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Teaching Web Programming in an Undergraduate Course Using Web Learning Media

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Abstract

Web programming is an extremely important key skill for students in the information technology field, and effective teaching methods are essential to ensure in-depth understanding and optimal use. This study investigates the effectiveness of using web learning media in teaching web programming at the undergraduate level. This research involved student participants from several information technology study programs at universities. Participants will be divided into two groups, namely the experimental group which will receive web programming instruction using interactive web learning media, and the control group which will receive conventional instruction using textbooks and lectures. Data will be collected through initial tests before teaching begins, final tests after teaching is completed, as well as questionnaires and interviews to collect responses and experiences from participants regarding the use of web learning media. The results of the two groups will be analyzed comparatively to measure the level of understanding of web programming concepts, practical skills, and the level of student engagement and satisfaction. This research shows that teaching web programming using web learning media can significantly improve students' understanding and skills compared to conventional teaching methods. This research provides valuable insights for curriculum development and teaching strategies at the undergraduate level in the field of information technology, as well as providing a foundation for the use of web learning media in higher education contexts.

Keywords: Undergraduate Course, Web Programming, Web learning media

INTRODUCTION

Teaching web programming is an integral component in the curriculum of information technology undergraduate programs. Technological advances and the development of the digital industry have demanded an increase in the quality of teaching web programming so that students can have competencies that are relevant to the needs of the job market (Cabada et al., 2018; J R Batmetan, 2018). Amid the rapid development of information technology, traditional teaching methods such as lectures and textbooks may no longer be completely adequate to face increasingly complex and dynamic learning challenges (Batmetan et al., 2023). Web learning media are an attractive solution for presenting web programming material

interactively and creatively. With various interactive elements, video tutorials, animations, and other multimedia resources, web learning media can present web programming material in a more interesting and easy-to-understand way (López-Soler et al., 2023). By using this media, it is hoped that students will be more motivated and involved in the learning process, thereby strengthening their understanding of web programming concepts.

Teaching web programming in undergraduate courses using web learning media is an interesting and relevant research topic in the field of information technology education (Islam et al., 2023). To investigate the effectiveness of this teaching method, the research problem that can be identified is the Effectiveness of Web Learning Media, namely, what is the level of effectiveness of the use of web learning media in teaching web programming to undergraduate students (Yilmaz & Karaoglan Yilmaz, 2023)? Can the use of web learning media improve students' understanding of web programming concepts significantly compared to conventional teaching methods? Apart from that, student motivation and involvement were identified as one of the problems, namely How does the use of web learning media influence student motivation and involvement in learning web programming (Lamonge & Baua, 2023)? Can web learning media increase student interest and participation in the learning process? The next problem is the influence of independent learning abilities, namely how do students' independent learning abilities influence learning outcomes when using web learning media? Do students who have good independent learning abilities tend to be more successful in utilizing web learning media? Next is the Comparison of Learning Outcomes, namely How do the learning outcomes compare between the group of students who took web programming, teaching using web learning media, and the group who took conventional teaching? Are there significant differences in the understanding and skills achieved by the two groups (Nwaesei et al., 2023)? Next is the Evaluation and Development of Learning Materials, namely How can the evaluation and development of learning materials based on web learning media be carried out effectively (Tsai et al., 2023)? How to organize learning materials that suit the needs and characteristics of students in web programming courses? However, the use of web learning media in teaching web programming at the undergraduate level has not been fully investigated in depth. Several previous studies have shown the potential of web learning media in improving learning outcomes and student engagement (Batmetan et al., 2022; Ho et al., 2023; Tsai et al., 2023). However, more in-depth research is still needed to evaluate the effectiveness of using web learning media, specifically in the context of teaching web programming at the undergraduate level. Research gaps that need to be considered include several aspects that have not been fully researched or are insufficient in the related literature, namely Student Involvement in Web Programming Teaching, namely, Although web learning media is considered to be able to increase student involvement, specific methods of web learning media have not been able to encourage active and active involvement. Student participation in the web programming learning process (Batmetan & Palilingan, 2022). It is necessary to study how the interactivity, layout, and presentation of material in these media can increase the level of student involvement. Next is Understanding Deep Web Programming Concepts, namely identifying whether web learning media can help students understand more complex and in-depth web programming concepts (Sigayret et al., 2022). How can web learning media overcome the barriers to understanding that students often face in understanding more abstract and complex concepts? Apart from that, the effectiveness of web learning media on students with different backgrounds, namely evaluating the effectiveness of web learning media in general, requires further analysis of how this media affects students with different programming backgrounds (Gordon et al., 2022). Is web learning media more effective for students with minimal programming background, or is it also effective for students who already have previous programming knowledge and skills? Apart from understanding concepts, it is also important to evaluate the effectiveness of web learning media in improving students' practical skills in building web applications (Kwen & Oh,

