IMPROVEMENT OF STUDENT LEARNING OUTCOMES IN PHYSICS USING CASE STUDY METHOD

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Abstract

This research was carried out to study student learning outcomes using case study and conventional method and its comparison using both of methods. The problem of conventional class with teacher-centered learning are: 1) student doesn’t understand how to connect physics concept in technology and daily life, 2) student can not solve contextual physics problems, 3) critical thinking is not developed. Case study method was choosen in this study in order to develop student critical thinking and their ability to solve contextual physics problems. Experimental research method using experiment and control class was conducted in this study. Research shows that the student learning outcomes using the case study is better than conventional method.

Key Word: casestudy, critical thinking, physics, learning outcomes, static fluid
Introduction

In Article 3 UU No. 20 of 2003 of Sistem Pendidikan Nasional (UUSPN) stated that the function of Education is to develop skills and form the character and civilization of a dignified nation in the context of the intellectual life of the nation. Teaching and learning at school level must be inline with the objectives. Success or failure of educational outcomes depends on how the learning process experienced by students as learners. Learning process must be conducive in order to direct learning so that learners can develop their potential (Sanjaya, 2008). This means that the educational process must be oriented to students (student active learning).

Physics as one branch of the Natural Sciences (IPA) must be learned in order to understand natural phenomena and solve contextual problem encountered in daily life. Physics is also underlie the development of advanced technologies and the concept of living in harmony with nature. However, research report shows that student have unsatisfactory learning outcomes in physics. Most of the student have low motivation in learning physics. Motivation are important in contributing to students' success in their science courses (Pintrich & Schunk, 2002).

Case Study is a way of giving students the chance to perform tasks based on direct instructions, issues, events, or situations that have been prepared by the teacher. Case study method could involved the student actively in learning and improve student interaction as shows previous research (Shiva in Jhonson, 2004). Student are allowed to find alternatives solution for the given contextual problem. In performing the assignment, the students can explore the problem by hands-on experience. Tasks can be assigned in groups or individually. Through this method, students can develop skills and habituation to an independent, honest, develop critical thinking, and creatively find a new solution of a task to be solved. This method can be applied when the student has had prior knowledge about the issues presented. The steps of using the case study method is to observe, think, and act in dealing with certain situations.

Research Method

This research was conducted at SMAN 1 Tebing Tinggi of North Sumatera province in May until July 2013. Quasi experiment method was use in this research using experiment class and control class. The topic of learning is static fluid.

Research Instrument

The research instrument used in collect data of students' achievement test of subject matter consists of 20 items multiple-choice. Content validity of the test is multiple-choice questions that validated by lecturers and teachers. Predict validity of the test is giving a test to another students in different school.

Hypothesis Testing

The hypothesis is verified using t-test:

a. Pre-test of student ability Test

T test is use to determine the similarity of students ability in both of sample.

The hypothesis will be test is:

\[ H_0: \bar{x}_1 = \bar{x}_2 \]  

The average value of the experimental classes as equal as the average value of the control classes.
If research data have normal distribution and homogeneity, the test of hypothesis using test, which is:

\[ t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \]

(Sudjana, 2008: 239)

With \( S \) is combination of deviation standard that can calculate with the formula according to Sudjana (2002):

\[ S^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2} \]

where:
- \( \bar{X}_1 \) = The average value of learning outcomes in the experiment class.
- \( \bar{X}_2 \) = The average value of learning outcomes in the control class.
- \( n_1 \) = Total experiment class sample.
- \( n_2 \) = Total control class sample.
- \( S^2 \) = Varians two of class
- \( t \) = Value of \( t \)

With the criteria is:
- \( H_0 \) accept if \(-t_{1-\alpha/2} < t < t_{1-\alpha/2}\)
- \( t_{1-\alpha/2} \) we get from \( t \) list with \( dk = n_1+n_2-2 \) and probability \((1-\frac{1}{2}\alpha)\). To another value of \( t \) \( H_0 \) not accepted.

