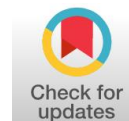# INCREASED MATHEMATICAL CRITICAL THINKING SKILLS THROUGH REACT LEARNING STRATEGIES IN JUNIOR HIGH SCHOOL STUDENTS

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Abstrak

Penelitian ini bertujuan untuk mengetahui peningkatan kemampuan berpikir kritis matematis pada siswa SMP antara siswa yang memperoleh pembelajaran strategi REACT (*Relating, Experiencing, Applying Cooperating and Transferring*) dan siswa dengan pembelajaran langsung. Penelitian ini menggunakan metode kuasi eksperimen dengan desain penelitian *Non-equivalen Pretest-Posttest Control Group Design*. Populasi dalam penelitian ini yaitu siswa kelas VIII di salah satu SMP Negeri di kota Bandung. Teknik pengambilan sampel berupa *purposive sampling* dengan sampel yang terdiri dari 2 kelas, yaitu kelas VIII-A sebagai kelas kontrol sebanyak 25 siswa dan VIII-C sebagai kelas eksperimen sebanyak 26 siswa. Pengumpulan data diperoleh dari hasil pretest dan posttest. Hasil penelitian menunjukkan bahwa peningkatan kemampuan berpikir kritis matematis melalui pembelajaran strategi REACT lebih tinggi secara signifikan dibandingkan dengan pembelajaran langsung. Peningkatan hasil belajar siswa kelas eksperimen ada pada kategori sedang, sementara peningkatan hasil belajar siswa kelas kontrol ada pada kategori rendah.

Kata Kunci: kemampuan berpikir kritis matematis, strategi REACT, siswa SMP

Abstract

This research aims to determine the improvement of mathematical critical thinking skills in junior high school students between students who get REACT (Relating, Experiencing, Applying Cooperating and Transferring) strategy learning with students who get direct instruction and find out student responses to learning with the REACT strategy. The research uses a quasi-experimental method with type of research was with Non-equivalent Pretest-Posttest Control Group Design. The population in this research were grade VIII students in even semester 2018/2019 in one of the state junior high school in the city of Bandung. The sampling technique was purposive sampling with a sample consisting of 2 classes, namely class VIII-A as a control class of 25 students and VIII-C as an experimental class as many as 26 students. Data collection obtained from the results of pretest and posttest. The results showed that the improvement of mathematical critical thinking skills through REACT strategy learning was significantly higher than direct learning. The increase in the learning outcomes of the experimental class students is in the medium category, while the increase in the control class students' learning outcomes is in the low category).

Keyword: Mathematical Critical Thinking, Strategy REACT, Junior High School's Student

INTRODUCTION

The ability of critical thinking is one of the most important skills nowadays. Ennis (2011) states that critical thinking is a process of using the ability to think rationally and reflectively which aims to make decisions about what to believe or do. This definition is a combination of five basic things in critical thinking, namely practical, reflective, reasonable, belief, and action. Currently, the ability of critical thinking has been manifested in every subject in school, including in learning mathematics. Critical thinking is one of two higher-order thinking skills along with creative thinking skills that must be accustomed or trained to students. In order to train and get used to thinking in students, it should start from the basic education level to the secondary education level (Istianah, 2013).

The ability of critical thinking in schools is still facing so many obstacles. The current learning system still adapted the students with the only received information, so that students are

only able to solve procedural problems. As a result, students in the class are classified as passive, less critical, and less creative. In addition, Nuryanti, et al., (2018) and Syutaridho (2016) through their research stated that the critical thinking skills of the junior high school students were still underdeveloped or still low because students were not accustomed to being presented with active learning to maximize students' thinking potential so that critical thinking skills students still need to be trained further so that it can be able to be improved. The reported research of the middle and high school students to feel embarrassed when the answer is wrong (Syutaridho, 2016). The cause is due to the junior high school student relying on the formulas they memorize and tend to have the same answers with other students so that some of the students' have the same solution strategy.

