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# Analysis of Blended Learning Models Using Technology 4.0 to Improve Critical Thinking Skills

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## Abstract

*This study aims to measure the level of effectiveness of applying blended learning-based learning models by utilizing ICT technology (Technology 4.0) to improve students' critical thinking skills in normal news life while maintaining adaptation to the industrial revolution 4.0. This behavior has positioned students to carry out blended learning that is oriented towards the continuous use of technology 4.0. This new habit encourages students to have a competitive level of adaptation in the more complex era of the industrial revolution, and students must also have adaptations with technology to overcome problems that exist in the current era So the researchers made a concern to instill and strengthen the skills and abilities needed by students to face the Industrial Revolution 4.O era in the current era. In discussing this research, Critical thinking skills are selected as skills that are needed by every individual student today, because Critical thinking skills enable students to involve various aspects and tools needed in learning and through a systematic thinking process. Researchers are trying to find a method that is appropriate to the current era, namely blended learning. Blended learning which has been implemented by the educational institution where this research takes place is a collaborative learning method between conventional methods and modern methods (technology 4.O). This method is implemented by implementing several cycles and meeting parts. The methods used and those given in developing critical thinking are combining problem solving methods with video, blogging, YouTube and zoom meeting. Thus, students will learn something different and new in the implementation of their learning. This will spur students to think critically. Thus, students will have optimally developed critical thinking skills and students will be able to adapt quickly to the current era of the industrial revolution 4.0.*

Keywords
effectiveness; 4.o technology; blended learning

## I. Introduction

Technology 4.0 is currently developing rapidly, which has been used in various fields. One of them as a tool in the field of education. According to (Mesterjon & Kom, 2021) in a book entitled " *Theory and Management Concepts of Learning Systems 4.0* " explains that the use of Technology 4.0 in the world of education, especially in learning, will have an impact on empowering teaching and learning processes to become more creative and competitive. The use of technology 4.0 in the learning model also allows teachers to benefit from designing learning models with new innovations at the same time

that can help the teaching and learning process. The use of technology in the 4.0 era in learning is a necessity, including digital simulation learning.

From some of the expert explanations above, the researcher draws the perception that the learning environment in the blended learning model can be used separately because it uses a combination of different media and methods and is used for different needs of the audience (students), so researchers need to measure the level of effectiveness of the type of face. to face learning that occurs in a teacher-directed environment with person-to-person interactions in live synchronous and high-fidelity environments.

## II. Research Methods

In completing this study, researchers used the Term Frequency (Weighting) method which is a method for calculating the weight of each term in the text, as well as in the learning process researchers used the demonstration learning model So researchers to find the level of effectiveness of the Blended learning learning system. With technology 4.0, researchers use this method, each term is assumed to have an importance value that is proportional to the number of occurrences of that term in the text. The weight of a term t in a text d is formulated in the equation: W(d,t) = TF(d,t), If term frequency focuses on the occurrence of terms in a text, Inverse Document Frequency (IDF) focuses on the occurrence of terms in the entire collection text. In IDF, terms that rarely appear in the entire term collection are considered more valuable. The importance value of each term is assumed to be inversely proportional to the amount of text containing that term. The IDF value of a term t is formulated in the equation: IDF (t) = Log ( N/(df(t))). IDF can improve the precision value, because it focuses specifically on a term in the entire document. This research has combined TF and IDF to calculate term weights and shows that the combination of the two results performance that allows for further analysis.

The hypothesis in this study are: (1). There is the effectiveness of the demonstration learning method that integrates the Blended learning 4.0 model to improve students' critical thinking skills in learning evaluation classes (2). There is no effectiveness of the demonstration learning method that integrates the Blended learning 4.0 model to improve students' critical thinking skills in learning evaluation lessons. There are 3 indicators in the data collection process that researchers do, namely observation, questionnaires and documentation. These indicators are measured using the t-test or t-test and observation sheets. This study involved students participating in learning evaluation lectures as a sample. The data in this study were obtained through a questionnaire instrument and multiplechoice question sheets to obtain the data the researcher needed.

