The Effect of Using Brainstorming Methods on Students Critical Thinking Ability in Middle School Science Learning

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ABSTRACT

A research was conducted on students' critical thinking skills in science learning in SMP. This study aims to determine the differences in the critical thinking skills of students who learn with the brainstorming method in class VII students of SMP Negeri 6 Banjarmasin. This study used a quasi-experimental method using a pretest-posttest nonequivalent control group design. The sample of the study was class VII A students consisting of 30 students as the experimental class and class VII G students consisting of 30 students as the control class. The sampling technique used was cluster random sampling. Data collection techniques using test techniques. The data analysis technique used the t-test to analyze differences in the critical thinking skills of students in the experimental and control classes, and descriptive analysis to describe the differences in the level of critical thinking skills between students who used the brainstorming and expository methods. The results showed that there was a significant difference between the experimental class and the control class as indicated by the results of the t-test from the price tcount> ttable (2,41> 2), and there was a difference in critical thinking skills between the experimental class and the control class as indicated by the percentage value. posttest experimental class namely 82.08% and control class 71.39%.

Keywords: Brainstorming, Expository, Critical Thinking, Science.

ABSTRAK

Telah dilakukan penelitian tentang kemampuan berpikir kritis peserta didik pada pembelajaran IPA di SMP. Penelitian ini bertujuan untuk mengetahui perbedaan kemampuan berpikir kritis peserta didik yang belajar dengan metode brainstorming pada peserta didik kelas VII SMP Negeri 6 Banjarmasin. Penelitian ini menggunakan metode eksperimen kuasi dengan menggunakan pretest-posttest nonequivalent control group design. Sampel penelitian yaitu peserta didik kelas VII A terdiri dari 30 orang sebagai kelas eksperimen dan peserta didik kelas VII G terdiri dari 30 orang sebagai kelas kontrol.Teknik pengambilan sampel yang digunakan yaitu cluster random sampling. Teknik pengumpulan data menggunakan teknik tes. Teknik analisis data menggunakan uji-t untuk menganalisis perbedaan kemampuan berpikir kritis peserta didik kelas eksperimen

dan kontrol, dan analisis deskriptif untuk menjabarkan perbedaan tingkat kemampuan berpikir kritis antara peserta didik yang menggunakan metode brainstorming dan ekspositori. Hasil penelitian menunjukkan bahwa terdapat perbedaan yang signifikan antara kelas eksperimen dan kelas kontrol yang ditunjukkan dengan hasil uji- t dari harga thitung > ttabel (2,41 > 2), dan terdapat perbedaan kemampuan berpikir kritis antara kelas eksperimen dan kelas kontrol ditunjukkan dari persentase nilai posttest kelas eksperimen yaitu 82,08% dan kelas control 71,39%.

Kata kunci: Brainstorming, Ekspositori, Kemampuan Berpikir Kritis, Ilmu Pengetahuan Alam.

BACKGROUND

The learning process is a process in which there is interaction between teachers and students on the basis of reciprocal relationships that are not just relationships between teachers and students, but educational interactions. Learning activities are the most basic activities of the entire educational process in schools. The success or failure of achieving an educational goal depends on how the learning process experienced by students.

(Samarraie & Hurmuzan, 2018) reveals that Brainstorming It has been proposed specifically to develop individual creativity and productivity. However, knowledge is available about the potential Brainstorming It still seems very limited in education. Teachers have an important role as creators in developing a learning atmosphere that can attract students. Students are expected to be able to express ideas in the learning of teaching. In addition, teachers also act as models for students, where teacher insight and knowledge will lead students to be able to think critically and creatively in solving the problems they face and to create a better future.

Based on the results of observations that have been carried out, learning can be done with scientific methods combined with approaches, strategies, models and learning methods. A teacher must be good at choosing the right method used in the learning process of students. In fact, not all teachers can choose the right learning method in learning.(Fikriyah & Shofiyani, 2021)

The lecture method is still widely used in the learning process because it is considered easy to apply and can include a large number of students. But in addition to these advantages, this method has disadvantages such as not providing opportunities for students to actively participate in the learning process. The lecture method treats students equally, so it is not appropriate to handle the diversity possessed by students, especially intelligence, interests, talents and physical development. Thus, the use of conventional learning methods is only able to produce students who lack self-awareness, lack critical and creative thinking, are less independent and have not been able to communicate flexibly with the learning environment and social life of the community.

