The effect of ICT learning media and discipline on the effectiveness of learning mathematics

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ABSTRACT

This study aims to determine the effect of information computer technology (ICT)-based learning media and learning discipline on the effectiveness of mathematics learning process. The experiment was carried out in two groups where each group was given different treatments. The first group was taught using ICT-based learning media, while the second group was taught using conventional learning media. Each group was further divided into two categories according to their level of discipline, namely groups with high levels of discipline and groups with low levels of discipline. The method used in this research is an experiment with a treatment by level analysis model. The type of test used is Anova Two-Way. Based on the results of the analysis, it shows that the group taught using ICT-based learning media obtained a higher effectiveness of learning process than the group taught using conventional learning media. and groups that have a high level of discipline get a higher effectiveness of the learning process than groups with low levels of discipline. It is also evident that there is an influence of the interaction between the use of ICT-based learning media and the level of discipline on the effectiveness of learning process.

Keywords: ICT-Based Learning Media; Discipline Learning; Effectiveness of Learning Process

1. INTRODUCTION

Facing global competition in the 21st century the flow of information interactions cannot be controlled. It is necessary to produce various competitive advantages from the results of education. Education must be able to build bridges to address gaps between processes, outcomes and learning experiences in schools. Education is the maturation of students to develop their talents, potential and skills in living life. A person who learns, will interpret all the events that occur in his life changes. The change was not only visible in his mind, but also seen from the change in his behavior gradually and as a whole become more mature in dealing with life's problems. Learning is a change in behavior thanks to experience and practice. That is, the purpose of a learning activity is a change in behavior, whether related to knowledge, skills or attitudes, even covering all aspects of the organism and personal. (Djamara and Zain, 2006) The factors influence student learning can be classified into two classifications, namely in-ternal and external factors. Internal factors are those that exist within the individual at the time of learning, the consists of physical, psychological, and health factors, while external factors are those that exist outside the individual, including family, school and community factors (Slameto, 2010).

The teacher as one of the determinants of student learning success is required to be able to develop learning strategies. In the teaching and learning strategy book written syahminan and quoted by AE Sinaga, the teaching style is a statement of the teacher's personality in delivering learning materials to students. (AE Sinaga, 2018) Teachers committed to professional enthusiastically participate in the training to stay abreast of technological advances and emerging trends in education. (Joshua Abah, 2018) The learning process is an interactive process for teachers and students in teaching and learning activities. Teachers have an effort in developing ed-ucation, as well as increasing effectiveness in teaching through learning strategies, learning methods, learning models and learning media. Learning media are all tools or objects used in teaching and learning activities, to convey learning messages from source to recipient (Daryanto, 2010). According to Rusli, there are the three main functions of information communication technology used during the learning process. Technology functions as a tool, as science, as well as materials and learning aids (Rusli, 2009). The use of ICT-based learning materials for learning mathematics is a very appropriate step. And the government is obliged to provide various trainings for teachers, especially mathematicians. although there are still many teachers who have difficulty using ICT in the mathematics learning process.

Mathematics is currently still an obstacle to education in Indonesia. Based on the results of TIMSS research on Mathematics abilities in 38 countries, the mathematics abilities of students in Indonesia are in 34th (TIMSS, 2011). Mathematics is a science that requires symbols, this symbol provides a communication capable of providing information to form a new concept. New concepts are formed because of understanding previous concepts, so the concept is complete. The logical approach used in mathematics starts with definitions and axioms. From this it can be concluded that a theorem is stated
by a statement which is proven by deductive reasoning and mathematical truth is developed on the basis of logic. (Anggun Pastika Sandi, 2018).

In the process of learning mathematics, teachers make disciplinary policies with the aim of creating calm and order in the classroom. In the learning process, disciplinary techniques designed to punish, humiliate, frighten, and repay students for delinquency can only temporarily change student behavior. For this reason, teachers are expected to make disciplinary policies with the aim of creating calm and order in the classroom. Syaiful Bahri said, Discipline in educational interactions is defined as a pattern of behavior that is regulated according to the provisions that have been consciously regulated by teachers and students (Syaiful Bahri, 2010). Departing from this definition, a study was conducted the effect of information computer technology (ICT)-based learning media and learning discipline on the effectiveness learning process.

2. RESEARCH METHOD

The method used in this research is an experiment with a treatment by level analysis model. The type of test used is Anova Two-Way. Supardi said, Anova Two-way used if experimental research or expose facto research consists of two independent variables, for the treatment of two experimental factors or one experimental factor and one attribute variable (Supardi, 2017).