2022). How can web learning media help students develop problem-solving, debugging, and other practical skills that are relevant to developing web applications? Another research gap is how the implementation of web learning media can be effectively integrated into the web programming curriculum at the undergraduate level. How can lecturers adopt and adapt web learning media as a whole to improve the quality of teaching and learning web programming? More in-depth research is needed to evaluate the long-term impact of using web learning media in teaching web programming (Knudsen et al., 2022). How can the use of this media influence students' academic achievement in the long term and the relevance of the skills they acquire in their professional careers (Takahashi & Suzuki, 2022)? By filling this research gap, this research can provide deeper insight into the potential and challenges of using web learning media in the context of information technology education. The results of this study can guide the development of innovative and effective teaching methods in teaching web programming to undergraduate students.

The main novelty of this research lies in an Innovative Approach to Teaching Web Programming, namely the use of an innovative approach using web learning media in teaching web programming at the undergraduate level. Although web learning media have been used in various educational fields, their use specifically in teaching web programming at the undergraduate level has not been fully explored. This research will explore the potential of web learning media as a new and more interactive teaching method in the context of web programming. In addition, this research will specifically focus on teaching web programming, which is a key topic in the information technology curriculum. This ensures that the novelty of the research is directly related to the need for information technology education in teaching web programming skills that are relevant to industry needs. The novelty of the research also lies in the approach to comprehensively measure the effectiveness of teaching web programming using web learning media and its impact on student engagement. In the context of information technology education, assessing the effectiveness of teaching methods and the level of student engagement is critical to ensuring understanding and mastery of web programming concepts. On the other hand, this research can make a valuable contribution to the development of web programming curricula at the undergraduate level. By identifying the strengths and potential of web learning media, this research can guide for preparation of relevant and innovative curricula for teaching web programming. By focusing on teaching web programming using web learning media, this research will provide new insights and contributions that are relevant to the field of information technology education, especially in the context of understanding and mastering web programming concepts by undergraduate students.

Therefore, this study aims to investigate the effectiveness of teaching web programming using web learning media at the undergraduate level of information technology. In addition, this research will also identify design elements of web learning media that can improve learning outcomes and student involvement in the teaching and learning process. It is hoped that the results of this research will provide a valuable contribution to the development of information technology education, especially in the context of teaching web programming at the undergraduate level. In addition, this research is also expected to provide insight into the use of web learning media in higher education more broadly. The results of this research can become the basis for curriculum development and teaching strategies that are more effective and innovative in teaching web programming to undergraduate students.

METHOD

This research was conducted through an experimental approach, involving student participants from

several information technology study programs at Manado State University. Participants will be divided into two groups, namely the experimental group which will receive web programming, and teaching using web learning media, and the control group which will receive conventional teaching using textbooks and lectures. Data was collected through a pre-test before teaching began to measure students' initial understanding of web programming, and a post-test after teaching was completed to evaluate the understanding and skills that had been acquired. In addition, data collection will be carried out through questionnaires and interviews to obtain responses and direct experience from participants regarding the use of web learning media.

Research design

This research uses an experimental design with two groups (Sigayret et al., 2022). The first group will be an experimental group that will receive web programming instruction using web learning media. The second group will be a control group which will receive conventional teaching using textbooks and lectures.

