The Effect Of Online Learning On The Interest And Learning Outcomes Of Basic Chemistry Of Civil Engineering Students

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Abstract

Online learning is very effective and efficient during the current Covid-19 pandemic. Through this online learning, students can still carry out lectures without having to face to face with the lecturer. The purpose of this study was to determine the effect of online learning on the interest and learning outcomes of Basic Chemistry students of the Civil Engineering Study Program. The research samples were first semester students of the Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021 who took online learning during the Covid-19 pandemic, with a total of 40 respondents. The research method used to determine the effect of online learning on students' interest and learning outcomes was carried out using qualitative and quantitative research methods. Based on the Pearson Product Moment Correlation test, $r_{count} > r_{table}$ or 4.401 > 0.2573 which means that H_1 is accepted and H_o is rejected. So that online learning has an effect on interest in learning Basic Chemistry for first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021. Based on the t-test conducted, it is found that $t_{count} \geq t_{table}$ is 6.22 ≥ 2.023, which means H_o is rejected or H_1 is accepted. Thus, online learning also affects the learning outcomes of Basic Chemistry of first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021.

Keywords: online, interest, learning outcomes, face-to-face

INTRODUCTION

The Covid-19 pandemic has forced all educational units to carry out learning activities that are usually face-to-face into online learning. Not only in Indonesia, but all countries in the world are also implementing this online system (Diva et al., 2021). This is a challenge for the world of education, especially universities to continue to carry out learning activities by complying with health protocols. Lecturers as educators must also be responsible for developing the Tri Dharma of Higher Education so that the target is achieved to deliver teaching assignments, where courses must be completed according to the specified time (Siahaan, 2020). So that many lecturers carry out online learning.

Online learning is the use of the internet network in the learning process (Nugraha et al., 2019). Utilization of an online learning system is one of the efforts that can be made to overcome problems and make it easier for students to access lecture material. Thus, the thing that can be done during online learning is to communicate with each other and discuss online (Anugrahana, 2020).

Online learning has many benefits for lecturers and students. The advantages of the online learning process include being economical, easily accessible, efficient, interactive and collaborative, consistent, flexible, creative and independent (Nugraha et al., 2020). Thus, online learning is very effective and efficient during the current Covid-19 pandemic. Through this online learning, students can still carry out lectures without having to face to face with the lecturer. This is aimed at reducing the chain of spread of the Covid-19 pandemic that is currently hitting Indonesia.

Apart from having advantages, online learning also has some disadvantages. Based on research conducted by Nengrum et al. (2021), online learning makes students ineffective in participating in the learning process, the provision of material is not effective and not all students have good internet access if they are outside the city. However, the disadvantages of online learning can be minimized depending on the interests of students who want to take part in the learning.

According to Damayanti and Jirana (2018), ineffective material delivery makes students bored quickly in attending lectures so that learning interest becomes less which has an impact on low learning outcomes. In online learning, lecturers are required to be creative in carrying out the learning process with the aim of creating a pleasant learning atmosphere for students. In addition, online learning is sought to increase student interest and learning outcomes (Azizah, 2019).

In this study, online learning will be applied to Basic Chemistry learning which is one of the courses that must be passed by first semester students of the Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan. This course has a weight of 2 (two) credits with the course code UNV-1602. The materials studied in this course include Stoichiometry, Solution Concentration, Chemical Equilibrium, Acid-Base and Salt, Solubility and Solubility Product and Hydrolysis. In this research, the study will focus on Acid-Base and Salt materials because these materials are considered as materials that are very closely related to everyday life.

Therefore, the author wants to research about "The Influence of Online Learning on Interests and Learning Outcomes of Basic Chemistry Students of Civil Engineering Study Program". This study aims to determine the effect of online learning on the interest and learning outcomes of Basic Chemistry students of the Civil Engineering Study Program. The author hopes that through the results of this research, online learning can be applied to other courses, especially during the current Covid-19 pandemic.

RESEARCH METHODS

Determining the Effect of Online Learning on Students' Interest in Learning

The research method used to determine the effect of online learning on student interest in learning is carried out by qualitative and quantitative research methods. Qualitative research is a descriptive research and tends to use analysis. The characteristics of qualitative research are conducting research in natural conditions, directly to the data source, the researcher being the key instrument, presenting data in the form of words or pictures and not emphasizing numbers, conducting data analysis. This qualitative research method is not manipulated by the researcher, the data analysis is based on the facts found in the field. While quantitative research is research based on numbers (statistical tests) (Yunitasari and Hanifah, 2020).

