MATHEMATICS LEARNING EXPERIMENT ON GUIDED INQUIRY METHOD AND OPEN-ENDED METHOD VIEWED FROM STUDENT'S CRITICAL THINKING ABILITY IN GRADE VII OF SMP N 1 SURAKARTA

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ABSTRACT

MATHEMATICS LEARNING EXPERIMENT ON GUIDED INQUIRY METHOD AND OPEN-ENDED METHOD VIEWED FROM STUDENT’S CRITICAL THINKING ABILITY IN GRADE VII OF SMP N 1 SURAKARTA

By

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This research paper aims to know (1) the difference learning achievement between Guided Inquiry method and Open-Ended method in mathematics learning on the subject of Set, (2) the difference learning achievement viewed from student’s critical thinking ability in mathematics learning on the subject of Set, (3) the interaction between Guided Inquiry method and student’s critical thinking ability in mathematics learning against learning achievement learning on the subject of Set. Population of the research is all of students in grade VII of SMP N 1 Surakarta academic year 2012/2013 consist of 8 classes. The research sample is take two classes, i.e. grade VIIG consist of 26 students be experimental class using Guided Inquiry learning and grade VIIH consist of 24 students be control class using Open-Ended learning. Type of research is experimental research with methods of collecting data using test, questionnaire and documentation. Prerequisites test this research using normality test and homogeneity test. In this research using two-way Analysis of Variance. The result of hypothesis testing using α=5% it show that (1) F_{obs}=0.013 < F_{table}=4.064 so H₀ accepted it means there aren’t effect of learning methods to mathematics achievement on the subject of Set, (2) F_{obs}=5.008 > F_{table}=3.214 so H₀ rejected it means there are effect of student’s critical thinking to mathematics achievement on the subject of Set, (3) F_{obs}=0.107 < F_{table}=3.214 so H₀ accepted it means there aren’t interaction between learning methods and student’s critical thinking to mathematics achievement on the subject of Set.

Key words : Guide-Inquiry, Open-Ended, Critical Thinking, Set
INTRODUCTION

Education is one of the important things for humans. Kind of education can be formal, non-formal and informal. Situation of formal education which is implemented in the school environment through the learning process are critical success factors of one's educational series, because in this situation the transfer of knowledge between individuals is going on, both between teachers and students and students to students. Education in formal situations the most important is the implementation process not the end result, because the students can acquire the knowledge that they have the knowledge of the eternal provision for him to be brought into the future.

It is inevitable that in the implementation process of formal education, teaching and learning activities always have a variety of obstacles. The obstacles can come from some factors teachers, teaching materials, and even the students themselves because of the use of learning methods. As matter of fact in SMP N 1 Surakarta show that there are many learning process using conventional methods or a lecture by the teacher, so most students do not when teacher teaches because student activity is very limited. Conventional methods lead students to be passive during the learning process, because the task of the student in this case the most important thing is to sit quietly and listen carefully and note the main points from that proposed by the teacher.

One of the goals of learning mathematics in educating children is able to think critically. Critical thinking in students is to develop the students brain to direct reflection and always question, analyze, investigate, identify, ascertain and investigate further information submitted by the teacher in learning of mathematics. This can make the student have better performance.

Learning method expected to shift the use of conventional learning and to improve student’s critical thinking ability in the learning process of mathematics such as the use of Guided Inquiry learning method and / or Open-Ended method. It encourages researchers to conduct experiments mathematics learning by applying methods of guided inquiry and / or the method of open-ended in terms of student’s critical thinking ability.
In research of Ozdilek and Bulunuz (2009), conclude that the effectiveness of a guided inquiry method to increase the sense of self-efficacy beliefs of pre-service teacher in learning process. This is in line with research Mohamed (2009), in his study concluded that in Process-Oriented Guided Inquiry Learning [POGIL] has many benefits to the students of the conventional learning on student achievement and learning perceptions. In this research, Oliver and Hannafin (2001), using a qualitative case study focused on the learning of science through an Open-Ended problem solving that shows that by grouping students in learning Open-Ended problem solving over impact both on the achievement of the individual.

This research aims to know (1) the difference learning achievement between Guided Inquiry method and Open-Ended method in mathematics learning, (2) the difference learning achievement viewed from student’s critical thinking ability in mathematics learning, (3) the interaction between Guided Inquiry method and student’s critical thinking ability in mathematics learning against learning achievement learning. It can be hypothesized as follows:

$H_{0A}$  : There is no a significant difference of learning achievement between Guided Inquiry method and Open-Ended method in mathematics learning

$H_{1A}$  : There is a significant difference of learning achievement between Guided Inquiry method and Open-Ended method in mathematics learning

$H_{0B}$  : There is no a significant difference of learning achievement viewed from student’s critical thinking ability in mathematics learning

$H_{1B}$  : There is a significant difference of learning achievement viewed from student’s critical thinking ability in mathematics learning

$H_{0AB}$  : There is no a significant interaction between Guided Inquiry method and student’s critical thinking ability in mathematics learning against learning achievement

$H_{1AB}$  : There is a significant interaction between Guided Inquiry method and student’s critical thinking ability in mathematics learning against learning achievement
RESEARCH METHOD

Type of research is experimental research, in this case is the application of learning methods in mathematics learning, for further controlled and visible impact on student’s critical thinking ability and mathematics achievement. Implementation of the experiments in this research used two classes i.e. the experiment class is treated the application of Guided Inquiry and the control class is treated the application of Open-Ended.