Table 1. Research Design

<table>
<thead>
<tr>
<th>Discipline Levels (B)</th>
<th>Treatment Learning Media (A)</th>
<th>Σ B</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level (B1)</td>
<td>ICT Based Learning (A1)</td>
<td>Σ B1</td>
</tr>
<tr>
<td>Low Level (B2)</td>
<td>Conventional (A2)</td>
<td>Σ B2</td>
</tr>
<tr>
<td>Σ A</td>
<td>Σ A1</td>
<td>Σ A2</td>
</tr>
</tbody>
</table>

Information:

ΣA1 : Effectiveness of learning process in the ICT-based learning model group

ΣA2 : Effectiveness of learning process in the conventional learning model group

ΣB1 : Effectiveness of learning process on respondents who have high discipline

ΣB2 : Effectiveness of learning process on respondents who have low discipline

A1B1 : Effectiveness of learning process in the ICT-based learning model group have high discipline

A1B2 : Effectiveness of learning process in the ICT-based learning model group have low discipline

A2B1 : Effectiveness of learning process in the conventional learning model group have high discipline

A2B2 : Effectiveness of learning process in the conventional learning model group have low discipline

The data collection technique used in this data is to give questionnaires to respondents. In the discipline variable, a statement is given to measure the level of discipline of the respondent. On the learning process effectiveness variable, respondents were given a statement in the form of a perceived response referring to the pre-test and post-test after being given treatment. The questionnaire was measured based on validity and reliability tests.

2.1. Validity

Validity is a measure that shows the level of validity or validity of an instrument. (Riduwan, 2010) Analysis of the instrument validity was carried out through internal consistency analysis, namely the correlation between the statement items and the number of instruments. by using the Pearson product moment correlation formula, as follows (Sugiyono, 2012)

\[ r_{xy} = \frac{n \sum XY - \sum X \sum Y}{\sqrt{(n \sum X^2 - (\sum X)^2)(n \sum Y^2 - (\sum Y)^2)}} \]
Information:
\[ r_{xy} = \text{Product Moment Correlation Coefficient} \]
\[ \sum X = \text{Total Score Spread of } X \]
\[ \sum Y = \text{Total Score Spread of } Y \]
\[ \sum XY = \text{Multiplication Total Score X and Score Y} \]
\[ \sum X^2 = \text{The sum of squares of the X test score} \]
\[ \sum Y^2 = \text{The sum of squares of the Y test score} \]
\[ n = \text{Number of Respondents} \]

The product moment correlation coefficient value obtained from the calculation results is compared with the \( r \)-table value at a significant level of 5%. If \( r \)-count is greater than \( r \)-table value then the item is considered valid, whereas if \( r \)-count is smaller than \( r \)-table value then the item is considered invalid and the item cannot be used.

2.2. Reliability

Reliability means trustworthy, if the instrument can produce consistent results. The instrument is said to be reliable if it shows consistency of measurement results and has determination of measurement results, so that it can prove that the measuring instrument can be justified (Arikunto, 2001). The formula used in the reliability test is to use the Alpha Cronbach method, this formula can be used to test a test question in the form of a test description where the score per item is different (Riduwan, 2010). Alpha Cronbach formula as follows:

\[ r_{11} = \frac{k}{k-1} \left(1 - \frac{\sum Si}{St}\right) \]

Where:
\( r_{11} \) = Reliability coefficient test
\( k \) = Number of item
\( \sum Si \) = Variance of item scores.
\( St \) = Variance total

2.3. Normality Test

The normality test aims to determine whether the data collected is normally distributed or not. This will affect the continuation of the statistical analysis process, if the data is normally distributed, the analysis will use parametric statistics, whereas if the data are not normally distributed, the analysis will use non-parametric statistics. In SPSS, the normality test can be performed using the Kolmogorov-Smirnov analysis. If the sig KS value > 0.05, the data is normally distributed (Suparman, 2014).

2.4. Homogeneous Test

Homogeneity testing was carried out to test the variance of each data group. Homogeneity test requirements are needed to perform inferential analysis in a comparative test (Supardi, 2017). In SPSS, data criteria are said to be homogeneous if the sig value > 0.05 (Tatan & Maria, 2015).

3. RESULTS AND DISCUSSION

Based on the data description, the effectiveness of the mathematics learning process is measured through the ICT learning model and the learning discipline. The data obtained is as follows,

3.1. Description of Data

<table>
<thead>
<tr>
<th>Table 2. Description of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptive Statistics</strong></td>
</tr>
<tr>
<td>Media Pembelajaran</td>
</tr>
<tr>
<td>TK</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Konvensional</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
Table explained, that ICT-based learning media and high discipline have a very good average score, Whereas on ICT learning media with low discipline, conventional learning media with high and low discipline have a fairly good average score. Furthermore, the effectiveness of the learning process has a good average score.