The development of science in today's era allows students to obtain extensive information quickly and easily. This encourages students to have abilities that require critical thinking so that they are able to face problems. Therefore, improving critical thinking skills is very necessary to be developed, especially in the present which is full of problems and applied in science learning so that students are responsive in making observations to solve problems in learning.

One of the learning methods that can train critical thinking skills is the method Brainstorming. The brainstorming method is expected to improve students' critical thinking skills because students are given the opportunity to express their opinions without fear of criticism. Learning process using methods (Aldeirrel & Komala, 2018)Brainstorming Provide opportunities for students to train independence, openness and self-integrity in choosing the best alternative actions, able to express opinions and self-actualize in solving a problem and able to respect the interests of others.

The brainstorming method is a method to make students active in the learning process where students can propose creative opinions and ideas in a group so that they can make a mind map for them. In science learning always discusses what happens in the environment, so that many problems arise that can be studied by students then students can give their ideas or opinions in understanding a concept in science learning. Students need to be involved in activities related to science, students also need to actively involve themselves to find answers to problems found in society. This is in accordance with the brainstorming method in science learning that underlies student learning activities which aims to provide opportunities for students to study problems about phenomena that occur in nature based on the experiences of students, so that students are able to solve problems based on critical thinking found.

The ability to think critically has 5 indicators (Ennis, 2011), namely: a) Basic Clarification, including: (1) formulating a question, (2) analyzing arguments and (3) asking and answering clarification questions; b) Provide reasons for a decision (The Bases for a decision), including (1) considering the credibility of a source, (2) observing and considering the results of observations; c) Inference, including (1) making deductions and considering the results of deductions, (2) making inductions and considering the results of inductions, and (3) making and considering decision values; d) Advanced Clarification, including (1) Identifying terms and considering definitions, and (2) referring to unstated assumptions; e) Supposition and integration, including (1) considering and thinking logically, premises, reasons, assumptions, other positions and proposals, and (2) combining other abilities and dispositions in making and defending a decision.

The brainstorming method is applied to science learning in junior high school with the hope that students can improve critical thinking skills and optimize students' abilities in mastering science concepts. The brainstorming method will be a very effective method if applied in science learning, where students will express more opinions and can build a productive learning environment so that the expected science learning runs optimally. Based on the background mentioned, this study will apply brainstorming methods in science learning in junior high school to improve students' critical thinking skills.

RESEARCH METHODS

This study uses a quantitative approach with a type of quasi-experimental research with a pretest-posttest nonequivalent control group design, the author applies the brainstorming method to the learning process to improve students' critical thinking skills. Quasi-experimental research methods are intended to investigate possible cause-and-effect relationships by exposing one or more experimental groups and one or more experimental conditions.

The sample of this study used class VII A which amounted to 30 people as an experimental class and class VII G which amounted to 30 people as a control class. Pre-test is given before the learning process on environmental pollution material, while post-test is given at the end of learning. The instrument used in this critical thinking test refers to critical thinking indicators according to Ennis to determine the critical thinking ability of students before and after being given treatment as many as 25 questions. Learning activities are carried out as many as four meetings in each class. The experimental class applies the brainstorming method, while the control class applies the expository method.

Before using the instrument made, first testing the validity and reliability of the problem. Research instruments can be said to qualify as data collection tools if the research instruments are valid and reliable. The validated instruments are test instruments, and reliability is known in this study, namely short description test instruments (essay) and multiple choice (multiple choice) used to determine critical thinking skills. The level of difficulty and differentiating power of short description (essay) and multiple choice test instruments (multi choice) need to be considered to produce a good test instrument.

Data collection using test techniques. Test techniques are used to collect data on critical thinking skills. The instruments used are ten essay test instruments and multiple choice as many as 15 questions referring to Ennis's critical thinking indicators. The instrument has previously met the feasibility test, including reliability tests, validity tests. degree of difficulty and differentiation.

The research tools used are in the form of syllabus, RPP, and LKPD. Data analysis techniques use descriptive and inferential analysis. Inferential analysis techniques, analyzing pretest and posttest result data using homogeneity tests, normality tests and hypothesis tests using t tests to analyze differences in critical thinking skills of experimental and control class students and descriptive analysis to analyze students' critical thinking skills.