## III. Discussion

### 3.1 Results

From the findings of this study, it was found that learning using the demonstration method integrated the Blended learning 4.0 model after being analyzed that it was found that there was a fairly high level of effectiveness, so that there was an impact on positive changes and an increase in students' critical thinking skills in normal news life in the Learning Evaluation class, as shown in the test results data in the following table:

**Table 1.** Tests of Normality

| Normality | Kolmogorov- Smirnov[2] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | **Statistics** | **'df1** | **Sig** | **Statistics** | **'df2** | **Sig.** |
| *Pretest.* Dw | 0.173 | Xyy | 0.203 | 0.926 | Xyy | 0.359 |
| *PostTest.* Dw | 0.173 | Xyy | 0.203 | 0.971 | Xyy | 0892 |
| *Pretest.* Dw.j | 0.283 | Xyy | 0.015 | 0.883 | Xyy | 0.111 |
| *PostTest.* Dw.j | 0.285 | Xyy | 0.015 | 0879 | Xyy | 0.098 |

Table in above presented that the normality test of learning outcomes data with the demonstration method that integrates the Blended learning 4.0 *(PreTest Dw) model* on students' critical thinking abilities *(PostTest Dw)* using the *Kolmogorov Smirnov test.* From the table it is known that the p value (Sig.) of the observation questionnaire for data (PreTest Dw.j) is 0.203 , while the p *value* (Sig.) of the multiplechoice questions ***(PreTest** Dw.j)* is 0.015 Meanwhile, the p value (Sig.) of the observation questionnaire *(PostTest Dw.)* was 0.203 , while the pvalue (Sig.) of the multiplechoice questions ***(**PostTest Dw.j)* was 0.098 . From these results p value is obtained > 0.05 then the data is the test result *(PreTest* and *PostTest)* can be perceived as having an n normal distribution. (a). from the test results homogeneity This it is known that from the weighting and grouping of data it has variant Which The same. And the test results also illustrate that the data set Which researched have characteristics Which The same. This homogeneity test explains that the data displayed has criteria for value effectiveness interpretation, that is value: 1). sign > 0.05 = variation data is homogeneous. 2). sign < 0.05 = data variation is heterogeneous.

**Table 2.** Tests of Homogeneity of Variances Dw_1

| Mark | Levane Statistics | 'df1 | 'df2 | Sig. |
|---|---|---|---|---|
| *Based on Means* | 0.019 | 1 | 21 | 0.996 |
| *Based on Median* | 0.031 | 1 | 21 | 0966 |
| *Based on Median and with adjusted df* | 0.031 | 1 | 20,054 | 0966 |
| *Based on trimmed mean* | 0.015 | 1 | 21 | 0.908 |

From the *Based on Mean, Based on Median, Based on Median and with adjusted df and Based on trimmed mean values* in the table below above explains that the *output value of the Homogeneity of Variances* Dw_1 test is the data obtained from the questionnaire *(Pre - Test)* as well as the learning outcome data using the demonstration method which integrates the Blended learning model on students' critical thinking skills *(PostTest*). It can be perceived that *the Levene* test (test F) with the acquisition of a p value of 0.908. So from the exposure of the results it was found that the *p value* was greater than (> 0.05) so it could be classified as having a homogeneous distribution.

**Table 3.** Results of Tests of Homogeneity of Variances Dw.j

| Mark | Levane Statistics | 'df1 | 'df2 | Sig. |
|---|---|---|---|---|
| *Based on Means* | 0.033 | 1 | 21 | 0969 |
| *Based on Median* | 0.000 | 1 | 21 | 1,001 |
| *Based on Median and with adjusted df* | 0.000 | 1 | 19,827 | 1,001 |
| *Based on trimmed mean* | 0.021 | 1 | 21 | 910 |

From the test data table obtained from multiplechoice (Dw.j) values *Based on Mean, Based on Median, Based on Median and with adjusted df and Based on trimmed mean it is* known that the learning outcomes of students who are taught by conventional methods *(PreT est)* and data on student learning outcomes taught by demonstration methods that integrate the Blended learning model *(PostTest*) using the *Levene Test* (F test) obtained a p value of 0.96 9. So it can be seen that from the two F tests above, the value of p> 0.05 is obtained, so the data can be declared homogeneous.