Participant

Participants in this research were 60 students from several information technology study programs at Manado State University. Students taking web programming courses will be research subjects. It is important to ensure that the two groups have similar initial characteristics, including prior programming background and initial level of understanding of web programming.

Data collection

Data is collected through a variety of methods, including:

a. Initial Test (Pretest)

Before teaching started, participants from both groups took pre-tests to measure their initial understanding of web programming. This test is the basis of comparison to assess the increase in understanding after teaching.

b. Final Test (Post-test)

After the lesson was finished, participants from both groups took a final test to evaluate their understanding and skills after attending the web programming lesson.

c. Questionnaires and Interviews

Participants were asked to fill out a questionnaire about their experiences and perceptions of using web learning media in teaching web programming. In addition, interviews were conducted to obtain more in-depth and detailed responses from the participants.

Data analysis

The data collected was analyzed comparatively to compare the learning outcomes between the experimental group and the control group. Statistical analysis was used to measure the level of understanding and skills achieved by each group after participating in the teaching. Data from questionnaires and interviews were analyzed qualitatively to gain insight into students' perceptions and experiences of web learning media.

Web Learning Media Processing

The web learning media used in the experimental group needs to be carefully designed and developed. Design aspects such as interactivity, layout, content variety, and user involvement are considered to create an effective and interesting learning experience.

Evaluation and Reflection

This study relies on the evaluation and reflection of participants and lecturers who are involved in teaching. The results of research and experience during teaching will help improve web learning media and provide guidance for the development of better teaching methods in the future.

By using an experimental research design and a combination of quantitative and qualitative data, this research is expected to provide a deeper understanding of the effectiveness of teaching web programming using web learning media and its impact on student understanding and engagement. The results of this study can become the basis for developing teaching strategies that are more innovative and effective in teaching web programming at the undergraduate level.

RESULT AND DISCUSSION

Testing Requirements Analysis

In data analysis, hypothesis testing was carried out using the t-test, but first, the normality test and homogeneity test were carried out. The data used in the normality test and homogeneity test uses the results of the experimental class Pre-Test (O_1), experimental class Post-Test (O_2), control class Pre-Test (O_3), and control class Post-Test (O_4). The aim of carrying out the normality test and homogeneity of variance test is to determine the normality and uniformity of the data which is a requirement for conducting experiments in both classes, namely the experimental class and the control class.

1. Normality Test

The normality test aims to determine whether the research data is normally distributed or not. For this normality test, researchers use the Shapiro-Wilk test with the help of the IBM SPSS Statistics 26 application. The basis for decision-making is:

a) If the sig value > 0.05, then the research data is normally distributed
b) If the sig value <0.05, then the research data is not normally distributed

The significance value is obtained from the Shapiro-Wilk test which can be seen in Appendix V, which uses a significance level of 5% or a value of 0.05. The tests that will be tested are the experimental class pre-test normality test, control class pre-test, experimental class post-test, and control class post-test.

a. Pre-Test Data

1) The results of the pre-test data normality test in the experimental class showed a significance value = 0.378. Because the significance value is > 0.05, i.e. 0.378 > 0.05, the sample from the experimental class population is normally distributed.
2) The results of the pre-test data normality test in the control class showed a significance value = 0.245. So the significance value is > 0.05, i.e. 0.245 > 0.05, so the sample from the control class population is normally distributed.

b. Post-Test Data

1) The results of the post-test data normality test in the experimental class show a significance value = 0.061. So the significance value is > 0.05, i.e. 0.061 > 0.05, so the sample from the experimental class population is normally distributed.

2) The post-test data normality test results in the control class show a significance value = 0.170. Because the significance value is > 0.05, i.e. 0.170 > 0.05, the sample from the control class population is normally distributed.

c. Psychomotor Outcome Data

1) The results of the normality test of student psychomotor learning outcomes data show a significance value in the experimental class = 0.33. Because the significance value is > 0.05, namely 0.33 > 0.05, the experimental class research data is normally distributed.
2) The results of the normality test of student psychomotor learning outcomes data show a significance value in the control class = 0.351. Because the significance value is > 0.05, namely 0.351 > 0.05, the control class research data is normally distributed