The source of the data taken by the researcher is the result of student assessment through a questionnaire that is distributed, filled out and collected directly during the Final Semester Examination for the Basic Chemistry course, Academic Year 2020/2021. The research sample was first semester students of the Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021 who took online learning during the Covid-19 pandemic, with a total of 40 respondents. To check the validity of the research, the researcher used reference techniques obtained during the study such as research journals and respondents' answers. It aims to test and correct the results of research that has been done.

In qualitative research, descriptive analysis is carried out or describes the variables in the study. The variables described are online learning and interest in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan. Meanwhile, in quantitative research, inferential analysis (statistical test) was conducted. Before conducting the correlational test (hypothesis testing), statistical prerequisite tests were first carried out, which included: normality test, homogeneity test and linearity test.

Normality test

The normality test was performed with the chi-square statistic (X^2). The test criteria to determine the normality of the data distribution is the provision that the magnitude of $X^2_{count} < X^2_{table}$ with degrees of freedom dk = k − 3 and significance level (α) = 0.05. The steps taken in the normality test with chi-square statistics are as follows:

1) Formulate a hypothesis
   H_o = data normally distributed
   H_1 = data is not normally distributed
2) Determining the value of statistical test
   $$\boldsymbol{X^2}_{hitung} = \sum\left(\frac{(O_i \ - \ E_i)^2}{E_i}\right)$$
3) Determine the real level (α)
   To get the value of X^2_{table} used the formula: $X^2_{table} = X_2 (1-α) (dk)$
4) Determining hypothesis testing criteria
   H_o is rejected if $X^2_{count} \geq X^2_{table}$
   H_o is accepted if $X^2_{count} < X^2_{table}$
5) Drawing conclusions (Arikunto, 2016).

Homogeneity test

Data homogeneity test aims to see the level of homogeneity of a data. The homogeneity of variance test was carried out using the F test. The test criteria to determine the homogeneity of variance were $-F_{table\ left} < F_{count} < +F_{table\ right}$ with a significance level of 0.05. The steps taken in the homogeneity test with the F test are as follows:

1) Formulate a hypothesis
   $H_o = ɓ^2_1 = ɓ^2_2$ (all populations have the same/homogeneous variance)
   $H_1 = ɓ^2_1 \neq ɓ^2_2$ (there is a population that has a different/non-homogeneous variance)
2) Calculate the value of the variance/standard deviation of variables X and Y with the formula:
   $$S^2_x = \sqrt{\frac{n \sum X^2 - (\sum X)^2}{n(n-1)}}$$
   $$S^2_y = \sqrt{\frac{n \sum Y^2 - (\sum Y)^2}{n(n-1)}}$$
3) Find F_{count} of variance X and Y with the formula:
   $$F_{count} = \frac{S_{big}}{S_{small}}$$
4) Find the $F_{right\ table}$ with the formula:
   $F_{right\ table} = F1/2α$ (dk smallest variance − 1, dk biggest variance − 1)
5) Find the $F_{left\ table}$ with the formula:
   $F_{left\ table} = 1/F\_({original\ table})$
6) Determining hypothesis testing criteria
   H_o is rejected if $F_{count} > F_{table}$
   H_o is accepted if $F_{count} < F_{table}$

7) Draw conclusions (Arikunto, 2016).

Linearity test

The linearity test of the data aims to determine the linear relationship between one variable and another. The linearity test was carried out using the F test. The test criteria to determine the linearity of the data were $F_{count} < F_{table}$ with a significance level of 0.05. The steps taken in the linearity test with the F test are as follows:

