DEVELOPMENT OF TEACHING MATERIALS WITH SCIENTIFIC APPROACH TO IMPROVED STUDENTS’ CRITICAL THINKING SKILL

Mulia Rasyidi¹, Supartono², Ari Yuniastuti³

¹Postgraduate program student of Science Education Program Study, Semarang State University
²Postgraduate program of Science Education Program Study, Semarang State University
³Departement of Biology, Faculty of Mathematics and Sciences, Semarang State University
¹mulia.rasyidi@gmail.com

ABSTRACT

Learning is a system that aims to help students’ learning process through a series of activities has been designed to support students’ learning process. One supporter of the establishment of the learning process is to use appropriate teaching materials and in accordance with the applicable curriculum in schools. Education in Indonesia is now implementing the curriculum in 2013 which has a special characteristic that is using the scientific approach. A scientific approach to learning that is designed so that students are able to construct concepts through the stages-resistant observe, ask, try, associate and communicate. Development of teaching materials using the scientific approach is expected to facilitate learning in school. The aim in this study was to determine the validity and effectiveness of teaching materials with a scientific approach to the critical thinking skills of students. This study is a modification of Sugiyono Research and Development. The results showed that using the teaching materials developed scientific approach is valid and effective way to improve students’ critical thinking skills. The average yield scores validation assessment by experts reached 72.31 which is valid with good criteria, improved critical thinking skills of students using the formula N-Gain by 0.73. Based on the results of the study concluded that the teaching material with viable scientific approach and effective use of the students' critical thinking skills.

Keywords – Scientific Approach, Teaching Material, Critical Thinking

Introduction

The learning process in schools affected by the development of a curriculum imposed by the government. The learning process in education in Indonesia has been implementing Curriculum 2013. The curriculum adopted by this government is the curriculum that use traditional scientific approach in the learning process.

Aragon (2007) revealed that the scientific approach is an orderly process of learning to acquire new knowledge and have a basic principle of inductive and deductive reasoning. So that the learning process by using a scientific approach learners will be able to explain and analyze causal relationships related phenomena in learning.

The learning process using a scientific approach is also expressed by Machin (2014) which revealed that the stages of learning the scientific approach capable of delivering students to construct the concept of the learning material. In addition, in its application the scientific approach has several advantages it has, among others, is the ability of the intellect possessed by the student is able to be improved. One of the capabilities of the intellect is the ability to think critically. Critical thinking skills is an important foundation of the other three patterns of thinking that problem solving, creative thinking, and decision making (Costa, 1995).

Excellence where students have the ability to think critically mentioned by Hill (2013) which revealed that students who have the scientific capabilities such as high critical thinking skills that are better than students who have the ability to think critically low. So is the claim of the Burris (2006) that students who have the ability to think
critically high tend to have higher achievement than students who have the ability to think critically low.

The use of media in learning should be in accordance with the learning process that is used as the use of appropriate teaching materials should be in accordance with the approach used in the applicable curriculum at the school is a scientific approach to achieve learning objectives.

Based on observations in SMP Islam Roudlotus Saidiyah, obtained information that the school has been using the curriculum in 2013 with a scientific approach, but the implementation is still not optimal because it still uses the previous curriculum teaching material in the form of textbooks that do not use a scientific approach. Additionally in the learning process happens on the field not in accordance with the conditions expected. During the study carried out by the teacher usually transfer their knowledge through the definition and exercise. The learning process is done by providing material and questions to the students on the blackboard by the teacher, the students lack role in the learning process. It reflects the ability to think critically low student at the school.

Low student critical thinking skills is also evident from the learning process that the students do not dare argue or argued during the learning process takes place.

Based on observations and the issues mentioned above will require an innovative form of teaching materials developed using a scientific approach that can enhance students' critical thinking skills. The purpose of this study were: 1) test the validity of teaching materials using a scientific approach developed, 2) describe the critical thinking skills of students after using teaching materials using a scientific approach.

Research Methods

This type of research used in this research is the development, The subject of research is in junior high school students of class VII Islam Roudhotus Saidiyah Lessons Semarang year 2014/2015 consisting of 32 students.