**Table 4.** Output results of the Paired Samples Statistics t-test

| | Questionnaire Instrument | Means | N | std. Deviation | Std Error Means |
|---|---|---|---|---|---|
| Pair 1 | Pretest | 21.19 | Xyz | 3,198 | 0.741 |
| | Posttest | 34.28 | Xyz | 3,296 | 0.773 |

Table in above describes the average value (*mean*) and the standard deviation value (*Std. Deviation*) for student learning outcomes **taught by the** demonstration method that integrates the Blended learning *model (pre - test)* and the results of students' critical thinking abilities *(Posttest).* From the table it is known that the values obtained from the observation questionnaire with an average value (*mean)* of 21.19 and a standard deviation value (*Std. Deviation*) of 3.198 for the results of students' critical thinking skills (*pre - test),* in obtain an average value (*mean*) of 34.28 and a standard deviation value (*Std. Deviation*) of 3,296.

**Table 5.** Output results of the Paired Samples Statistics t-test

| | Questionnaire Instrument | Means | N | std. Deviation | Std Error Means |
|---|---|---|---|---|---|
| Pair 1 | Pretest | 3.66 | Xyz | 2,325 | 0.477 |
| | Posttest | 8.84 | Xyz | 2.215 | 0.444 |

Table above shows the values obtained from multiplechoice with an average value *(mean*) *of* 2.55 and a standard deviation value (*Std. Deviation*) of 1.2 14 for student learning outcomes **with the demonstration** method which integrates the Blended learning model (*pre - test),* while the mean value (mean*)* is 8.84 and the standard deviation value (*Std. Deviation*) is *2.215* for students' critical thinking abilities *(post-test).*

**Table 6.** Results of *Paired Samples Correlations*

| Questionnaire Instrument | N | Correlation | Significance | |
|---|---|---|---|---|
| | | | One-Sided p | Two-Sided p |
| Pre Test & PostTest | Xyz | 0.959 | < 001 | < 001 |

Table in above illustrates the results of the average difference test between student learning outcomes **taught by the method** demonstration that integrates the Blended learning model *(PreTest)* and students' critical thinking skills *(PostTest)* by using the *independent samples t- testTest. Independent samples t- test* test *is* used because the data *(PreTest)* and *(PostTest)* normally distributed. From the table it is known that the value of the independent samples t-t test (*t)* for data obtained from the questionnaire instrument is 0.959 with a p-value of 0.00 1.

**Table 7.** Results of *Paired Samples Correlations*

| Multiplechoice instrument | N | Correlation | Significance | |
|---|---|---|---|---|
| | | | One-Sided p | Two-Sided p |
| Pre Test & PostTest | Xyz | 0.954 | < 001 | < 001 |

In the table above the data obtained by multiplechoice shows a value of 0.954 with a p value of 0.00 1. Because p value <0.05 then it is said that there is an average difference between the learning outcomes of students **who are taught by the method** demonstration that integrates the Blended learning model *(PreTest)* and the results of students' critical thinking abilities *(PostTest)*

**Table 8.** Paired Samples Test Results

| Means | Instrument Data Dw | | | | Q | Df | Significance | |
|---|---|---|---|---|---|---|---|---|
| | Std Deviation | Std Error Means | Confidence Intervals of the Difference | | | | One Sided p | Two Sided p |
| | | | Lower | Upper | | | | |
| -14,092 | 0.802 | 0.322 | 14,673 | 13,730 | 72,989 | 51 | < 001 | < 001 |

Table in above describes the results of the average difference test between student learning outcomes with the demonstration method that integrates the Blended learning model *(pre-test)* and the results of students' critical thinking abilities *(post-test).* by using the *paired samples t-test test.* From the table it is known that the standard deviation (*Std. Deviation*) for the questionnaire instrument data is 0.802 with a p value greater than 0.0 01.

