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THE EFFECTIVENESS OF TEACHING MATERIALS BASED SCIENTIFIC ON CRITICAL THINKING SKILLS

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Abstract

The Teaching material based scientific is a teaching material which in its implementation is carried out in a laboratory to conduct experiments or investigations in finding concepts based on scientific steps. This study aims to determine the effectiveness of the use of scientific-based teaching materials on critical thinking skills of class VII students of SMP AN-Nizam. This research was a quasi-experiment using pretest-posttest control group design. The population comprised of class VII students of SMP AN-Nizam in their second semester of the academic year of 2017/ 2018. The sample was chosen 2 classes, namely VII class Hasan Albana (HA) as the Experiment class and Said Qutub Class (SQ) as the control class. The data were collected through testing of critical thinking skills. the results showed that the use of teaching materials based scientific was effective towards student's critical thinking skills where t count 3.43 was greater than t table 2.017. Besides that, it was also found that the control class post-test average was 56.7 and the experimental class post-test average was 76. Thus groups of students who use teaching materials based scientific have a higher average compared to groups of students who are in learning without using teaching materials based scientific

Keywords: Effectiveness, teaching material, scientific, and critical thinking skills.

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1. Introduction

The success of learning in achieve the goals is determined by various factors, and one of the factors is the teaching material by the teacher. Based on preliminary observations conducted at SMP AN-Nizam Medan, the teaching material is not yet fully able to facilitate students in the process of critical thinking skills. Most of the learning still applies the expository learning approach in teaching material which the learning process is centered on the teacher, and it makes the students passive in the learning process. The teaching materials used by teachers in An-Nizam schools have not used an approach that is able to foster students' critical thinking. This is in line with the research conducted by Krisnawati (2014) mentions that currently learning devices are not yet many activities that involve students for high-level thinking. Therefore, one approach that can be used in improving critical thinking skills is a scientific approach. According to Lavoie (as cited in Yatin, Siti, Enni, & Priyantini, 2012) learning with the scientific skill approach has a significant advantage compared to the learning model traditional approach.

Through a scientific approach, the process of learning science in junior high school is conducted through various stages of scientific activities such as observing, questioning, do a simple experiments, reasoning, and communicating the results of learning; and learning in the scientific approach is not just an activity to delivery of various collections of science concepts that must memorized by students. The activities will make the students have direct experience and the learning results will be more memorable and meaningful for students (Syarifuddin, 2018).

Phang and Tahir (2012) state that “scientific skills such as making hypotheses, making inferences and stating variables are fundamental skills in scientific investigation” (p. 307). The scientific process skill involves making hypotheses to make conclusions. The scientific approach guides students to become scientists due to the steps in scientific approach follow the way of scientist to find out the theory. The scientific approach involves students in a complex problem-solving activitiy through discussion, creative thinking, conducting research activities, and building knowledge concepts. Learning using scientific approach provides the widest opportunity to students to do the contextual learning, and the learning becomes more meaningful (meaningful learning).

2. Problem Statement

This research was carried out because there were several problems. Among them:

1. Students are still not used to always thinking critically in learning
2. Teachers do not yet understand in applying learning that fosters students' critical thinking
3. There is no teaching material that can be used to improve students' critical thinking in An-nizam school.

3. Research Questions

The particular research concerned here use teaching material based scientific to see the effectiveness of improving students' critical thinking skills. The research questions were as follows:

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Is there significant differences in effectiveness between classes using teaching materials based scientific and those that do not use teaching materials based Scientific in improving the critical thinking of students of Grade VII (the first grade at SMP)?

4. Purpose of the Study

The research purpose include of theoretical and practical purpose. Theoretical the purpose may add as the reference in further research especially for the subjects of Natural Sciences (IPA) for class VII in junior high school. The practical purpose, for students, The particular research may improve the students' critical thinking skills. For teachers, the particular research may use as materials to teach and develop the methods or approaches in the classroom learning that aim to improve the quality of learning. For researchers, the particular research is expected to provide practical experience and insight in the development and improvement of science learning in junior high school.

5. Research Methods

This study aims to determine the effective¬ness of teaching materials based scientific on critical thinking skills for vii class of smp An-Nizam. The study used a quasi-experimental research method.The research design was pretest-posttest control group design with its design as follows (Table 01):

Table 01. Experiment design

	Pretest	**Treatment**	**Posttest**
Experiment Class	O_1	X	O_2
Control Class	O_1		O_2

Notes:
O1: *Pretest* Implementation
O2: *Posttest* Implementation
X: *Treatment*

Data collection techniques in the research were tests in the form of written test to deter-mine students' critical thinking. The tests were con ducted at the beginning of learning (pretest), and after the students followed the learning process (posttest). The form of test was essay. If the test score result after treatmeant showed that the experiment class is better than control class, and then, there is an influence from the treatment. Data analysis techniques in the particular research used descriptive statistics and inferen-tial statistics. Descriptive analysis was used to describe the obtained data to support the discussion of the research. Statistical techniques used to describe the pretest and posttest data of the experimental group and the control group including mean, median, mode, standard devia-tion, variance, minimum score, and maximum score. Inferential analysis was used to test the hypotheses.

