicators of creative thinking: fluency, flexibility, and novelty (Siswono, 2010; Silver, 1997). Fluency (fluency) measures how many answers students make in response to a problem. Flexibility is used to measure the number of different solving methods used to solve a problem. Novelty (novelty) to measure the originality of ideas or answers made by students solving a problem and different from those done by other students. Prasetiyo and Mubarokah (2014) suggests that the ability to think creatively is formulated as an ability that reflects the following indicators: (a) Fluency is the ability to generate lots of ideas, answers, problem solving or questions; (b) Flexibility, the ability to produce diverse ideas, answers or questions; (c) Originality the ability to obtain things that are new and unique or an unusual combination of everyday things; (d) Elaboration the ability to reproduce and develop an idea.

In this study using indicators of creative mathematical thinking according to Munandar (2009), there are four indicators of creative thinking as shown in Table 2 below:

Tabel 2. Indikator Berpikir Kreatif

Aspect	Indicator
Fluency	To measure the number of correct answers that students make in solving a problem
Flexibility	To measure the number of different and correct solutions to solving a problem
Originality	To measure the authenticity of answers made by students in response to a problem
Elaboration	To measure the ability of students to answer in detail in solving problems

RESEARCH METHODS

This study used a quasi-experimental design with a two experimental control group pretest and posttest design. The research design can be seen in Table 3 below:

Table 3. Research Design

R : E	O_1	X	O_2
R : K	O_1		O_2

This study used one experimental class and one control class. Sampling was done by cluster random sampling method. There are two variables: one dependent variable and one independent variable. The dependent variable is learning outcomes, the independent variable 1 is the ATI model, and the dependent variable is the ability to think creatively and mathematically. The limitations examined in this study were the ability to think creatively mathematically in class VIII, the subject of opportunity.

The data collection technique in this study used a mathematical creative thinking test; the test used was an essay test with two questions. Before the questions are used as research instruments, the questions are first tested to determine the validity and reliability of the questions. Data analysis techniques for student learning outcomes used the normality and homogeneity tests as prerequisites. Test for normality using the Shapiro-Wilk formula. The data obtained were normally distributed and then tested for homogeneity using the Levene Statistic test. After the data is normally distributed and homogeneous, a hypothesis test is carried out using the t-test (2 parties). Then if the average of the two classes is different, it will be followed by an analysis of the N-Gain Score (%).

RESULTS AND DISCUSSION

Data Description

Table 4. Data Description

Experiment Class	Test	N	Max. Value	Min. Value	Mean
	Pre Test	33	41	9	21,50
	Post Test	33	81	38	56,82
Control Class	Test	N	Max. Value	Min. Value	Mean
	Pre Test	33	44	6	19.98
	Post Test	33	75	13	47.82

Based on Table 4, it can be seen that there was an increase in student learning outcomes after being given good treatment in the experimental class and the control class.

Normality Test

Based on the SPSS output table, it is known that the significance value (Sig.) of the experimental class is Sig. = 0.709 > 0.05, so the post-test value data for the experimental class are normally distributed. Then in the control class, it is known that the significance value is (Sig.) = 0.232 <0.05. Thus, it can be concluded that the data in the control class are normally distributed.

Homogeneity Test

From the results obtained, the Based Mean significance value is Sig. = 0.060 > 0.05. It can be concluded that both classes are homogeneous.

T Test

From the SPSS calculation results, the Equal variances assumed significance value is 0.006, which is smaller than 0.025, so it can be concluded that there is an average difference between the experimental class and the control class.

Percent Score N-Gain Analysis

The n-Gain analysis is used to determine how much the value of the pre-test and post-test changes from the creative thinking variable after being treated with the application of the Aptitude Treatment Interaction learning model after calculating the N-Gain Score (%). The t-test was also carried out on the average N-Gain Score (%), which obtained a significance value (2-tailed) of 0.009,

which is smaller than 0.025, so it can be concluded that there is a significant increase in ability in the experimental class compared to the control class. The pre-test results for the ability to think creatively about opportunities in the experimental class of the 33 students who took the test obtained an average of 21.5, with the highest and lowest scores being 41 and 9. Meanwhile, the results of the pre-test for creative thinking skills in the experimental class of the 33 participants students who took the test got an average of 21.5, with the highest and lowest scores being 41 and 9.