3.2. Normality Test

<table>
<thead>
<tr>
<th>Media Belajar</th>
<th>Media Belajar</th>
<th>Media Belajar</th>
<th>Media Belajar</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIKT dan Disiplin Tinggi</td>
<td>TIKT dan Disiplin Rendah</td>
<td>Konvensional dan Disiplin Tinggi</td>
<td>Konvensional dan Disiplin Rendah</td>
</tr>
<tr>
<td>H Normal Parameters</td>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Mean</td>
</tr>
<tr>
<td>Residuals</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Normal Parameters</td>
<td>.001</td>
<td>.118</td>
<td>.136</td>
</tr>
<tr>
<td>Most Extreme Differences</td>
<td>.910</td>
<td>.106</td>
<td>.077</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov</td>
<td>.354</td>
<td>.457</td>
<td>.526</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.100</td>
<td>.985</td>
<td>.943</td>
</tr>
</tbody>
</table>

Based on these data, It can be concluded that all data came from populations that were normally distributed, because the sig value > 0.05. On the effectiveness of learning with high discipline has sig 1.00, about the effectiveness of learning with low discipline has sig 0.985. While the sig value of learning effectiveness in conventional learning media with high discipline 0.943 and sig value of learning effectiveness in conventional learning media with low discipline has 0.935.

3.3. Homogeneous Test

Based on the results of the analysis above, obtained sig value 0.925 > 0.05. It can be concluded that the data came from a homogeneous population.

3.4. Research Hypothesis Test

Research hypothesis testing can be done, if the data meet the requirements of a normal distribution and homogeneous. Based on the previous analysis, the data were normally distributed and homogeneous. Based on the requirements of the hypothesis, the data were analyzed using ANOVA Two-Ways test.
Hypotheses were tested with significant coefficients:

If the sig value > 0.05; then $H_0$ accepted and $H_1$ is rejected

If the sig value < 0.05; then $H_0$ rejected and $H_1$ is accepted

Hypothesis 1: There is a significant effect of the use of instructional media on the effectiveness of the mathematics learning process.

Hypothesis 2: There is a significant effect of discipline on the effectiveness mathematics learning process.

Hypothesis 3: There is a significant influence on the interaction of the use of learning media and discipline.

After the analysis test was carried out, there was a significant interaction between the three hypotheses. Therefore, it is necessary to carry out further tests to find out which group has the most influence on the effectiveness of the mathematics learning process.

**The effectiveness of the mathematics learning process with learning media**

**Table 6.** Learning media toward the effectiveness of learning

<table>
<thead>
<tr>
<th>Group Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media Pemelajaran</td>
</tr>
<tr>
<td>Eksitutus Belajar</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Independent Samples Test**

<table>
<thead>
<tr>
<th>Group Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Eksitutus Belajar</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Hypothesis:

$H_0$ : $\mu_1 = \mu_2$

$H_1$ : $\mu_1 \neq \mu_2$

$H_0$ : There are similarities in the effectiveness of learning on ICT learning media with conventional learning media

$H_1$ : There are differences in the effectiveness of learning on ICT learning media with conventional learning media

**Criteria:**

$H_0$ is rejected and $H_1$ accepted, if $t_{count} > t_{table}$.

$H_0$ is accepted and $H_1$ rejected, if $t_{count} < t_{table}$.

$t_{table} = \sqrt{\frac{\text{df}}{n_1 + n_2 - 2}} = 30 + 30 - 2 = 58 * \text{sig level 0.05} = 2.00$

Based on the table independent sample test $t_{count} 3.279 < t_{table} 2.000$ that is there are differences in the effectiveness of learning on ICT learning media with conventional learning media. Based on the mean, The effectiveness of the mathematics learning process with ICT-based learning media better than conventional learning media.

**The effectiveness of the mathematics learning process with learning discipline**

**Table 7.** Learning discipline toward the effectiveness of learning

<table>
<thead>
<tr>
<th>Group Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kedisipinan</td>
</tr>
<tr>
<td>Eksitutus Belajar</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Independent Samples Test**

<table>
<thead>
<tr>
<th>Group Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Eksitutus Belajar</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Hyphotesis:

H₀ : µ₁ = µ₂
H₁ : µ₁ ≠ µ₂

H₀ : There are similarities in the effectiveness of learning on higher discipline with low discipline
H₁ : There are differences in the effectiveness of learning on higher discipline with low discipline

Criteria:

H₀ is rejected and H₁ accepted, if t_count > t_table.
H₀ is accepted and H₁ rejected, if t_count < t_table.

\[ t_{table} = \frac{n_1 + n_2 - 2}{\text{sig level 0.05}} = 2.00 \]

Based on the table independent sample test \( t_{count} 4.512 < t_{table} 2.000 \) that is there are differences in the effectiveness of learning on higher discipline with low discipline learning. Based on the mean, The effectiveness of the mathematics learning process with higher discipline better than low discipline.

