USING MANIPULATIVES IN ETH-COOPERATIVE LEARNING TO ENHANCE MATHEMATICAL LEARNING OUTCOMES

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ABSTRACT
This study aims to obtain an overview of the improvement in student mathematics learning outcomes using manipulatives with Cooperative Learning Everyone is a Teacher Here (ETH-cooperative learning) and students who learn to use manipulatives with conventional learning. The research design used was quasi-experiment with the type of pretest-posttest control group design with a population of all first-level students who were studying matriculation at one of the STIKES in Indonesia. The number of samples of two groups was selected by purposive sampling, with the number of control group students being 38 people and the experimental group being 44 people. Group A as a control group gets conventional learning using manipulatives. Group B as an experimental group receives learning by using manipulatives through ETH-cooperative learning. The result is an increase in mathematics learning outcomes of students who learn to use manipulatives with ETH-cooperative learning higher than students who learn to use conventional manipulatives. The use of manipulatives with ETH-cooperative learning can be tried in other lectures.

KEYWORDS
Learning outcomes, STIKES students, manipulatives, ETH-cooperative learning, quasi-experiments

INTRODUCTION
Mathematics is very necessary because in mathematics learning has a very important goal (Sudihartinih, 2012). Mathematics is really needed by STIKES students because learning about health science requires numeracy, reasoning, and problem-solving skills. But some students at STIKES (College of Health Sciences) did not understand mathematics lecture material, they seemed less motivated, bored, went out during lectures, were sleepy, and recorded the material delivered by lecturers only when instructed (Rivan and Masnarivan, 2017). Many students at STIKES have unsatisfactory learning outcomes (Sappa, 2015). So that an effort is needed to improve student learning outcomes. Figure 1 is an example of student work at STIKES which is wrong in performing arithmetic operations. I took the student work in learning mathematics.
One way to improve student learning outcomes in mathematics is to use manipulatives. Increased mathematical understanding of students who use manipulatives is higher than students whose lectures are without manipulatives (Sudihartinih and Purniati, 2017). Learning is more effective with manipulatives and student attitudes are positive towards manipulatives (Schweyer, 2000; McGee, et al, 2012).

Cooperative learning can also facilitate students in learning. Research has identified cooperative learning as one of ten High Impact Practices that enhance student learning (Millis, 2010). The research findings show that cooperative learning in general, can improve student achievement, pay attention to each other among students, student self-esteem, and other positive results (Slavin, R.E., 1980). Other studies also report the results of a meta-analysis that integrates research on undergraduate science, mathematics, engineering, and technology (SMET) education since 1980, showing that various forms of small-group learning are effective in promoting greater academic achievement, a better attitude towards learning, and increasing perseverance in learning (Springer, Stanne, and Donova, 1999). So that in this study obtain an overview of the improvement in student mathematics learning outcomes using manipulatives with ETH-cooperative learning and students who learn to use manipulatives with conventional learning at STIKES.
LITERATURE REVIEW

Learning outcomes
The Center for Teaching & Innovation Support - University of Toronto states that "Learning outcomes are statements that describe the knowledge or skills students must obtain at the end of a particular assignment, group, course or program, and help students understand why knowledge and skills will benefit them". Learning outcomes are abilities possessed by students after they have received their learning experience (Sudjana, 1991). More complete according to Nasution states that learning outcomes are changes that occur in individuals who learn, not only changes in knowledge but also to shape skills and rewards in self-learning (Lestari, 2015).

Manipulatives
Manipulatives are concrete objects that can help students learn. Most practitioners and researchers argue that manipulatives are effective because they are concrete, in addition, students who use manipulatives in mathematics groups usually outperform those who do not (Clements, 1999). But there is a problem using manipulatives if children begin to make connections between manipulatives and newborn ideas, certain physical actions with manipulatives might suggest mental actions that are different from what we want students to learn. For example, there is a mismatch between students who use number lines to make additions. When adding 4 + 3, students who are at 4, count 'one, two, three, 'and read the answer. This does not help them solve problems mentally, because they have to count 'five, six, seven' and at the same time count 5 is 1, 6 is 2, and so on. Therefore, although manipulatives have an important place in learning, their physicality does not carry the meaning of mathematical ideas, so good manipulatives are those that help students build, strengthen, and connect various representations of mathematical ideas (Clements, 1999). Manipulatives used in this paper are as written by Sudihartinih (2014) in which manipulatives consist of charged cards and number lines.

ETH-cooperative learning
Cooperative learning has long been in education, which has undergone a substantial revival in research and educational practice. This term refers to a group technique where students work on learning activities in small groups and receive gifts or recognition based on their group's performance (Slavin, 1980). Many types of cooperative learning include Jigsaw, Teams Games Tournament, Think Pair Share, and others. Whereas in cooperative learning the steps prepared (Johson and Johnson, 1999), are as follows:
1. The teacher determines the objectives for the lesson, decides the size of the group (3-4 people), the method of assigning students to the group, the role students will be given, making instructional materials and the way the room will be arranged.
2. The teacher explains the task, asks students to work together effectively, individual accountability provides criteria for success, and explains the social skills that will be used. In ETH-cooperative learning students who have understood explain the assignment, teach the concepts and strategies needed to group friends.
3. The teacher monitors student learning and provides scaffolding in groups to provide assistance or to improve interpersonal and group skills when needed. The teacher systematically observes and collects data in each group as he works.
4. Assess student learning and help students play well in their groups.
RESEARCH METHOD

The research design used was quasi-experiment with the type of pretest-posttest control group design as performed by Sudihartinih and Purniati (2017). The study population was all first-level students who were studying matriculation at one of the STIKES in Indonesia, Indonesia. The number of samples of the two groups was selected by purposive sampling. The control group consisted of 38 people and the experimental group consisted of 44 people. They are students who have just graduated from Senior High School about 17 years old. Group A as a control group gets conventional learning using manipulatives. Group B as an experimental group receives learning by using manipulatives through cooperative learning type Everyone is a Teacher Here (ETH). The instrument of this research is a description test question on paper given before and after each lesson for 30 minutes. Research instruments were prepared by researchers. Likewise, the instructor in the lecture is a researcher. The concepts taught are arithmetic operations in real numbers, units of length, units of area, units of volume, units of mass, and units of time.