In experiment class using Guided Inquiry method, where this method have any phase e.g. (1) Introduction phase : teacher try to attract students' attention and sets the focus lessons, (2) Open phase : teacher give students examples and ask students to observe and compare examples, (3) Convergent phase : teachers ask more specific questions designed to guide students to an understanding of the concept or generalization, (4) Conclusion and application phase : teachers guide students to understand the definition of a concept or statement of generalizations and students apply their understanding in a new context (Eggen and Kauchak in Wahono, 2012:190).

In control class using Open-Ended method, where this method have any steps e.g. (1) First step : individual work in solving the teacher at the beginning of learning for all students in the class. Then in groups of four students they discuss the work of individuals and group representatives to write the discussion group. (2) Second step : the results of each group is presented and discussed. Then study concluded Hashimoto (1998:13).

Collecting technique of sample performed with Cluster Random Sampling technique, where researcher mix subjects in the population so that all of subjects assume same (Arikunto, 2009:111). Method used to collecting data in this research e.g. (1) Main method with test method, and (2) Supplement method with questionnaire method and documentation method. Before calculating the data from the research, in addition to checking for normality and homogeneity have also conducted tests of balance. Balance test aims to determine the equilibrium initial ability students.
Before questions used to collecting data, beforehand be tested (tryout). From the result of tryout, test be sought the validity and the reliability. To calculate the validity of test item, use the formula of the product moment correlation from Karl Pearson. To calculate the reliability index of essay used alfa cronbach formula. Questionnaire method used to determine student’s critical thinking ability in the following learning.

RESEARCH FINDING AND DISCUSSION

Research Finding

Balance test used is independent sample t test, from the test obtained \( t_{\text{obs}} = 0.048 \), while the \( t_{\text{table}} = 1.960 \) at a significance level of 0.05 (5%). Since \( t_{\text{obs}} < t_{\text{table}} \) then \( H_0 \) accepted so can concluded that the experimental class and control class has same the ability or balance (no difference), so the research will proceed to the next stage.

After conducting the balance test, the researcher conducts tryout which is aimed to collect data on mathematics learning achievement and questionnaire based on student’s critical thinking ability. Testing tryout include validity and reliability. Testing tryout conducted on respondents outside of the research sample. A measuring instrument as valid if the instrument can measure something exactly what it intends to measure. Test the validity of this item using analytical techniques Product Moment Correlation of Karl Pearson, e.g. to correlate the scores of each questionnaire with total score. The correlation coefficient table is taken \( \alpha = 5\% \) with \( r_{\text{table}} \), then \( r_{xy} \) must be greater than from \( r_{\text{table}} \).

The results of testing the validity to uncover student’s critical thinking ability of the 30 items obtained about 11 items that are not valid because \( r_{\text{obs}}(r_{xy}) < 0.388 \) (\( r_{\text{table}} \)), then 11 of 30 items given researcher to determine student’s critical thinking ability discarded or not in use. While the 19 items are valid or \( r_{xy} > r_{\text{table}} \) (0,388) is used as an instrument in this research. Based on the results of testing the validity items of student achievement, 8 items given nothing item is not valid, it can be seen in that \( r_{\text{obs}}(r_{xy}) < r_{\text{table}} \) (0,388). Thus all of items (8 items) to determine the level of student achievement as feasible used as an instrument in this research.
A reliable measuring instrument is said to be consistent if the measurement is accurate and thorough. So the instrument reliability test conducted to determine the consistency of the instrument as a measuring tool, so that the results of the measurements can be trusted. Otherwise reliable instrument if the $r_{obs} > r_{table}$.

Based on the reliability testing results, it is the reliability of the results of test obtained $r_{obs}$ ($r_{11}$) for the variable student’s critical thinking ability and student achievement is greater than $r_{table} = 0.388$, it means that all of items from both variables are reliable.

On the subject of the set with sub subject is universal set, venn diagrams, subsets and the empty set get data of student achievement test scores in the control class and experiment class.

<table>
<thead>
<tr>
<th>Table of Mathematics Achievement Score</th>
<th>n</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EKSPERIMENT CLASS</strong></td>
<td>26</td>
<td>77.231</td>
<td>14.946</td>
</tr>
<tr>
<td><strong>CONTROL CLASS</strong></td>
<td>24</td>
<td>75.375</td>
<td>9.591</td>
</tr>
</tbody>
</table>

Figure of Histogram for Experiment and Control Class

With the fulfillment the properties of normality and homogeneity of two way Anova can be executed. Normality test is used to determine whether the data
analyzed came from a normally distributed population or not. The technique used is *liliefors* test the significant level at 0.05. Based on tests of normality that has been done by researcher, we can see each of these factors satisfy $L_{\text{obs}} < L_{\text{table}}$. Thus it is known that the data in this research is normally distributed.