1) Formulate a hypothesis
   H_o = data presented linear
   H_1 = data presented is not linear
2) Determine the price of JKreg a with the formula:
   JKreg a = $(\frac{(\sum Y)^2}{n})$
3) Determine the price of JKreg b/a with the formula:
   JKreg b/a = $[b(\sum XY - (\frac{\sum X \ \sum Y}{n}))]$
4) Determine the price of JKres with the formula:
   JKres = $\sum Y^2$ - $JK_{reg \ b/a}$ - $JK_{reg \ a}$
5) Determine the price of RJKres with the formula:
   RJKres = $\frac{JK_{res}}{n-2}$
6) Determine the JKE price with the formula:
   JKE = $[K(\sum Y^2 - (\frac{(\sum Y)^2}{n}))]$
7) Determine the price of JKTC with the formula:
   JKTC = JKres - JKE
8) Determine the price of RJKTC with the formula:
   RJKTC = $\frac{JK_{TC}}{k-2}$
9) Determine the price of RJKE with the formula:
   $RJK_E = \frac{JK_E}{n-k}$
10) Determine the price of Fcount with the formula:
    $F_{count} = \frac{RJK_{TC}}{RJK_E}$
11) Determining the level of significance
12) Determine the price of F_{table} with the formula:
    F(df1,df2) = F(k-1, n-k)
13) Determining hypothesis testing criteria
    H_o is rejected if $F_{count} > F_{table}$
    H_o is accepted if $F_{count} < F_{table}$
14) Drawing conclusions (Ananda and Fadhli, 2018).

After performing the statistical prerequisite test, then the hypothesis test can be carried out. Test the hypothesis with the Pearson Product Moment correlation. To test the hypothesis used r-test statistics as follows:

$r_{xy} = \frac{\sum XY}{\sqrt{\sum X^2 \ Y^2}}$

Description: $r_{xy} = r_{count}$
          X = variable X
          Y = variable Y

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The test criteria for this statistical analysis are $r_{count} > r_{table}$ with a significance level of 0.05, which means H_1 is accepted and H_0 is rejected (Ananda and Fadhli, 2018). The research hypothesis is as follows:

H_1 = there is an influence of online learning on the learning outcomes of Basic Chemistry in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021.

H_o = There is no effect of online learning on the learning outcomes of Basic Chemistry in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021.

Determining the Effect of Online Learning on Student Learning Outcomes

The research method used to determine the effect of online learning on student learning outcomes is carried out by quantitative research methods. This study uses a quantitative approach. The quantitative approach is one of the scientific inquiry efforts based on the philosophy of logical positivism which operates with strict rules regarding logic, truth, laws and predictions. This research is a type of quasi-experimental research. This is because there are still external variables that also influence the formation of the dependent variable.

Population is a generalization area consisting of objects/subjects that have certain qualities and characteristics determined by the researcher to be studied and then draw conclusions. The sample is part of the population that is sufficiently represented to be used as a data source. For sampling, the researcher used purposive sampling technique. Purposive sampling is a sampling technique with certain considerations (Rahmatia et al., 2017). Thus, the sample in this study was first semester students of Civil Engineering Study Program, Academic Year 2020/2021 who took online learning during the Covid-19 pandemic, with a total of 40 respondents.

The technique used in this research data collection is the test. The test is a measurement method in which there are various questions, or a series of tasks that must be done or answered by the respondent. The data in the research that has been collected, then processed using the appropriate statistics, the test is intended to meet the requirements of the t-test on the hypothesis. Data processing activities begin by tabulating the collected data into a frequency distribution list, with the following steps:

1) Create a frequency distribution table with the same class length, then first specified:
   a. Range, which is the largest data minus the smallest data.
   b. The number of required interval classes, for that using Sturges rule, namely: many classes = 1 + (3,3) log n.
   c. Interval class length (p).
      P = range/(many classes)
   d. The lower end of the first interval, for this it can be chosen, is equal to the smallest data or data value smaller than the smallest data, but the difference must be less than the specified class length.
2) Average and standard deviation for data that has been compiled in a frequency list, the average value or mean (M) is calculated using the formula:

   Mean (M) = $\dfrac{\sum fi.xi}{\sum fi}$

   Description: M = Mean (average value)
   fi = i-th data frequency
   xi = i-th data

   While the formula to find the standard deviation is:

SD (Standard deviation) $= \sqrt{\dfrac{n\Sigma fi.xi^2 - (\sum fi.xi)^2}{n(n-1)}}$

Description: M = Mean (average value)

SD = Standard Deviation

  xi = i-th data

  fi = i-th data frequency

  n = number of samples (Nuryadi et al., 2017)

  To test the hypothesis, the following t-test statistics were used: $t = \dfrac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$

Description: x = the average value of students in the experimental method

  μ_0 = the minimum standard value is 60.00

  s = standard deviation

  n = sample in the experimental method

  The criteria for testing the hypothesis of the t-test are to reject H_o if $t \geq t_{1-\alpha}$ and accept H_o if t is different. The degrees of freedom for the t distribution list are dk = (n-1) and the significance level is = 0.05. To test the hypothesis, a right-hand side test whose partner:

H_o: μ = μ_0 → H_0 : μ = 60.00

H_1: μ > μ_0 → H_1 : μ > 60.00 (Ananda and Fadhli, 2018).