Value of \( t_{\text{calculate}} \) compare with \( t_{\text{table}} \) get from \( t \) table list to \( \alpha = 0.05 \). If \(-t_{1-\alpha/2} < t < t_{1-\alpha/2} \) on the level \( \alpha = 0.05 \) and independent degree \( df = n_1+n_2-2 \), so have the same initial ability of student.

\( H_a \) accepted if \( t_{\text{calculate}} > t_{\text{table}} \) get from distribution \( t_{\text{table}} \) list for \( \alpha = 0.05 \), it mean have not same initial ability of student.

If \( S_1 \neq S_2 \), so, \( t \) test formula will be use is:

\[ t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \]

With test criteria: accept \( H_0 \) if:

\[-w_1t_1 + w_2t_2 < t < \frac{w_1t_1 + w_2t_2}{w_1 + w_2} \]

with \( w_1 = \frac{S_1^2}{n_1} ; w_2 = \frac{S_2^2}{n_2} \)

\[ t_1 = t_{(1-\alpha), (n_1-1)} ; t_2 = t_{(1-\alpha), (n_2-1)} \]

b. Post-test of student ability test

Two tail \( t \)-test used to determine the difference of student learning outcomes using case study and conventional method.

The form of hypothesis will be test is:

\( H_0 : \bar{X}_1 = \bar{X}_2 \) : Case study method is not effecting to student learning outcomes.

\( H_0 : \bar{X}_1 > \bar{X}_2 \) : Case Study Method is effecting to student learning outcomes.

If data distribution is normal and homogeneity, the hypothesis in the research using \( t \)-test with the formula is:

\[ t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \]

With:

\[ S^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2} \]

With test criteria is:
- \( H_0 \) accepted if \( t_{\text{calculate}} < t_{(1-\alpha)} \) where \( t_{(1-\alpha)} \) get from distribution table \( t \) with independent degree \( (df) = n_1+n_2-2 \) and the probability \((1-\alpha)\) with \( \alpha = 0.05 \) for another value of \( t \) \( H_0 \) not
accepted, so Case Study Method have effect in student learning outcomes. If $S_1 \neq S_2$, so the formula t-test will use:

$$t = \frac{X_1 - X_2}{\sqrt{(S_1^2/n_1) + (S_2^2/n_2)}}$$

Test criteria is not accepted ($H_0$ is rejected) if:

$$t \geq \frac{w_1 t_1 + w_2 t_2}{w_1 + w_2}$$

with $w_1 = \frac{S_1^2}{n_1}$; $w_2 = \frac{S_2^2}{n_2}$

$$t_1 = t_{(1-\alpha), (n_1-1)}; t_2 = t_{(1-\alpha), (n_2-1)}$$

Research Result

The study involved two classes with treatment using different learning methods, namely the case study method (experiment class) and conventional method (control class). Before the treatment is applied, the first two classes are given pre-test in order to determine the ability of students before conducting the treatment. Furthermore, after a given treatment, the two classes are given post-test to determine student learning outcomes.

Student competency in test completion is show in table 1!

**Table 1. Pretest Score and Post Test Score in Experiment Class and Control Class**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Experiment Class</th>
<th>Control Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre Test</td>
<td>Post Test</td>
</tr>
<tr>
<td>Sum</td>
<td>161</td>
<td>272</td>
</tr>
<tr>
<td>Average</td>
<td>4.47</td>
<td>7.5</td>
</tr>
<tr>
<td>Deviation</td>
<td>1.64</td>
<td>1.072</td>
</tr>
<tr>
<td>Variance</td>
<td>2.71</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Data normality test was examined using Liliefors testing. Using this test, it is found that the value of the second pretest sample group had a normal distribution, revealed from $L_{\text{count}} < L_{\text{table}}$ at significance level 0.05 and $n=36$ and 34.

**Table 2. Summary of Calculation**

<table>
<thead>
<tr>
<th>Normality Test of Pre-test and Post-test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Pre-test</td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>Post-test</td>
</tr>
<tr>
<td>Control</td>
</tr>
</tbody>
</table>

Based on Table 2 shows that $L_{\text{count}} < L_{\text{table}}$, we can conclude that pre-test and post-test data are two groups of samples which are normally distributed.