Products developed in this study is the impact of environmental pollution teaching materials with scientific-oriented approach to improve students' critical thinking skills. The steps in this development is a step-by-step research and development of modified Sugiyono (2011) which includes: (1) find the problem, (2) the design of the product, (3) design validation, (4) pilot scale is limited, (5) revision of product design, (6) large-scale trials, (7) product revision.

Retrieval techniques and data collection instruments used in this study is covering validation, test and observation techniques. Instrument collecting data on validation techniques are expert validation sheet, matter in the form of descriptions used for data retrieval students' critical thinking skills, while the questioner or the questionnaire used to retrieve data legibility teaching materials by students.

The research process in the development of teaching materials is also using experimental designs that pre-experimental design one group pretest posttest design for a class of small-scale trials, while for large-scale trials using quasi-experimental design that is Nonequivalent Control Group Design (Sugiyono, 2011).

The instrument descriptions about the critical thinking skills of students first conducted trials to determine the level of validity, reliability, level of difficulty and distinguishing matter. This is done to determine the feasibility of a description about the instruments used before it is used to measure students' critical thinking skills.

Hypothesis testing using nonparametric statistical Manny Whitney (U test), the use
of the test statistic is based on electoral considerations prerequisite test statistical test that is test data normality and homogeneity of data. This study measured the Effectiveness of use of teaching materials for students’ critical thinking skills (Nachar, 2008).

Results and Discussion

Based on the results of the validation by experts, which the experts who provide assessment consists of 3 people who generally provide an assessment of the teaching materials developed using scientific approach is valid with the criteria of "good" that the average gain the scores given by the experts of 72.31.

The criteria of "good" given by all the experts is a total of criteria given by the expert teaching materials with well-developed scientific approach that aspect of assessing the feasibility of the contents of teaching materials, as well as evaluating the presentation of appropriate language used in teaching materials. In addition to providing an assessment of the teaching materials developed by the scientific approach, the expert also gave a good assessment of the syllabus and lesson plan used in this study.

Results of the assessment showed that the assessment scores given by experts to plan the implementation of learning used had average scores of all experts is 91.67 with the criteria of "very good", while the syllabus for the assessment of the average score given by the experts was 96, 67 with the criteria of "very good". So that the device in the form of lesson plan and syllabus of learning used in this study could be used in the research process. Results validation by expert instructional materials have averaged criteria of "good" but at first experts provide an assessment of teaching materials, namely the criteria of "Enough". Results validation teaching materials provided by the expert can be seen in Table 1.

<table>
<thead>
<tr>
<th>Expert</th>
<th>Score</th>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>58.87</td>
<td>Satisfactory</td>
<td>invalid</td>
</tr>
<tr>
<td>II</td>
<td>80.65</td>
<td>Good</td>
<td>invalid</td>
</tr>
<tr>
<td>III</td>
<td>77.42</td>
<td>Good</td>
<td>invalid</td>
</tr>
<tr>
<td>Mean</td>
<td>72.31</td>
<td>Good</td>
<td>invalid</td>
</tr>
</tbody>
</table>

Devices and teaching materials that have the criteria of "good" can then be used for the research stage to the next. On research and development is the next step is to use the card at a small-scale trials.

Small-scale trials conducted as a prelude to enter the preparation for the use of teaching materials developed by the scientific approach and to know the legibility of the instructional materials before use in the wider class. To determine the readability level of teaching materials on students, conducted questionnaire form questionnaire responses of students to use teaching materials as applied in the classroom. The data were obtained on a limited scale trial is the student response data to be analyzed to determine the deficiencies found in the small-scale trials.

Stages small scale trial using one group pretest posttest design so that at this stage the data is a value obtained pre-test and post-test. Pre test at this stage given the treatment given before the application of teaching materials using a scientific approach developed, while the post-test was given after a given treatment application of teaching materials using a scientific approach developed.

Stages of research on small-scale trials using a single class sample of 10 students were selected using sampling techniques pourposive sampling. Results of data analysis in the class of small-scale trials showed that all of the students responded positively to the teaching materials using a scientific approach that learned in class.

