Critical Thinking Skills of Students Through Mathematics Learning with ASSURE Model Assisted by Software Autograph

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Abstract. This study aims to examine the ability of critical thinking and students who attain learning mathematics with learning model ASSURE assisted Autograph software. The design of this study was experimental group with pre-test and post-test control group. The experimental group obtained a mathematics learning with ASSURE-assisted model Autograph software and the control group acquired the mathematics learning with the conventional model. The data are obtained from the research results through critical thinking skills tests. This research was conducted at junior high school level with research population in one of junior high school student in Subang Regency of Lesson Year 2016/2017 and research sample of class VIII student in one of junior high school in Subang Regency for 2 classes. Analysis of research data is administered quantitatively. Quantitative data analysis was performed on the normalized gain level between the two sample groups using a one-way anova test. The results show that mathematics learning with ASSURE assisted model Autograph software can improve the critical thinking ability of junior high school students. Mathematical learning using ASSURE-assisted model Autograph software is significantly better in improving the critical thinking skills of junior high school students compared with conventional models.

1. Introduction
Law of the Republic of Indonesia Number 20 Year 2003 on National Education System Article 37 confirms that the subject of mathematics is one of the compulsory subjects for students in elementary and secondary education. It is believed that mathematics is one of the basic sciences that must be mastered by students, especially in the elementary and secondary education units that proceeds to organize and improve the students’ reasoning sharpness, to clarify the problem solving in daily life, to train the ability to communicate by using numbers and symbols, to rehearse students to always be oriented to the truth by developing a logical, critical, creative, objective, rational, meticulous, disciplined, and to be able to cooperate effectively; to nurture students to think regularly, systematically, and structured in a clear conception [1]. Mathematical functions will be realized if students have a mathematical ability, one of the abilities is to think critically [2]. Being able to achieve mathematical skills, especially critical thinking, as NCTM discloses, a teacher should be able to create an atmosphere of learning that allows students to actively learn by constructing, discovering and developing their knowledge. Therefore, teaching mathematics should not merely compile a sequence of information but should also review the relevance, usefulness, and interests of students in their lives. Therefore, mathematics learning is expected to improve students’ critical thinking ability. Unfortunately students’ critical thinking skills are not expected to match the purpose of learning mathematics.

Problems about the ability to think critical mathematically, learning motivation, mathematics learning with ASSURE model assisted Autograph software is not a new study in the world of
mathematics education. Several previous studies have revealed these issues separately. Associated with critical mathematical abilities, Viewed from the learning and categories of mathematical ability of students and mathematics learning with better guided inquiry approach in improving critical thinking skills and mathematical communication of students compared with conventional learning [3]. Then related to learning mathematics with ASSURE model assisted Autograph software, improvement of students’ mathematical creative thinking ability of which learning using mathematics learning with ASSURE model assisted Autograph software are better than students who learn mathematics with conventional model [4]. Based on these reasons, mathematics learning with ASSURE model (Analyze learner characteristics, state, objective methods, media and materials, requirements learner participation, evaluation and revision) can be an option for achieving the output Desired.

Based on previous explanation, it is clear that the selection of mathematics learning with ASSURE model assisted by Autograph software on mathematics learning can be one solution in facing the problem of learning mathematics for students. Therefore, teachers are expected to use ASSURE-assisted model of Autograph software in mathematics learning. Researchers are encouraged to conduct more specific study on how to improve the ability of critical thinking and motivation of junior high school students through learning mathematics with ASSURE model assisted Autograph software. Based on the background of the problem, then the formulation of the problem in this research is: can the mathematics learning with ASSURE model assisted Autograph software improve the critical thinking skills of junior high school students? Based on the background and the formulation of the problem, the authors formulate the purpose of research conducted is to examine: by mathematics learning with ASSURE model assisted Autograph software can improve students’ critical thinking skills. Based on the background of the problem, the formulation of the problem, and the purpose of the study, the hypothesis formulation in this study are: Improvement of students’ critical thinking skills that mathematics learning using ASSURE model assisted Autograph software are better than students who learn mathematics using conventional model.