**Table 9.** Paired Samples Test Results

| Means | Instrument Data Dwj | | | | Q | Df | Significance | |
|---|---|---|---|---|---|---|---|---|
| | Std Deviation | Std Error Means | Confidence Intervals of the Difference | | | | One Sided p | Two Sided p |
| | | | Lower | Upper | | | | |
| -6,293 | 0.506 | 0.233 | 0.6.565 | 0.5.913 | 42,596 | 56 | < 001 | < 001 |

From the multiplechoice table above it is known that the standard deviation value of the Dw.j instrument (*Std. Deviation*) is 0.506 with a p value of 0.0 01 . Because the value of the questionnaire instrument data and multiplechoice questions is p <0.05, it is said that there is an average difference between student learning outcomes with the demonstration method which integrates the Blended learning model ***(pre-test)*** **as well** students' critical thinking skills *(post-test)* are more effective.

### 3.2 Discussion

From the results of testing the data hypothesis in this study, the discussion in this study can be described in more detail. From the hypothesis that has been analyzed, there is a tendency that there is effectiveness between the use of demonstration learning methods that integrate the Blended learning model to increase students' critical thinking abilities. The difference in the data is indicated by the average value of student learning outcomes (PostTest) for the questionnaire instrument score of 44.38, and the value of

multiplechoice questions of 8.8473. As for the results, the average value taught by the demonstration method (pre-test) for the questionnaire instrument was 22.29 and the value for multiplechoice questions was 3.66. Student learning outcomes in the learning evaluation class using the observation questionnaire instrument in the pre-test with a number of student samples in the medium category with a percentage of 53.6% - 68.6%, in the post-test there are a number of student samples in the sufficient category with a percentage of 76.06% - 78.52%, there are a number of samples that are in the high category with a percentage of 83.34% - 93.54%. Meanwhile, some data samples using the multiplechoice question instrument on the Pre-Test got a very low category with a percentage of 10.05 – 13.07%, and some samples got a low category with a percentage of 21.09% - 32.08%, and some samples got an adequate category with a percentage of 41.09% - 52.07% and in the PostTest some samples got the moderate category with a percentage of 63.04% - 72.07% and there were some samples got the high category with a percentage of 83.07% - 92.09%. In the students' critical thinking skills (PreTest), the samples were jointly given a questionnaire instrument and multiplechoice questions. From the total sample studied, the questionnaire instrument and the multiplechoice instrument with the perception that there was an appropriate level of student knowledge. Likewise in the use of the demonstration method that integrates the Blended learning model (PostTest). A number of samples were again given questionnaire instruments and multiplechoice questions with the results showing students' critical thinking abilities (PreTest) previously. This can happen because in the use of the demonstration method which integrates the Blended learning model students can directly see and be involved in the learning process. This is in line with Arikunto's statement (2016: 197) the demonstration method is a way of delivering material by demonstrating a process or activity, this is also in line with the opinion expressed by Mesterjon (2021) Mesterjon (2021) defines blended learning as a learning environment that designed by integrating face-to-face learning with online learning which aims to improve student learning outcomes. This method is very effectively applied to show the process of an activity. From the test data that has been analyzed, it shows that the research results have been tested and analyzed using measurable methods so that this research produces one of which is "the influence of the demonstration learning method that integrates the Blended learning model on Student Learning Outcomes. Which states that the method applied to this learning evaluation class has been able to influence the results of students' critical thinking abilities significantly.

## IV. Conclusion

Based on the results of the research analysis, it can be concluded that the demonstration learning method integrates the Blended learning 4.0 model, on students' critical thinking abilities in the learning evaluation class. From the results it can be stated that the research was carried out by sampling trials from a number of populations, the results obtained were that a number of students received an adequate category rating with a percentage of 63.08% - 71.21% and there were a number of students who received a high category rating with a percentage of 81.57% - 91.09%. So that from the results of the percentage of assessment results that have been analyzed in this study, it can be concluded that the application of a demonstration learning model that integrates the Blended learning 4.0 model, has had an effective impact on students' critical thinking abilities in the learning evaluation class.

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