Homogeneity test performed using the F-test to determine the homogeneity of the population. The results of homogeneity test of pretest is $F_{\text{count}} = 1.9$. While the significance level $\alpha = 0.05$ $F_{\text{table}} = 1.94$. For $F_{\text{count}} < F_{\text{table}}$, we can conclude that then the second pretest sample data is homogeneous.

The results of calculations of data homogeneity test pre-test of both classes are shown in Table 3 below:

**Table 3. Data of Homogeneity Test**

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>Variance</th>
<th>$F_{\text{count}}$</th>
<th>$F_{\text{table}}$</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>Experiment</td>
<td>2.71</td>
<td>1.9</td>
<td>1.94</td>
<td>Homogeneity</td>
</tr>
<tr>
<td>Control</td>
<td>1.44</td>
<td>1.9</td>
<td>1.94</td>
<td>Homogeneity</td>
<td></td>
</tr>
</tbody>
</table>

Tabel 4 Summary of Hypothesis Test

To determine the influence of the case study method to student learning outcomes, then the data of pre-test and post-test was analyzed using two ways (t-test).

Results of hypothesis testing at significance level of 0.05, and $df = 68$ obtained $t_{\text{count}} = 1.97$ with $t_{\text{table}} = 1.9973$. It can be shown that $-t_{\text{table}} < t_{\text{count}} < t_{\text{table}} (-1.9973 < 1.97 < 1.9973)$ so can be conclude that the experiment class and the control class have the same initial capabilities.
Analysis of post-test shows that $t_{\text{count}} > t_{\text{table}}$ (4.53 > 1.9973), then $H_0$ is rejected and $H_a$ is accepted. It means that there is a difference in student learning outcomes using the case study method and conventional method.

**Tabel 5 Summary of Students’ Activity**

<table>
<thead>
<tr>
<th>Num</th>
<th>Pre-Test</th>
<th>Students’ activity</th>
<th>Post-Test</th>
<th>Total of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Good</td>
<td>Active</td>
<td>Very Good</td>
<td>12</td>
</tr>
<tr>
<td>2.</td>
<td>Bad</td>
<td>Moderate</td>
<td>Moderate</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Bad</td>
<td>Active</td>
<td>Good</td>
<td>7</td>
</tr>
<tr>
<td>4.</td>
<td>Moderate</td>
<td>Active</td>
<td>Very Good</td>
<td>9</td>
</tr>
<tr>
<td>5.</td>
<td>Bad</td>
<td>Very Active</td>
<td>Good</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Very Bad</td>
<td>Very Active</td>
<td>Moderate</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>Moderate</td>
<td>Active</td>
<td>Good</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Very Bad</td>
<td>Moderate</td>
<td>Very Good</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>Good</td>
<td>Active</td>
<td>Good</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Good</td>
<td>1</td>
</tr>
</tbody>
</table>

Significant improvement of student activity when learning using case study method is shows in Table 5. This condition give result to student learning outcomes.

Several difficulty encountered in this study are : a)The student need more specific explanation with their environment relating to daily activities. b) Lack of laboratory apparatus is handicap in performing demonstration. This condition consumes extra time in learning with case study method.

**Conclusions**

Based on research result and discussion, can be concluded that:
(1) There are differences instudent learning outcome esusing the casestudy method and the conventional method in sub topic static fluid in class XIIPA SMA Negeri 1 TebingTinggi. (2) Student learning outcomes with case study method is more better than conventional method.

**Suggestions**

Based on discussion of research result and conclusion above, some suggestion is proposed: (1) Teacher should make a smaller condition based on their topic (2) Teacher should give more specific explanation to student with their environment relating to daily activities (3) More time must be allocated for student learning activities using case study method.

**References**

Dimyati and Mudjiono. 2006. *BelajardanPembelajaran*. Jakarta: RinekaCipta


Olivia, Jose M, 2005, *What professional knowledge should we as physics teacher have about the use of analogies?* Journal of Physics Teacher Education Online (JPTEO), "Vol 3, No 1", 11