2. Method
Mathematics learning with the ASSURE model contains steps that match its name, they are: (1) analyzing student characteristics (Analyze learner characteristics); (2) establishing learning objectives (State performance objectives); (3) selecting methods, media, and instructional materials (Select methods, media and materials); (4) using selected methods, media, and learning materials (Utilize materials); (5) enabling student involvement (Requires learner participation); (6) evaluation and revision (Evaluation and revision). The research is a quasi experiment or quasi experiment consisting of two research groups: experimental group (experimental class) is a group of students with mathematics learning using ASSURE model with Autograph software and control group which is a group of students with their math learning Conventional models. Consideration of the use of this research design because the existing class has been formed before, so no random grouping will be done again. The research design is a non-equivalent control group design [5] that is:

| Experiment Class | O | X | O |
|------------------|---|---|---|
| Control Class    | O | X | O |

Information:
O : Pre-test or Post-test
X : Math learning with ASSURE model with Autograph help
--- : Subjects are not randomly grouped
The population in this study is students of one of the SMP Negeri in Subang, West Java Province, academic year 2016/2017. The sample in this study is students of class VIII in one of the SMP Negeri in Subang, West Java Province, academic year 2016/2017. Selected schools are included in the middle level, so they are expected to represent students of high, moderate, and low levels of ability. Research sampling is determined by using purposive sampling, it is the sampling that the research can be carried out effectively but efficiently in purpose, especially in the case of supervision, the condition of the research subject, the time of the research, the condition of the study site and the licensing procedure. As the result we have two classes from the number of existing classes. One class is used as an experimental class, a class whose students acquire mathematics learning with ASSURE-assisted model Autograph software, the other is as a control class that obtains learning mathematics with conventional model.

3. Result and Discussion
This study aims to determine the effect of the application of mathematics learning with ASSURE model assisted Autograph software to improve the critical thinking skills of junior high school students. Before doing processing, we present description of research results. This section will explain the effect of the treatment given to the experimental class and examine the general hypothesis which states that there is an effect of applying mathematics learning with ASSURE model with Autograph software to increase the critical thinking ability of junior high school students.

This influence can be seen through the acquisition of the experimental class with the control class, with the formulation of the hypothesis as:
H0: Improvement critical thinking skills using mathematics learning with ASSURE-assisted model Autograph software is not better than using conventional models.
H1: Improvement critical mathematical thinking skills using ASSURE-assisted Autograph software is better than using conventional models.

The overall normality gain index test is presented in the following table:

| Hasil Klasifikasi | Kelas | Statistic | df | Sig. | Ket | Kesimpulan |
|-------------------|-------|-----------|----|------|-----|------------|
| N-gain Critical Thinking | ASSURE bsa | .950 | 32 | .147 | H0 | Normal |
| | conventional | .946 | 31 | .125 | H0 | Normal |

Table 3.1 Output of normality gain test

Because the amount of data in each class is less than 50, then to test the normality is used Shapiro-Wilk normality test using SPSS 22 software help on test of normality with significant level $\alpha = 0.05$. The test criterion is if the p-value (sig) is greater than $\alpha = 0.05$ then H0 is accepted and vice versa.

Table 3.1 is an SPSS output showing the N-gain normality test of the experimental class and the control class. The result of SPSS above shows the significance value (Sig) class ASSURE bsa equal to 0.147 and conventional class equal to 0.125. Both data have significance value (Sig) $>\alpha = 0.05$ so that H0 is accepted. This indicates that the data of both classes are normally distributed.