  The formulation of the H_o hypothesis and the H_1 hypothesis are as follows:

H_o = There is no effect of online learning on the learning outcomes of Basic Chemistry in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021.

H_1 = There is an effect of online learning on the learning outcomes of Basic Chemistry in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021.

RESULTS AND DISCUSSION

The Effect of Online Learning on Students' Interest in Learning

  Questionnaire of interest in learning for first semester students in the Basic Chemistry course of Civil Engineering Study Program, Graha NusantaraUniversity, Padangsidimpuan, Academic Year 2020/2021, obtained the frequency distribution in Table 1 below:

Table 1. Statistics of Questionnaire Results Interest to learn

Statistic	Interest Questionnaire Results
Statistics Sample Size	40
Mean	73.875
Median	75.00
Mode	70.00
Standard Deviation	11.59
Lowest Score	50.00
Highest Score	95.00

  Based on Table 1 above, it shows that the results of the student learning interest questionnaire given to 40 respondents obtained a mean value of 73.875, a median of 75.00 and a mode of 70.00. Based on the results of the statistical analysis of the student interest in learning questionnaire in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021 in the Basic Chemistry

course with an average score in the good category. The data from the questionnaire are presented in Figure 1 below:
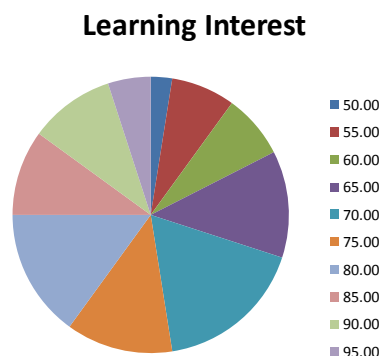

Figure 1. Learning Interest Bar Chart

Based on the data above, the results of the questionnaire on student interest in learning in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021 in Basic Chemistry courses with the lowest score of 50.00, the highest score of 95.00 and an average score of 73.875 . Thus, online-based learning for Basic Chemistry courses for first semester students of the Civil Engineering Study Program at Graha Nusantara University, Padangsidimpuan,Academic Year 2020/2021 is in the good category (Jusmawati et al., 2020).

The results of inferential statistical analysis showed that the results of the normality test using chi-square statistics (X^2) with degrees of freedom dk = k – 3 = 7 and a significance level (α) = 0.05 indicating that $X^2_{count} < X^2_{table}$ or 3.662 < 14.067. This means that the data comes from a normally distributed population. Briefly, the summary of the results of the data normality test is shown in Table 2 below:

Table 2. Data Normality Test

Method	X^2_{count}	X^2_{table}	α	Conclusion
Online	3.662	14.067	0.05	Normal

The results of the homogeneity test with the F test and a significance level of 0.05 showed that $-F_{table\ left} < F_{count} < +F_{table\ right}$ or -0.377 < 0.651 < +2.650. Thus, the data comes from a homogeneous sample. Briefly, a summary of the results of the data homogeneity test is shown in Table 3 below:

Table 3. Data Homogeneity Test

Method	F_{count}	$F_{left\ table}$	$F_{right\ table}$	α	Conclusion
Online	0.651	-0.377	2.650	0.05	Homogeneous

The results of the linearity test with the F test and a significance level of 0.05 showed that $F_{count} < F_{table}$ or -3.326 < 3.287. Thus, the data from each variable has a good relationship/linearity. Briefly, a summary of the results of the linearity test of the data is shown in Table 4 below:

Table 4. Data Linearity Test

Method	F_{count}	F_{table}	α	Conclusion
Daring (Online)	-3.326	3.287	0.05	Linear

After testing the hypothesis with the test criteria obtained, reject H_o and accept H_1 if $r_{count} > r_{table}$. Then the r-test statistic is used whose formula is:

$$r_{xy} = \frac{\sum XY}{\sqrt{\sum X^2 \quad Y^2}}$$

Where the value of $\sum XY = 108{,}225$; $\sum X^2 = 106{,}850$ dan $\sum Y^2 = 116{,}825$.