In the hypothesis test, there data analysis techniques which were independent t-test. In the hypothesis test began with the average difference test using independent t-test, and the test aimed to know the effect of teaching material based scientific through critical thinking in science separately. Before the inferential statistical test, the data must meet the prerequisite tests which were the normality test and homogeneity test. Normality test was conducted by kolmogrov-sminorv, and the test aimed to know the data was normally

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distributed or not. Meanwhile, the homogeneity test aimed to know the data were from a homogeneous population or not by using levene's test.

6. Findings

Based on the data analysis obtained the following findings:

6.1. Result

Descriptive analysis in the particular research aimed to describe the pretest and posttest data of the experimental class and control class using statistical techniques. The result of descriptive analysis of pretest data of students' critical thinking of experimental class, and control class, is presented in Figure 01. The result of descriptive analysis of posttest data of students' critical thinking of experimental class, and control class, is presented in Figure 02.

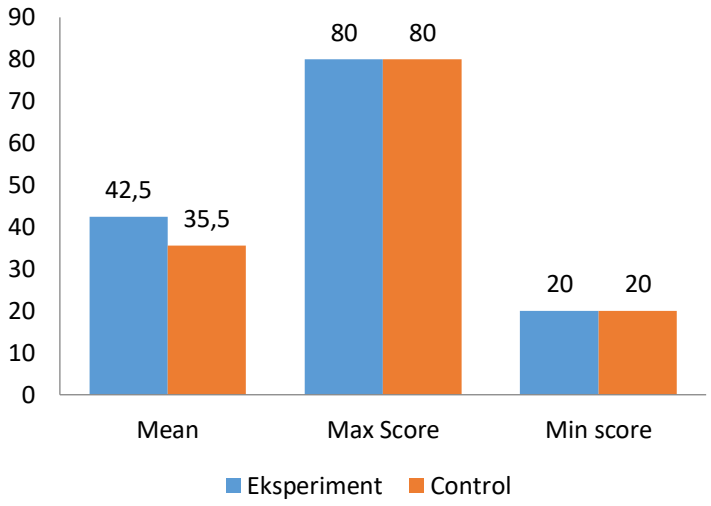

Figure 01. Pretest Score of Critical Thinking

Figure 01 shown that pre-test critical thinking skill mean score of experiment class is 42,5 and control class is 35,5 with the same maximum score between the experimental class and the control class, 80.

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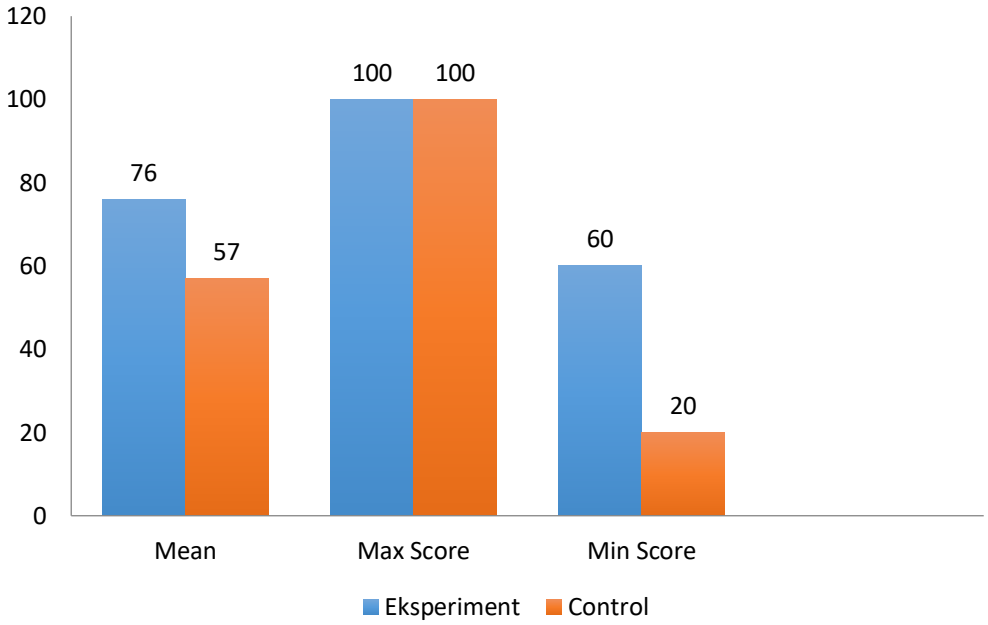

Figure 02. Posttest Score of Critical Thinking

Figure 02 indicates that post-test critical thinking skill mean score of experiment class (which is 76) is greter than that of control class (which is 57). Inferential statistics are used to test hypotheses. The test used in this study is the t-test whose results are shown in table 02.