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| .578 | 1 | 61 | .450 |

Table 3.2 Output of homogeneity N-gain test

Table 3.2 is the output of SPSS which shows the homogeneity test of gain in experimental class and control class. The purpose of this homogeneity test is to find out whether the data has the same
variance. The way to find out significant homogeneity is to pay attention to the numbers in the Sig column. To determine the homogeneity, the applicable criteria are as follows: (1) Setting a significant level of test is α = 0.05, (2) Formulating hypotheses $H_0: \sigma_1 = \sigma_2$ and $H_1: \sigma_1 \neq \sigma_2$, (3) Testing Criteria. Significantly obtained > α, then $H_0$ is rejected, Significant obtained < α, then $H_0$ is rejected.

It can be seen in Table 3.2 above that for the Test of Homogeneity of Variances table, one of the test tool used is Levene Statistic. In the table shows that the significance value of the data is 0.450 because $0.450 > \alpha$ then $H_0$ accepted. Thus, the data in the experimental class and the control class came from populations having the same (homogeneous) variance at a significant level of 0.05.

The comparison of the gain results between the experimental class and the control class is used to see the effect of the treatment given to the experimental class. By testing criteria: Significant obtained > α, then $H_0$ accepted, Significant obtained < α, then $H_0$ is rejected.

![Table 3.3 Output t-test N gain](image)

Table 3.3 describes the difference test of experimental class gain and control class gain. The purpose of the t-test is to find out whether two sets of data have the same average or not. The way to find out the significant difference in average of these two samples is to pay attention to the numbers in the Sig column. Since both variance are the same, compare the average population with t-test using equal variances assumed. It can be seen that the probability value is 0.000. Because of the value 0.000 < α then there is a difference in improving students’ critical thinking skills in the experimental class with the control class. Because there are differences, we see in the Group Statistic table, it shows that the average increase in the experimental class is higher than the control class, therefore $H_0$ is rejected. It means that $H_1$ is accepted, then the mathematics learning with ASSURE model assisted by Autograph software is better or has an effect on the critical thinking ability of mathematic.

From the information above, it can be concluded that there is influence of application of mathematics learning with ASSURE model assisted by Autograph software toward improvement of critical thinking ability to junior high school students (Hypothesis accepted). From the result of the research, it can be seen that there is an improvement of critical thinking ability of junior high school students using mathematics learning with ASSURE model assisted by Autograph software compared to the students using conventional model. Starting with the result of pretest mathematical critical thinking ability, obtaining normal data from each pretest result, then both homogeneous data and tested the average difference obtained displayed that both data pretest has no difference.

Based on the pretest, posttest and N-gain results obtained normal and homogeneous data so that t-test is done, and the obtained result shows difference of the average of both classes. Furthermore, the test gain is normalized, the two classes have normal and homogeneous data, afterwards the average equation test is tested and there is an average difference between the two classes. Apparently the statistical hypothesis data can be concluded that the critical thinking skills of students whose learning mathematics using ASSURE model assisted by Autograph software is better when compared with students who uses conventional models.

Research on critical thinking is also done by [6], [7], [8], [9] and [10]. Based on Rohayati’s research shows that the thinking ability of junior high school students who get contextual learning is better than those who get conventional learning. Mayadani, Fahinu and Rochaminah conducted research on the
students. Their results showed that students who received discourse learning, generative learning and discovery learning were better at developing critical thinking skills than those with conventional learning although the results were not satisfactory.

4. Conclusion

Based on the formulation of the problem and the results of research and discussion of the results of research as described previously has obtained conclusions from the results of these studies, namely: Mathematics learning with ASSURE model assisted by Autograph software can improve the ability of critical thinking junior high school students.

Acknowledgments

This study is still lacking and shows weaknesses that are beyond the ability of researchers. Therefore, suggestions and criticisms are highly expected by researchers to improve in the future. The researchers would also like to say thank you to Pendi Suhendi, S.Pd, MM.Pd and also Hudiwirama, S.Pd as headmaster where researchers are conducting this study, which has given support to researchers. Hopefully this study can provide benefits for the general readers and for researchers in particular.

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