Homogeneity test aims to test whether one of the assumptions applicable to Anova, if all variants have the same variance. The results of homogeneity test using *Barlett* method obtained $\chi^2_{\text{obs}} = 3,720$ and $\chi^2_{\text{table}} = 3,841$ ($\alpha = 5\%$). Since $\chi^2_{\text{obs}} < \chi^2_{\text{table}}$ then $H_0$ is accepted, it mean that the data in this research have the same variance (homogeneous). The results of homogeneity test using *Bartlett* method for student’s critical thinking ability obtained $\chi^2_{\text{obs}} = 0,022$ dan $\chi^2_{\text{table}} = 5,991$ ($\alpha = 5\%$). Since $\chi^2_{\text{obs}} < \chi^2_{\text{table}}$ then $H_0$ accepted, it mean that the data in this research have the same variance (homogeneous).

With the fulfillment the properties of normality and homogeneity of two way Anova can be executed. Testing the hypothesis in this research using two way Anova, e.g. to see differences based on the level of student’s critical thinking ability (high, medium, and low), the learning method used between the methods of Guided Inquiry and Open-Ended.

1. **Hypothesis 1**

   Based on the calculation of two way Anova the result that the methods (Guided Inquiry method and Open-Ended method) obtained $F_{\text{obs}} = 0,013 < F_{\text{table}} = 4,064$ then $H_0$ is accepted which means that there is no significant difference to learning mathematics achievement.

2. **Hypothesis 2**

   Based on the calculation of two way Anova the result that the student’s critical thinking ability obtained $F_{\text{obs}} = 5,008 > F_{\text{table}} = 3,214$ then $H_0$ is rejected which means that there is significant difference to learning mathematics achievement.

3. **Hypothesis 3**

   Based on the calculation of two way Anova the result that interaction between methods and student’s critical thinking ability obtained $F_{\text{obs}} = 0,107 < F_{\text{table}} = 3,214$ then $H_0$ is accepted which means that there is no interaction
between learning methods and student’s critical thinking ability to learning mathematics achievement.

Continuity test is done because the calculated F shows there are differences (significant). Based on the analysis can obtained as follows:

a) In column 1 and 2 obtained \( F_{1,2}=1.098 < F_{\text{table}}=6.428 \), then can conclude \( H_0 \) accepted. It means that there aren’t significant difference of mathematics achievement between high and medium of critical thinking group.

b) In column 1 and 3 obtained \( F_{1,3}=7.198 > F_{\text{table}}=6.428 \), then can conclude \( H_0 \) rejected. It means that there are significant difference of mathematics achievement between high and low of critical thinking group.

c) In column 2 and 3 obtained \( F_{2,3}=5.327 < F_{\text{table}}=6.428 \), then can conclude \( H_0 \) accepted. It means that there aren’t significant difference of mathematics achievement between medium and low of critical thinking group.

**Discussion**

1. **Hypothesis 1**

The method of this learning is Guided Inquiry method and Open-Ended method, shows that there is no significant difference between two methods used to mathematics achievement.

These results contrast with Ozdilek and Bulunuz research (2009) that shows improved learning achievement after being given guided inquiry treatment and the research of Oliver and Hannafin (2001) that shows each student after being given an Open-Ended problem becomes more productive. It is caused by several factors. One of the factors that caused no significant difference between the two methods used to mathematics achievement on student is the ability of intelligence each student's. Students at SMP N 1 Surakarta majority have intelligence ability are more than adequate.

Another factor, judging from the state of the field and showed each student on learning both Guided Inquiry in an experimental class and open-ended in control class, students have been active in the learning process in both tasks individually and in groups.
2. Hypothesis 2

The analysis showed that there is differences in student’s critical thinking ability significantly to mathematics achievement. Students with high critical thinking ability will have to learn mathematics achievement better than students who have low the ability to think critically. This is in line with research Lloyd and Bahr (2010) which emphasizes critical thinking in the learning process while increasing academic achievement is the impact of the critical thinking process.

3. Hypothesis 3

Interaction between student’s critical thinking ability and learning methods are given to mathematics achievement, showed no significant results. There are several factors, including internal factors such as intelligence of each student, physical factors, attitudes, interests, aptitude and motivation as well as the external factors (Hamdani, 2011:139).

CONCLUSION

1. The results shows that the learning of mathematics by using Guided Inquiry and Open-Ended method can not effect mathematics learning achievement. It is because intelligence of capability every student at SMP N 1 Surakarta is high, so that each student if given any method of learning will have no effect on mathematics learning achievement.

2. The results shows that student’s critical thinking ability can effects mathematics learning achievement. With high level of student’s critical thinking ability have better mathematics learning achievement than medium and low level of student’s critical thinking ability. The teacher is expected to develop student’s critical thinking, because the ability to think critically effect student achievement.

3. The results shows no significant interaction between method of Guided Inquiry learning and student’s critical thinking to mathematics learning achievement. It means that high-achieving students do not necessarily come
from a combination of learning methods Guided Inquiry and critical thinking medium or low.

**BIBLIOGRAPHY**