To improve the ability of students' critical thinking is applied the suitable learning strategy is. The learning strategy should provide a chance for the student to be more active in the learning process and able to construct their self-knowledge. Learning strategies that can improve critical thinking skills are those that allow the reconstruction and reorganization of the cognitive structures that students already have (Rahmaton, 2018). One alternative learning strategy that supports the construction of the students' knowledge is REACT (Relating, Experiencing, Applying, Cooperating, and Transferring) strategy. Crawford (2001) states that the REACT strategy can be used to encourage students' critical thinking skills in the learning process. Crawford developed the REACT strategy which refers to constructivism. Through this strategy, the teacher no need to make the students memorizes the concepts (such as facts, definitions, and procedures), but to engage in activities that continuously think and explain the reasoning, find out various relationships between themes and improve students' critical thinking skills in the studied basic concepts of the material (Nawas, 2003). 2018; Feronika, 2020). Therefore, the authors considered that the REACT strategy can encourage students to think critically, besides that this strategy also makes students learn meaningfully. By actively involving students in the learning process, the students' critical thinking skills in mathematics are well trained continuously.

Through the above description, a study was conducted in implementing the REACT strategy and direct learning to improve students' mathematical critical thinking skills, especially in Junior High School 19 Bandung. This reach aimed to analyze the improvement of mathematical thinking skills through the REACT strategy in junior high school students. This research is expected to help readers obtain an idea of improving the mathematics critical thinking skills of junior high school students who receive REACT strategy learning with students who receive direct learning.

METHOD

The method in this research used a quasi-experimental research method with the research design of Nonequivalent Pretest-Posttest Control Group Design. In this research, the experimental class is a class with REACT strategy learning and the control class will be a class with direct learning.

Below is the form of research design used (Sugiyono, 2010):

Experimental class   : O_1 X_1 O_2
$$----------------------$$
Control class   : O_1 O_2

Description:

O_1 : pretest of mathematical critical thinking ability

O_2 : posttest of mathematical critical thinking ability

X_1 : learning modela using REACT strategy

The population in this research was public junior high school students in Bandung in the even semester of the academic year 2018/2019. The sampling technique used is non-probability sampling, it is purposive sampling by considering there is no superior class or the ability of students in the class is homogeneous. Class VIII-A consists of 25 students as a control class, while class VIII-C consists of 26 students as an experimental class.

The test instrument was used to discover the ability of the students' critical thinking. The test instrument turned into a pretest/posttest question aimed to measure the students' initial and final mathematics critical thinking ability after conducting treatment to the experimental group. In

producing a proper research instrument, the researcher consulted with experts and conducted trials to discover: validity, reliability, discriminatory power, and difficulty index using SPSS 25 software for windows and MS. Excel 2019.

The form of the test was written test in a form of a description refer to the indicator of the ability of critical thinking. Ennis (1985) states that there are 5 indicators in critical thinking: elementary clarification (providing a basic explanation), basic support (building basic skill), inference (conclusion), advanced clarification (making further explanation), strategy and tactic (using strategies and tactics). This indicator eases the researcher to discover the actual students' ability through the steps way in answering the question.

The indicator of the critical thinking of this reseach as below.

Table 1 Critical Thinking Indicators in this research

Aspect	Indicator
Elementary clarification	Creating and determining the value of the probability based on the given information along with the reasons
Basic support	Identifying the correct statement in answering the matter regarding the probability with the reasons.
Interference	Creating the conclusion of the matter of probability based on the given information
Advanced clarification	Identifying the decision will be taken through the question of probability material
Strategies and tactics	Determining the suitable strategy in answering the problem and identifying and fixing the matter of the probability material

Quantitative data in this research obtained through tests of the ability of mathematics critical thinking in the form of pretest, posttest, and n-gain. The quantitative data analysis consisted of a normality test, a homogeneity test, and a test of the similarity or difference of two averages using SPSS 25 for windows.

RESULTS AND DISCUSSION

This part discussed the result of the research, which consists of the improvement of the ability of mathematics critical thinking students' through strategy learning. First, analyzed the pretest data and n-gain by using the statistics test. The statistics test are the normality test, homogeneity test, and the similarity test of two averages. This strategy aimed to discover whether there are differences in initial ability. Furthermore, this strategy aimed to increase the ability in mathematics critical thinking between students in experimental class and students in control class students.

Based on the result pretest data obtained through normality test Saphiro Wilk, the pretest data from the experimental class and control class were gained from the population that is not normally distributed. After that, the Mann-Whitney similarity test was conducted.

Table 2 The pretest result of Mann-Whitney test

	Pretest result
Mann-Whitney U	321,000
Wilcoxon W	672,000
Z	-,109
Asymp. Sig. (2-tailed)	0,913

Based on table 2, the significance value of the Mann-Whitney test is 0.913 is greater than the significance level is 0.05 ($ÿ = 0.05$). So can be concluded that the average mathematical critical thinking ability of experimental class and control class students is not significantly different.