Results of the data analysis of critical thinking skills in the class of small-scale
trials show that there are 4 students to the value of critical thinking skills were, three students with low grades and there are 3 students to the value of critical thinking skills is very low. The effectiveness of the use of teaching materials were tested on a small scale trial class has a criteria of "being", it is seen in the calculation of the value of gain that indicates the value of 0.51 which means an increase in critical thinking skills with the criteria of "being".

In addition to calculating the students' response to the use of teaching materials used as well as the calculation of the value of Gain, also calculated the value of the average difference in critical thinking skills possessed by students before taught by teaching materials with approaches scientific compared with the critical thinking skills possessed by students after taught use of teaching materials using a scientific approach.

Results of tests of significance differences in average ability to think critically analyzed using the t-test Paired Samples Test, the results of the calculation that the average yield critical thinking skills between the pretest to post-test values are significantly different. The calculation result is an indicator to proceed to the next stage of large-scale trial.

Stages in this study is a large-scale trials in the study conducted on a class consisting of 32 students each number of students per class is 15 students VIIA and VIIB grade 17 students. The data collected by the researchers in a large-scale trial is the response of the students to the teaching materials, grades pre-test and post-test and students' critical thinking skills. Average yield critical thinking skills of students in each class of experiments, the control and the class of small-scale trials are presented in Figure 1.

One purpose of this study was to determine how effective the teaching materials developed if used in learning. The effectiveness of teaching materials were analyzed in the same way to test a limited scale. Teaching materials are said to be effective if it meets the criteria that teaching material is said to be effective if the critical thinking skills of students achieving scores were. According to Scott (2007), there are many ways to assess critical thinking skills in the classroom, including the use of pre-test and posttest, case studies, telling stories, questions, role playing and debates.

Based on the results of research and data analysis that critical thinking skills possessed by the experimental class has an average of critical thinking skills in the post-test score was 73.89, which means having the criteria being while the average critical thinking skills is the control class 30.88 with the criteria of "very low". To find out the average difference between the critical thinking skills with classroom control classroom experiments to test the hypothesis the average difference.

Before the test the hypothesis first tested among other prerequisites normality test and homogeneity of data pre-test and post-test the data that will determine the type of statistics that will be selected to test the average difference between the critical thinking skills and classroom control classroom experiments.
Prerequisite test results showed that normality test data is not normally distributed with significant value smaller than the value of alpha is 0.028. This value is an indicator of $H_0$ is rejected and it shows the data were not normally distributed. In addition to normality test, homogeneity test result data homogeneity test data shows homogeneous with a significance value greater than the value of alpha, it is an indicator $H_0$ is rejected and the data showed the data homogeneous.

Based on the test results conducted prerequisite before investigators determine the statistical test that is used to calculate the average difference. Prerequisite test shows that the selection of the test statistic to test the average difference between the critical thinking skills class experiment with using a subset of the statistics control class that is using the non-parametric U test or Manny-Whitney because the data were not normally distributed and homogeneous. According Nachar (2008) discloses the use of statistical Manny-Whitney test was performed to compare the two independent groups that do not require the sample to be normally distributed.

Sugiyono (2012) revealed the selection nonparametric statistical Manny-Whitney followed by Z test if a large number of samples (greater than 20 samples). This study used a sample of two classes totaling 32 students so that in addition to using the Manny-Whitney test also continued with test Z. Based on test results obtained using the Manny-Whitney U value of 6,500 When converted to the value Z, the magnitude of -4.597. Sig value 0.000 <0.05. If sig <0.05 critical limit then there is a difference between the two groups (experimental group and the control group) which means that $H_0$ is accepted.

In addition to calculating the average difference in students' critical thinking skills on a large scale trial, Gain values are also calculated to determine the effectiveness of the use of a large teaching materials using a scientific approach to improving the critical thinking skills of students. Gain results in large scale trials show the value of 0.73 with the criteria of "high"

Conclusions

Development of teaching materials using a scientific approach to improve students' critical thinking skills that have been developed is valid according to experts at the level of validity of "good" with an average score of 72.31 and able to enhance students' critical thinking skills by 0.73 with the criteria of "high".

Reference


Nachar, N. 2008. The Mann - Whitney U: A Test for Assessing Whether Two Independent Samples Come from the Same Distribution. Tutorials in