The pre-test results for the ability to think creatively about opportunities in the experimental class of the 33 students who took the test obtained an average of 56.82, with the highest and lowest scores being 81 and 38. Meanwhile, the pre-test results for the ability to think creatively in the experimental class of 33 participants students who took the test got an average of 47.82, with the highest and lowest scores being 75 and 13. Students learn actively while learning the ATI model is implemented. In the low group, students actively listen to the steps and explanations explained by the teacher, and it is also not uncommon to ask questions, as well as groups who do not hesitate to ask questions when experiencing difficulties. The high group is more enthusiastic about completing the worksheet because they are free to access all relevant information to complete the worksheet. These things align with Snow's opinion (Nugroho, 2018) that a structured learning environment is suitable for students with low abilities, while a less structured (flexible) learning environment is more suitable for students with high abilities.

Student activities in ATI learning are working on student worksheets carried out in groups. This helps students to learn about the material presented. Through worksheets, students must discuss and work on solving the problems presented. In addition, worksheets also assist teachers in directing and opening new discussions by asking several questions related to the problems presented to stimulate students' creative thinking. The results of the t-test showed that there was an average difference between the experimental class and the control class. In addition, the N Gain score (%) between the experimental class and the control class also has an average difference which indicates that there is a difference in the increase in students' mathematical creative thinking abilities from the ATI learning model expecting students' mathematical creative thinking abilities compared to the cooperative model. This indicates that ATI learning is more effective in improving students' mathematical thinking skills than cooperative learning.

The effect of the experimental class that received the ATI model compared to the control class that received the cooperative model on the ability to think mathematically creatively was caused by the division of groups and the treatment in each group. In the ATI learning model, the division of groups is based on students' initial abilities so that groups have members who have homogeneous abilities, which causes students to be more active in learning activities because they feel they have a similar background to other group members. Whereas in the control class, group divisions were based on table order without regard to students' abilities. As a result, the group has members with heterogeneous abilities. With the differences in each group's abilities, students with low abilities tend

to be more passive in learning activities because they feel that every job is sufficiently done by students who are considered skilled in the group.

Apart from the division of groups, the treatment applied to each study group is another reason that causes the ATI learning model to be more influential in improving students' creative thinking abilities. The treatment in the ATI model is based on the group's ability to create a more conducive learning environment that makes students more enthusiastic and motivated and not feel worried about being left behind by friends in their group. While the treatment in the cooperative learning model in each group is the same, namely giving direction or guidance to groups experiencing difficulties. This resulted in the activity of students in groups only being carried out by students considered competent in their groups. This supports previous research that the ATI learning model can optimally improve learning outcomes and make students more active because they are directly involved in group activities (Maskur et al., 2020; Wirahmad & Arifin, 2020).

CONCLUSION

The research results that have been obtained regarding implementing the Aptitude Treatment Interaction learning influence model on students' mathematical creative thinking abilities obtained several conclusions. Based on the hypothesis testing using the independent sample t-test and calculating the N-Gain Score, it was found that there was a significant difference in the mean and significant influence on students' mathematical creative thinking abilities in the class that received the Aptitude Treatment Interaction model as the experimental class and the class that received the Cooperative model. as control class. Thus, the Aptitude Treatment Interaction learning model influences students' mathematical creative thinking abilities compared to learning in the control class. Based on the research results and conclusions obtained, this study suggests that Aptitude Treatment Interaction learning can be used as an alternative learning to optimize mathematical creative thinking abilities. With the limitations of researchers in conducting research, it is necessary to carry out further research regarding the Aptitude Treatment Interaction learning model with different approaches, research designs, research boundaries, and research objects.

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