2. The Homogeneity Test

The homogeneity test is used to ensure that the data groups come from populations that have the same (homogeneous) variance. The basis for decision-making is

a) If the Sig value > 0.05, then the data distribution is homogeneous
b) If the Sig value < 0.05, then the data distribution is not homogeneous

a. Pre-Test Data

The results of the analysis of homogeneity testing with SPSS on the pre-test results for the experimental class and control class obtained a significance value of Based On Mean = 0.444. This shows that the significance value on Based On Mean > 0.05 is 0.444 > 0.05. So it can be concluded that the variances of the two classes, namely the pre-test of the experimental class and the control class, are the same or homogeneous.

b. Post-Test Data

The results of the analysis of homogeneity testing using SPSS on the post-test results data for the experimental class and control class obtained a significance value of Based On Mean = 0.496. This shows that the significance value on Based On Mean > 0.05 is 0.496 > 0.05. So it can be concluded that the variances of the two classes, namely the post-test of the experimental class and the control class, are the same or homogeneous.

c. Psychomotor Outcome Data

The results of the analysis of homogeneity testing using SPSS on the psychomotor learning outcomes data of experimental class and control class students obtained a significance value of Based On Mean = 0.879. This shows that the significance value on Based On Mean > 0.05 is 0.879 > 0.05. So it can be concluded that the variances of the two classes are the same or homogeneous

Description of Research Data

Learning outcomes

The experimental class is a class that teaches web programming using web learning media. Where the experimental class consists of 30 students and the control class is a class that receives conventional teaching using textbooks and lectures and consists of 30 students. The pre-test and post-test data were processed using the IBM SPSS Statistics 26 application and the distribution table and histogram results were obtained. See Figure 1.

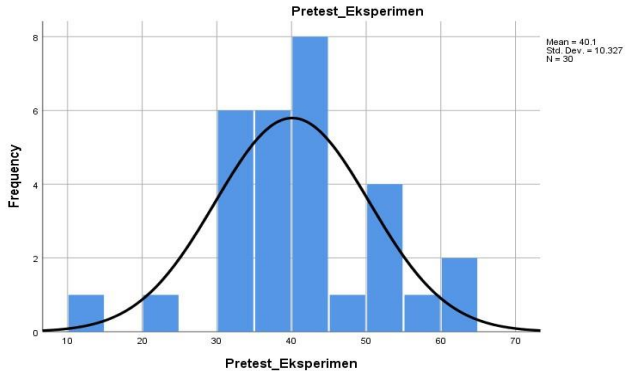

Figure 1. Pre-Test Histogram for Experiment Class

The pre-test score for experimental class students was the highest score of 60 and the lowest score of 13. The calculation results showed that the mean pre-test score for students in the experimental class was 40.1 and the standard deviation was 10,327.
Meanwhile, the post-test results obtained experimental class students with the highest score of 97 and the lowest score of 70. See Figure 2.

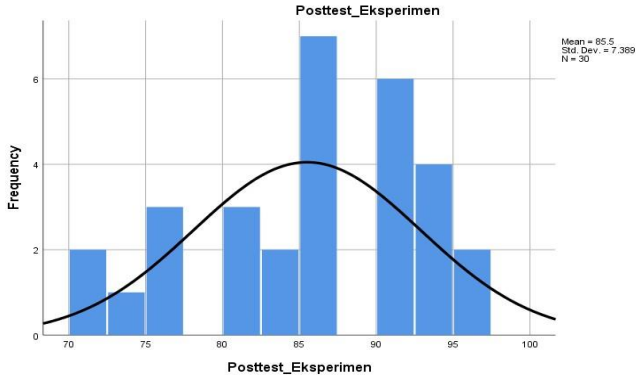

Figure 2. Post-Test Histogram Results of the Experiment Class

For the control class, the pre-test score of the control class students was obtained with the highest score of 65 and the lowest score of 20 and the mean pre-test value of students in the experimental class was 40.47 and a standard deviation of 11.557. See picture 3.

