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Research Article

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 experi-ment 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 pro-cess 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 dis-cipline. and 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. (Djamarah 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 profes-sional 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 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 mathematics. 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 Math-ematics 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 under-standing 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 dis-ciplinary 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 class-room. 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 learn-ing 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

Discipline Levels **(B)**	*Treatment Learning Media* **(A)**		**∑ B**
	ICT Based Learning **(A1)**	*Conventional* **(A2)**	
High Level **(B1)**	A1B1	A2B1	∑ B1
Low Level **(B2)**	A1B2	A2B2	∑ B2
∑ A	∑ A1	∑ A2	∑ T

Information:

∑A1 : Effectiveness of learning process in the ICT-based learning model group

∑A2 : Effectiveness of learning process in the conventional learning model group

∑B1 : Effectiveness of learning process on respondents who have high discipline

∑B2 : 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} = Product Moment Correlation Coefficient
$\sum X$ = Total Score Spread of X
$\sum Y$ = Total Score Spread of Y
$\sum XY$ = Multiplication Total Score X and Score Y
$\sum X^2$ = The sum of squares of the X test score
$\sum Y^2$ = The sum of squares of the Y test score
n = 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 2. Description of Data

Descriptive Statistics

Dependent Variable: Efektivitas Belajar

Media Pembelajaran	Kedisiplinan	Mean	Std. Deviation	N
TIK	Tinggi	87.20	8.213	15
	Rendah	70.67	7.355	15
	Total	78.93	11.374	30
Konvensional	Tinggi	73.20	8.793	15
	Rendah	67.13	8.903	15
	Total	70.17	9.225	30
Total	Tinggi	80.20	10.981	30
	Rendah	68.90	8.223	30
	Total	74.55	11.179	60

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 3. Normality Test

One-Sample Kolmogorov-Smirnov Test

		Media Belajar TIK dan Disiplin Tinggi	Media Belajar TIK dan Disiplin Rendah	Media Belajar Konvensional dan Disiplin Tinggi	Media Belajar Konvensional dan Disiplin Rendah
N		15	15	15	15
Normal Parameters[a,b]	Mean	87.20	70.67	73.20	67.13
	Std. Deviation	8.213	7.355	8.793	8.903
Most Extreme Differences	Absolute	.091	.118	.136	.139
	Positive	.091	.106	.077	.077
	Negative	-.078	-.118	-.136	-.139
Kolmogorov-Smirnov Z		.354	.457	.528	.537
Asymp. Sig. (2-tailed)		1.000	.985	.943	.935

a. Test distribution is Normal.

b. Calculated from data.

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

Table 4. Homogeneous Test

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Efektivitas Belajar

F	df1	df2	Sig.
.157	3	56	.925

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + A + B + A * B

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.

Table 5. Hypothesis Test

Tests of Between-Subjects Effects

Dependent Variable: Efektivitas Belajar

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3478.983[a]	3	1159.661	16.678	.000
Intercept	333462.150	1	333462.150	4795.716	.000
A	1152.817	1	1152.817	16.579	.000
B	1915.350	1	1915.350	27.546	.000
A * B	410.817	1	410.817	5.908	.018
Error	3893.867	56	69.533		
Total	340835.000	60			
Corrected Total	7372.850	59			

a. R Squared = .472 (Adjusted R Squared = .444)

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

Hyphotesis 1 : There is a significant effect of the use of instructional media on the effectiveness of the mathematics learning process.
Hyphotesis 2 : There is a significant effect of discipline on the effectiveness mathematics learning process.
Hyphotesis 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

Group Statistics

	Media Pembelajaran	N	Mean	Std. Deviation	Std. Error Mean
Efektivitas Belajar	TIK	30	78.93	11.374	2.077
	Konvensional	30	70.17	9.225	1.684

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Efektivitas Belajar	Equal variances assumed	3.279	58	.002	8.767	2.674	3.414	14.119
	Equal variances not assumed	3.279	55.6	.002	8.767	2.674	3.410	14.124

Hyphotesis:
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} = db = n1 + n2 – 2 = 30 + 30 – 2
= 58 * sig level 0.05 = 2.000

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

Group Statistics

	Kedisiplinan	N	Mean	Std. Deviation	Std. Error Mean
Efektivitas Belajar	Tinggi	30	80.20	10.981	2.005
	Rendah	30	68.90	8.223	1.501

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Efektivitas Belajar	Equal variances assumed	4.512	58	.000	11.300	2.505	6.287	16.313
	Equal variances not assumed	4.512	53.742	.000	11.300	2.505	6.278	16.322

Hyphotesis:
H_0 : $\mu 1 = \mu 2$
H_1 : $\mu 1 \neq \mu 2$
H_0 : There are similarities in the effectiveness of learning on higher discipline with low discipline
H_1 : There are differences in the effectiveness of learning on higher discipline with low discipline
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} = db = n1 + n2 – 2 = 30 + 30 – 2
= 58 * sig level 0.05 = 2.000

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

Group Statistics

	Post Hoc	N	Mean	Std. Deviation	Std. Error Mean
Efektivitas Belajar	A1B1	15	87.20	8.213	2.121
	A2B1	15	73.20	8.793	2.270

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Efektivitas Belajar	Equal variances assumed	4.506	28	.000	14.000	3.107	7.636	20.364
	Equal variances not assumed	4.506	27.9	.000	14.000	3.107	7.635	20.365

Hyphotesis:
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 high discipline and conventional learning media with high discipline
H_1 : There are differences in the effectiveness of learning on ICT learning media with high discipline and conventional learning media with high discipline
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} = db = n1 + n2 – 2 = 15 + 15 – 2
= 28 * 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

Group Statistics

	Post Hoc	N	Mean	Std. Deviation	Std. Error Mean
Efektivitas Belajar	A1B2	15	70.67	7.355	1.899
	A2B2	15	67.13	8.903	2.299

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Efektivitas Belajar	Equal variances assumed	1.185	28	.246	3.533	2.982	-2.574	9.641
	Equal variances not assumed	1.185	27.04	.246	3.533	2.982	-2.584	9.651

Hyphotesis :
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 low discipline and conventional learning media with low discipline
H_1 : There are differences in the effectiveness of learning on ICT learning media with low discipline and conventional learning media with low discipline
Criteria:
H_0 is rejected and H_1 accepted, if $t_{count} > t_{table}$.
H_0 is accepted and H_1 rejected, if $t_{count} < t_{table}$.
$t_{table} = db = n1 + n2 - 2 = 15 + 15 - 2$
$= 28$ * sig level 0.05 = 2.048

Based on the table independent sample test t_{count} 1.185 > t_{table} 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.

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