Table 02. Test Results of Independent Sample t-test

Data	T	Sig.(2-tailed)	Description
Critical Thinking	3,43	0,001	There is a difference

Table 02 indicates the results of the t-test that there was significant difference in effectiveness among experiment class and control class (with Sig <0.05) in improving critical thinking.

Based on the result of data analysis and hypothesis test that conducted on the research data aiming to know the effect of teaching material based scientific through students' critical thinking on the science learning of class VII SMP, the result that the use of teaching materials based scientific was effective towards student's critical thinking skills. This is in accordance with the research conducted by Fitriyah (2016) which states that learning tools with a scientific approach to learning Science of light material is feasible and can be used to train students' critical thinking skills. Sanjaya (2015) states the knowledge is gained through direct experience and indirect experience. The more directly the object is learned, the more concrete the knowledge is gained. And the more indirect the knowledge is gained; the student's knowledge is more abstract. The scientific approach is an approach that facilitates students to learn directly with real objects, in other words, through scientific approach, there is increasing on students' knowledge including students' critical thinking ability.

Based on the test score calculation, the average score of pretest on control class is 35,5, the experimental class is 42,5. Meanwhile, the average score of posttest on the control class is 57, experiment class is 76. The effect of scientific approach through students' critical thinking may see from the

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significance score of 0.001, so, the scientific approach has significant positive effect on students' critical thinking (Kartimi, Liliasari, & Permanasari, 2012). Critical thinking allows the students to discover the truth of each events and information on daily. Thus, the students' critical thinking skills are the students' way of thinking to analyze the argument and generate the insight into each meaning, interpretation, and develop a cohesive and logical reason pattern. In critical thinking, a person may able to organize, adjust, change, or rethink his/her mind in order he/she can act more appropriately. A person who has critical thinking is a skilled person of reason. He/she has the ability to use a reason in a context where the reason is used as the rationale. A person who has Critical thinking will decide and think rationally through multiple views of different contexts. They will prepare to make reasons and decisions about what is seen, heard, or thought.

Learning using teaching material based scientific may improve the students' critical thinking ability because students are trained to observe, question, experiment, reason, and communicate through the stages of scientific process. Students become the main subjects in the scientific approach, students may active in learning, and provide opportunities for students to build concepts in knowledge independently, make usual the students in formulating, dealing with, and solving the problems. Thus, students may improve their understanding of a certain material, then they are able to have critical thinking skills. In short, the teaching material based scientific is appropriate to improve the students' critical thinking ability.

7. Conclusion

Based on the result of data analysis and hypothesis test that conducted on the research data aiming to know the effect of teaching material based scientific through students' critical thinking on the science learning of class VII SMP, the result that the use of teaching materials based scientific was effective towards student's critical thinking skills where sig< p-value (0,001<0,05). Besides that, it was also found that experimental class post-test average was 76 greater than the control class post-test average was 56,7.

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References

Fitriyah, K. (2016). Pengembangan Perangkat Pembelajaran dengan Pendekatan Scientific untuk Melatih Kemampuan Berpikir Kritis Siswa pada Pembelajaran IPA Materi Cahaya Kelas IV SD. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan dan Hasil Penelitian, 2*(3), 265-276.

Kartimi, K., Liliasari, L., & Permanasari, A. (2012). Pengembangan alat ukur berpikir kritis pada konsep senyawa hidrokarbon untuk siswa SMA di Kabupaten Kuningan. *Jurnal Pendidikan MIPA, 13*(1), 18-25.

Krisnawati, N. M. (2014). *Pengembangan Perangkat Pembelajaran Biologi Model Kooperatif Dengan Pendekatan Scientific Untuk Melatih Berpikir Kritis Siswa SMA* (Tesis magister pendidikan tidak dipublikasikan). Universitas Negeri Surabaya.

Phang, F. A., & Tahir, A. (2012). Scientific skills among pre-service science teachers at Universiti Teknologi Malaysia. *Procedia -Social and Behavioral Sciences, 56*, 307–313.

Sanjaya, W. (2015). Perencanaan dan desain sistem pembelajaran. Jakarta: Kencana Prenadamedia Group

Syarifuddin, S. (2018). The Effect of Using the Scientific Approach Through Concept Understanding and Critical Thinking in Science. *Jurnal Prima Edukasia*, *6*(1), 21-31.

Yatin, M., Siti, H., Enni, S., & Priyantini, W. (2012). Pengembangan Perangkat Pembelajaran dengan Pendekatan scientific skill teknologi fermentasi berbasis masalah lingkungan. *Jurnal Ilmu Kependidikan, 41*(1), 21-26.