RESEARCH RESULT AND DISCUSSION

The results of the two group tests were assessed using rubric scoring that the researchers had compiled. Furthermore, the data is processed using SPSS 23.

Table 1. Descriptive Statistics of Pretest Data

<table>
<thead>
<tr>
<th>Code</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>38</td>
<td>6.63</td>
<td>3.03</td>
<td>1.00</td>
<td>13</td>
</tr>
<tr>
<td>Experimental</td>
<td>44</td>
<td>4.33</td>
<td>2.43</td>
<td>0.00</td>
<td>10</td>
</tr>
</tbody>
</table>

Based on Table 1, it is known that the average pretest of the control group is 6.63 with a standard deviation of 3.03. In the experimental group, the average data pretest is 4.33 and the standard deviation is 2.43. Descriptively the data of the two groups are different. Furthermore, to determine the type of similarity test, the two average pretest data for both groups were tested for normality.

Table 2. Tests of Normality Data Pretest

<table>
<thead>
<tr>
<th>Code</th>
<th>Shapiro-Wilk Statistic</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>0.956</td>
<td>38</td>
<td>0.140</td>
</tr>
<tr>
<td>Experimental</td>
<td>0.959</td>
<td>44</td>
<td>0.124</td>
</tr>
</tbody>
</table>

In Table 2, the significance level of the two groups is more than 0.05 so that the two groups come from populations that are normally distributed. The homogeneity test and t-test or t-test are then carried out.

Table 3. Independent Samples Test Data Pretest

<table>
<thead>
<tr>
<th>Levene's Test</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Lower</td>
<td>Upper</td>
</tr>
</tbody>
</table>

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The homogeneity test results using Leven’s test revealed that the data was homogeneous. Thus the similarity test of the two average data pretest using the t-test. The result is a significant <0.05 so that both groups have different initial abilities. Although the abilities of the two groups are different, this study can be continued because the average pretest of both groups is 6.63 and 4.43 from the ideal maximum score of 100.

To see an increase in the learning outcomes of both groups using normalized gain data from Meltzer (2002), namely:

\[
\text{Normalized Gain (g)} = \frac{\text{postest score} - \text{pretest score}}{\text{ideal score} - \text{pretest score}}
\]

Next, the descriptive gain data is normalized.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>38</td>
<td>0.68</td>
<td>0.25</td>
<td>0.04</td>
<td>1</td>
</tr>
<tr>
<td>Experimental</td>
<td>44</td>
<td>0.80</td>
<td>0.22</td>
<td>-0.02</td>
<td>1</td>
</tr>
</tbody>
</table>

Based on Table 4, the average gain and normalized gain the standard deviation of the control group are 0.68 and 0.25. While in the control group it is 0.80 and 0.22. Furthermore, a normality test was conducted to determine the type of test for the difference in the two average improvements in learning outcomes in both groups.

<table>
<thead>
<tr>
<th>Code</th>
<th>Statistic</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Shapiro-Wilk</td>
<td>38</td>
<td>0.004</td>
</tr>
<tr>
<td>Control</td>
<td>0.906</td>
<td>44</td>
<td>0.000</td>
</tr>
</tbody>
</table>

In Table 5, it can be seen that using the Shapiro Wilk test the normalized gain average in both groups comes from populations that are not normally distributed. So that the different test of two increases in the average of the two groups using the non-parametric test.

<table>
<thead>
<tr>
<th>Test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent-Sample Mann-Whitney U Test</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Based on Table 6 it is known that using the Mann Whitney U Test obtained a significance of less than 0.05. So that the increase in the two groups is different. Because the average gain and normalized standard deviation of the control group are 0.68 and 0.25, while in the control group is 0.80 and 0.22, so the experimental group student learning outcomes are higher than the control group students. This improvement occurs because the experimental group uses manipulatives that can help students’ understanding and ETH-Cooperative learning that can facilitate students to learn in groups so that they can help each other. These results are in accordance with other reports (Slavin, 1980; Springer, Stanne, and Donova, 1999), namely that cooperative learning
can improve student learning outcomes. Because in cooperative learning, students can maximize learning by cooperating positively in groups.

**CONCLUSION**

Improved mathematics learning outcomes of students who learn to use conventional learning manipulatives and students who use manipulatives with ETH-cooperative learning are different. And through the average data and standard deviation from normalized gain data both groups are known that the increase in mathematics learning outcomes of students who learn to use manipulatives with ETH-cooperative learning is higher than students who learn to use conventional manipulatives.

**Suggestion**

Based on the conclusions, manipulatives and ETH-cooperative learning can be tested in other lectures. Lecturers can also prepare teaching materials and manipulatives that are in accordance with the concepts in the lecture.

**REFERENCES**