So, the value of $r_{xy} = 4.401$ and r_{table} at a significance level of 0.05 and the number of samples 40 is 0.2573. Thus, the results of hypothesis testing with the Pearson Product Moment correlation test and a significance level of 0.05 and n = 40 indicate that $r_{count} > r_{table}$ or 4.401 > 0.2573. This means that H_1 is accepted and H_o is rejected. Finally, the results of this study conclude that there is an effect of online learning on interest in learning Basic Chemistry for first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021. Briefly, the results of the data hypothesis test are shown in Table 5 below:

Table 5. Hypothesis Testing Data

Method	r_{count}	r_{table}	α	Conclusion
Online	4.401	0.2573	0.05	H_1 accepted H_0 rejected

The Effect of Online Learning on Student Learning Outcomes

The results of the Basic Chemistry test for first semester students of the Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021 on Acid-Base and Salt materials show different results for each day. The average value of the Basic Chemistry test results for first semester students of Civil Engineering Study Program at Graha Nusantara University, Padangsidimpuan , Academic Year 2020/2021 is 72.25. The maximum value obtained is 95.00 and the minimum value obtained is 50.00. To identify the completeness of student learning outcomes, measurements were made using the minimum standard value reference, which is 60.00 for Basic Chemistry courses.

From the data obtained, it is known that from 40 students who took the test, 33 students were declared to be able to master the Acid-Base and Salt material through online learning with indicators that they succeeded in obtaining a score of more than or equal to the minimum standard score for Basic Chemistry courses is 60.00. If it is a percentage, then the number of students who are successful in online learning is 82.50%. Meanwhile, 7 other students were declared unsuccessful or still having difficulties in learning Acid-Base and Salt because they obtained scores below the minimum standard value for Basic Chemistry courses, which is 60.00. If it is a percentage, then the number of students who have not succeeded in online learning is 17.50%. To make a frequency distribution table of the required student scores, it is calculated using the mean and standard deviation of 72.25 and 12.45. The hypothesis test used is a t-test at a significance level of 5% (α = 0.05) and uses a minimum standard value (μ_0) = 60.00, which is the standard value to state that students have mastered 60% of the learning objectives in accordance with the right-hand one-sided test rule, as stated by Ananda and Fadhli (2018). The formulation of the hypothesis as follows:

H_o : μ = 60.00 (Online learning does not achieve complete Basic Chemistry learning outcomes for first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021).

H_1 : μ > 60.00 (Online learning achieves complete Basic Chemistry learning outcomes for first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021).

The test criteria obtained reject H_o if $t \geq t_{1-\alpha}$ and accept H_o if t has another value. Then the t-test statistic is used whose formula is:

$$t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

Where the value : x = 72.25; μ_0 = minimum standard value that is 60.00; s = 12.45; n = 40, then the value of t is: $t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$

$$= \frac{72.25 - 60.00}{\frac{12.45}{\sqrt{40}}}$$

$$= \frac{12.25}{\frac{12.45}{6.32}}$$

$$= \frac{12.25}{1.9681}$$

$$t = 6.22.$$

At the significance level = 5% and dk = n-1 = 40–1 = 39, then with the t distribution with $t_{1-\alpha}$ (dk) = $t_{1-0.05}$ (39) = $t_{0.95}$ (39) so we get $t_{0.95}$ (39) = 2.023. Because $t_{count} \geq t_{table}$ is 6.22 $\geq$ 2.023. Thus H_o is rejected or H_1 is accepted, so the results of this study state that there is an effect of online learning on the learning outcomes of Basic Chemistry in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021.

CONCLUSION

Based on the research results obtained, it can be concluded that the results of hypothesis testing with the Pearson Product Moment correlation test using a significance level of 0.05 and n = 40 indicate that $r_{count} > r_{table}$ or 4.401 > 0.2573. This means that H_1 is accepted and H_o is rejected. So that online learning has an effect on interest in learning Basic Chemistry for first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021. Meanwhile, the results of hypothesis testing with t-test using a significance level of 0.05 and dk = 39 indicate that $t_{count} \geq t_{table}$ or 6.22 $\geq$ 2.023. This means that H_o is rejected or H_1 is accepted. So that online learning affects the learning outcomes of Basic Chemistry for first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021. Thus, online learning has an effect on interest and learning outcomes of Basic Chemistry in first semester students of Civil Engineering Study Program, Graha Nusantara University, Padangsidimpuan, Academic Year 2020/2021

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