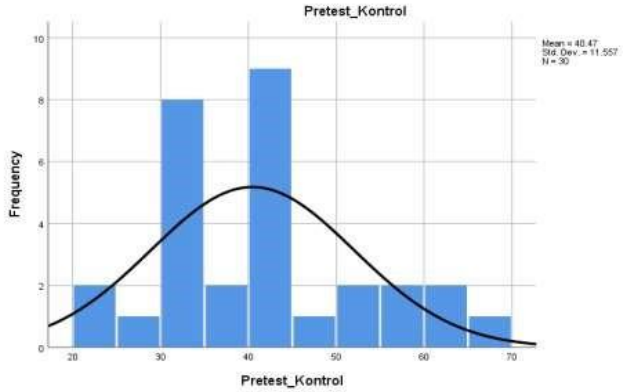

Figure 3. Pre-Test Histogram Results for Control Class

Whereas for the post-test in the control class, the post-test scores with the highest score of 93 and the lowest score of 60 were from 30 students in the control class and the mean value of the student's post-test was 80.03 and the standard deviation was 8,532. see figure 4.

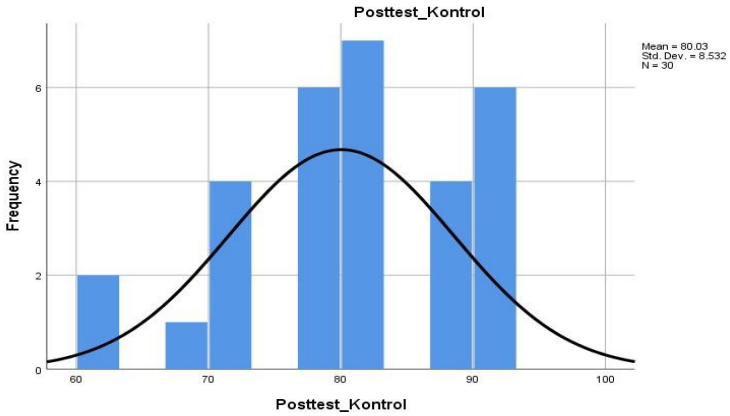

Figure 4. Control Class Post-Test Histogram

Psychomotor Learning Outcomes

The results of measurements on psychomotor aspects in the experimental class obtained a mean student score of 85.17 and a standard deviation of 7.539. See Figure 5.

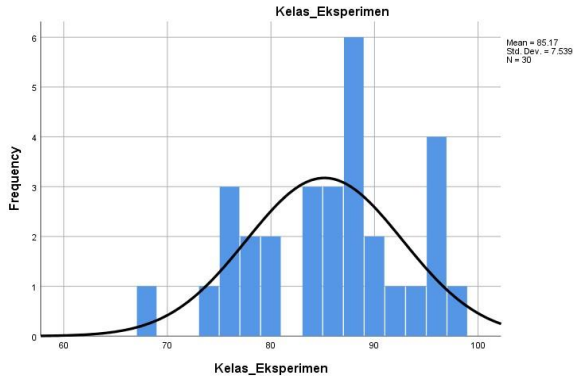

Figure 5. Histogram of Psychomotor Scores for Experimental Class

The results of measurements on psychomotor aspects in the control class obtained a mean student score of 80.23 and a standard deviation of 8.468. See Figure 6.

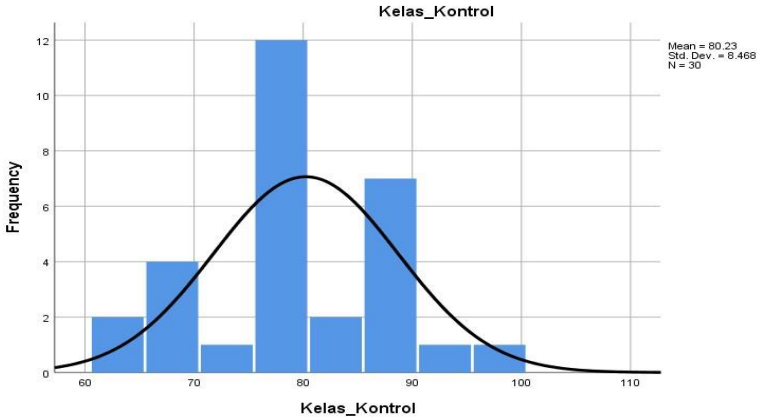

Figure 6. Histogram of Control Class Psychomotor Values

Cognitive Hypothesis Testing

After testing the normality and homogeneity tests have fulfilled the analysis prerequisite tests, then the hypothesis test is carried out by conducting a hypothesis t-test.