Sampling using Cluster Random Sampling technique. Cluster Random Sampling is a way of determining samples when the object to be studied or the data source is very extensive. To determine which sample will be used as a data source, the sampling is based on a predetermined population area. The data analysis techniques used in calculating the data in this study are N-gain, normality test, homogeneity test and t-test

RESULT AND DISCUSSION

The data obtained from this study is in the form of initial test scores and final tests of students' critical thinking skills. The data is then analyzed through several stages, namely descriptive statistical analysis and parametric statistical analysis. At the descriptive statistical analysis stage, the calculation of the minimum value, maximum value, average, and standard

deviation is carried out. Meanwhile, at the parametric statistical analysis stage, normality tests, homogeneity tests, similarity tests of two average initial test results to determine the initial abilities of students are the same, and similarity tests of two average final test results to answer predetermined problem formulations.

This study aims to see the difference in the level of critical thinking skills of students in science subjects, especially in environmental pollution materials using *brainstorming* methods and expository methods. The expository method used by the researcher follows the reference of how the teacher teaches in the classroom during the researcher's observation. Observations conducted for ±1 week aim to see the condition of the classroom, as well as adjust how the teacher's teaching pattern usually during class.

Table 1. Posttest data t-test results

Sample	N	Mean	SD	SD^2
Experiment	32	83.13	9.136	83.468
Control	32	77.50	9.202	84.677
T-test	Tcalculate	2.415245	ttable (5%)	2

Classes 7G and 7A have almost the same grade point average, so researchers decided to use both classes for research. This is also reinforced by initial test tests conducted by researchers before giving treatment to students. From the results of the initial test, after the normality test and homogeneity test, it was found that the class distribution was normal and homogeneous, so the researcher continued the analysis through the analysis of the difference test, namely the t test using the SPSS ver application. 23.0. From the results of the t test, a t value of 0.216 was obtained, where 0.216 > 0.05 so that it can be said that there is no difference in the ability of students in the initial test. After conducting initial tests on both classes of samples, researchers carried out the treatment at the next meeting. In class 7G applies conventional learning (adjusting to the maple teacher) as a control class and class 7A applies learning using *the brainstorming* method as an experimental class.

After treatment by teaching for 4 meetings, both in control classes and experiments, a final test or evaluation was carried out. The evaluation questions given are the same as the initial test tests given to students.

After conducting evaluation tests and obtaining averages, then normality, homogeneity, and t tests were carried out as in the initial test. Analysis prerequisite tests are still carried out to see whether the distribution of data is normal and homogeneous or not. After it is known that the data is normal and homogeneous, a different test is carried out using the t test through the SPSS ver application. 23.0 and obtained a result of 0.248, where 0.248 < 0.05 so that it can be concluded that there is a significant difference from the test results of the control class and experimental class and an increase in the scores of students in the experimental class which can be seen from the average score which has a considerable difference from the initial test. This result is in accordance with the research of Anggraeni et al (2013) and Ratnasari (2016) who used the *brainstorming* method to see differences in students' critical thinking skills before and after being treated, and obtained quite high difference results.

This difference in results is because in conventional learning, teachers still explain although not as a whole, and some students still memorize the material, without relating in everyday life, so that students still have little difficulty answering questions that are analyzing or relating to everyday life. This is in line with Ratnasari (2016) which states that *teacher-centered* learning experiences cannot make students' critical power develop, because students are only presented with material without being helped by seeing facts in the environment and relating them to the material. So, through the brainstorming method, students can start trying their independence and start trying to develop the ability to ask questions and analyze and conclude learning. The most important thing is to always instill in students that the material taught in science learning is material about our own body and environment, so that the more we understand the lesson, the more we will understand our body and environment, so that students are no longer awkward nature associates the material with everyday life.

The ability to think critically is the result of student learning in answering multiple-choice questions and descriptions made based on Ennis' critical thinking indicators. The indicators used in this study amounted to 5 indicators with 9 sub-indicators.

CONCLUSION

The results of research on the application *of brainstorming learning methods on the subject of environmental pollution on the results of students'* critical thinking skills show that brainstorming learning methods have a significant effect on students' critical thinking skills. The correlation between *pretest* and *posttest* values is 0.876 with a probability value of 0.0002. This states that the correlation between *pretest and* posttest *scores is* significantly related because the probability value < 0.05 and the relationship is 67.6%. This shows that the influence of *brainstorming* learning methods on students' critical thinking skills is 67.6%. The results obtained cannot reach a percentage of 100% because there are other factors that cannot be controlled that affect the critical thinking skills of students.

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