After the pretest, the next step is learning and experimenting with four learning meetings. The posttest conducted at the end of meeting, which the pretest and posttest scores obtained the n-gain value of each student by using the Meltzer (2002) formula.

The learning result for each class stated that the experimental class increased 0.50 or 50% (moderate), while the control class increased 0.20 or 20% (low). The critical thinking ability of each class at the first meeting is the same. Thus, an analysis of n-gain data was held to analyze which class is increased more concerning with mathematics critical thinking ability. The result of

the statistics test through n-gain data shows that one of the data did not normally distribute. Furthermore, the next n-gain data test uses a non-parametric Mann-Whitney test.

Table 3 The result of Mann-Whitney Test of data N-Gain

	Result of N-Gain
Mann-Whitney U	122,500
Wilcoxon W	447,500
Z	-3,876
Asymp. Sig. (2-tailed)	0

Based on table 3, the significance value of the Mann Whitney test is 0 because the one-sided test is conducted, so that the significance value divides into 2, so $\frac{0}{2} < 0,05 = \alpha$, then H0 is rejected so can be conclude that the improvement of the ability of students' mathematical critical thinking which received REACT learning strategy sginificantly higher than the students who received direct learning.

The result shows that the REACT learning strategy improves the ability of students' mathematical critical thinking. The REACT strategy has five syntaxes: Relating, Experiencing, Applying, Cooperating, and Transferring. In the relating stage, the teacher helped the students in connecting the next material with the previous material or the content that exists in real life. For example, in the first meeting, the students were asked to find out one thing that related to probability. They have their answer such as the probability of rain, probability of earning money, probability of winning, etc. This strategy aimed to give a chance to the student to stimulate their thought in answering the given question and improve the students' critical thinking (Feronika, 2020).

The experiencing-applying stage is an activity where groups of students are given a worksheet, then each group experiments and solves the problems in the worksheet. The first experiment was two dices to find the empirical probability (students' worksheet 3). The second experiment was used 2 coins to find the relation of empirical probability and theoretical probability (students' worksheet 4). After that, the students worked the questions on the students' worksheet. The experiment is a constructive activity to help the students discover and understand the concept. This strategy relates to Komalasari's (2010) idea. Komalasi (2010) states that an experiment helped the students in creating their knowledge through interaction by using the objects, phenomena, experience, and environment.

Crawford (2001) states that in a constructive class the teachers created the students' interest, confidence, and understanding. The students experience solving mathematical problems through experiments by seeking as much information as possible. While direct learning or direct instruction, students did not experiment so that students did not have the opportunity to explore their information and knowledge. Therefore, teachers should create situations in mathematics learning that provide opportunities for students to actively think critically. The REACT learning model involved students actively to gain the students' motivation and the learning process more delight (Wulandari, Dwijanto & Sunarmi, 2015) since the students conduct experiments during the learning process.

In the cooperative-transferring stage, the students analyzed mathematics problems together. From the distributed worksheets, the students discussed the problems and share their roles. The roles such as writing a note, calculating experiments, and working the experiments. Then, the representative presents the findings and along with the teacher, the students confirmed the findings. This activity is not only a constructive activity but also the investigation and asking a question turn into one of the activities in developing the ability of critical thinking. This finding is compatible with the seven principles of contextual learning in improving the ability of critical thinking. The seven principals are Constructivism, Inquiry, Questioning, Learning community, Modeling, Reflection, Authentic assessment (Kurniati et al., 2015).

On the other hand, direct learning created the student is working individually, not in a group. This may be caused the students to have the information based on their knowledge, whereas group

discussion allows the students to share the information, gain communication, and dare to express different opinions and sharpen their mathematics critical thinking.

The obstacles were found when in a group situation a student did not do their job and the students were still hesitant. This might be caused the group was divided into 5-6 people and some students did other activities not related to the material. Through this matter, the next learning is expected to only be 3-4 people. This suggestion would help the student play their role and the student can focus on the activity. At the next meeting, the teacher gave a score which determine by the students' liveliness or appointing the group. In addition, because of the group system, teachers must be able to emphasize the concepts repeatedly on the material.

CONCLUSION

The conclusion shows that through REACT strategy, the mathematics critical thinking was significantly higher than the students who received the direct learning method. The increase in the experimental class or in students who received REACT strategy learning was in the moderate category.

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