**ICT-based learning media with high discipline and conventional learning media with high discipline towards the effectiveness of the learning process**

**Table 8.** ICT and conventional based learning media with high discipline towards the effectiveness of learning process

<table>
<thead>
<tr>
<th>Post Hoc</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efektivitas Belajar A1B1</td>
<td>15</td>
<td>87.20</td>
<td>8.213</td>
<td>2.121</td>
</tr>
<tr>
<td>A2B1</td>
<td>15</td>
<td>73.20</td>
<td>8.793</td>
<td>2.270</td>
</tr>
</tbody>
</table>

Hyphotesis:

H₀ : µ₁ = µ₂
H₁ : µ₁ ≠ µ₂

H₀ : There are similarities in the effectiveness of learning on ICT learning media with high discipline and conventional learning media with high discipline
H₁ : There are differences in the effectiveness of learning on ICT learning media with high discipline and conventional learning media with high discipline

Criteria:

H₀ is rejected and H₁ accepted, if t_count > t_table.
H₀ is accepted and H₁ rejected, if t_count < t_table.

\[ t_{table} = \frac{n_1 + n_2 - 2}{\text{sig level 0.05}} = 2.048 \]

Based on the table independent sample test \( t_{count} 4.506 < t_{table} 2.048 \) that is there are differences in the effectiveness of learning on ICT learning media with high discipline and conventional learning media with high discipline. Based on the mean, The effectiveness of the mathematics learning process on ICT learning media with high discipline better than conventional learning media with high discipline.

**ICT-based learning media with low discipline and conventional learning media with low discipline towards the effectiveness of the learning process**

**Table 9.** ICT and conventional based learning media with low discipline towards the effectiveness of learning process

<table>
<thead>
<tr>
<th>Post Hoc</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efektivitas Belajar A1B2</td>
<td>15</td>
<td>70.67</td>
<td>7.355</td>
<td>1.999</td>
</tr>
<tr>
<td>A2B2</td>
<td>15</td>
<td>67.13</td>
<td>8.603</td>
<td>2.299</td>
</tr>
</tbody>
</table>

Hyphotesis:

H₀ : µ₁ = µ₂
H₁ : µ₁ ≠ µ₂

H₀ : There are similarities in the effectiveness of learning on ICT learning media with low discipline and conventional learning media with low discipline
H₁ : There are differences in the effectiveness of learning on ICT learning media with low discipline and conventional learning media with low discipline

Criteria:

H₀ is rejected and H₁ accepted, if t_count > t_table.
H₀ is accepted and H₁ rejected, if t_count < t_table.

\[ t_{table} = \frac{n_1 + n_2 - 2}{\text{sig level 0.05}} = 6.651 \]

Based on the table independent sample test \( t_{count} 1.115 < t_{table} 6.651 \) that is there are differences in the effectiveness of learning on ICT learning media with low discipline and conventional learning media with low discipline. Based on the mean, The effectiveness of the mathematics learning process on ICT learning media with low discipline better than conventional learning media with low discipline.
Hypothesis:

H<sub>0</sub>: µ<sub>1</sub> = µ<sub>2</sub>
H<sub>1</sub>: µ<sub>1</sub> ≠ µ<sub>2</sub>

H<sub>0</sub>: There are similarities in the effectiveness of learning on ICT learning media with low discipline and conventional learning media with low discipline
H<sub>1</sub>: There are differences in the effectiveness of learning on ICT learning media with low discipline and conventional learning media with low discipline

Criteria:
H<sub>0</sub> is rejected and H<sub>1</sub> accepted, if t<sub>count</sub> > t<sub>table</sub>.  
H<sub>0</sub> is accepted and H<sub>1</sub> rejected, if t<sub>count</sub> < t<sub>table</sub>.  

\[ t_{table} = \sqrt{\frac{n_1 + n_2 - 2}{2}} = 28 \times \text{sig level 0.05} = 2.048 \]

Based on the table independent sample test t<sub>count</sub> 1.185 > t<sub>table</sub> 2.048 that is there are similarities in the effectiveness of learning on ICT learning media with low discipline and conventional learning media with low discipline.

4. CONCLUSION

Based on the results of research, hypothesis testing and discussion can be concluded as follows: a) There are differences in the effectiveness of learning on ICT learning media with conventional learning media. Based on the mean, The effectiveness of the mathematics learning process with ICT-based learning media better than conventional learning media. b) There are differences in the effectiveness of learning on higher discipline with low discipline learning. Based on the mean, The effectiveness of the mathematics learning process with higher discipline better than low discipline. c) The use of ICT-based learning media with high discipline increases the effectiveness of the learning process compared to conventional learning media with high discipline.

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AUTHOR’S CONTRIBUTIONS

The author discussed the results and contributed to from the start to final manuscript.

CONFLICT OF INTEREST

There are no conflicts of interest declared by the author.

REFERENCES