1) Basis for Decision Making:

Ho : $\mu_1 \leq \mu_2$

H_1: $\mu_1 > \mu_2$

2) Selected a significance level $\alpha = 0.05$ 3) Test criteria:

Ho is accepted if ≤ and H_1 is rejected

H_1 is accepted if > and Ho is rejected

4) Test Statistics

T-test formula:

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

4) Critical area: $t_{hitung} > t_{tabel}$

5) Count: Known:

n_1= 30; $\bar{x}_1$= 85.50; s_1^2= 54.603;

n_2= 30; $\bar{x}_2$= 80.03; s_2^2= 72.792;

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} = \frac{85.50 - 80.03}{\sqrt{\frac{54.603}{30} + \frac{72.792}{30}}} = \frac{5.47}{\sqrt{1.8201 + 24264}}$$

$$= \frac{5.47}{\sqrt{4.2465}} = \frac{5.47}{2.0607} = 2.654438$$

6) Determine t_{tabel} =1.671553

Therefore 2.654438 > 1.671553. Based on the hypothesis testing criteria, the hypothesis Ho is rejected, and H_1 is accepted.

7) Significance Test

Testing was carried out to determine the significant influence of the differences in treatment given to each class. With the parametric statistical test requirements, namely Normal and Homogeneous. The basis for decision-making is:

- If the Sig. (2-tailed) < 0.05, then there is a significant influence on the differences in treatment given to each class.
- If the Sig. (2-tailed) > 0.05, so there is no significant influence on the differences in treatment given to each class.

The following is a significance test (2-tailed) which was processed using the IBM SPSS Statistics 26 application to obtain results:

Table 1. Cognitive (2-tailed) Significance Test

Independent Samples Test										
		Levene's Test fo Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2tailed)	Mean Difference	Std. Erro Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Hasil Belajar	Equal variance assumed	.469	.496	2.653	58	0.010	5.467	2.061	1.342	9.592
	Equal variance not assumed			2.653	56.84	0.010	5.467	2.061	1.340	9.593

In Table 1, the calculated results show the value of Sig. (2-tailed) of 0.01. it is known that the statement 0.01 <0.05, it can be concluded that there is a significant effect on the difference in the treatment given to each class. That means there is an influence of web programming using web learning media on learning outcomes of web programming.

D. Psychomotor hypothesis test

Hypothesis testing was carried out by conducting a hypothesis t-test.

1) Basis for Decision Making.

1) Basis for Decision Making:
   Ho : $\mu_1 \leq \mu_2$
   H_1 : $\mu_1 > \mu_2$
2) Selected significance level $\alpha = 0.05$ 3) Testing Criteria:
   H_0 is accepted if $t_{hitung} \leq t_{tabel}$ and H_1 is rejected
   H_1 accepted if $t_{hitung} > t_{tabel}$ and Ho is rejected

4) Test Statistics
T-test formula:

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

5) Critical area: $t_{hitung} > t_{tabel}$
6) Known Count :

n_{1}= 30; $\bar{x}_{1}$= 85.17; s_1^2= 56.833;
n_{2}= 30; $\bar{x}_{2}$= 80.23; s_2^2= 71.702;

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{85.17 - 80.23}{\sqrt{\frac{56.833}{30} + \frac{71.702}{30}}} = \frac{4.94}{\sqrt{1.8944 + 2.39}}$$

$$= \frac{4.94}{\sqrt{4.2844}} = \frac{4.94}{2.069879} = 2.386613$$

7) Define t_{tabel} =1.671553
Therefore 2.386613 > 1.671553. Based on the hypothesis testing criteria, the hypothesis Ho is rejected, and H_1 is accepted.

8) Significance Test

Table 2. Psychomotor Significance Test (2-tailed).

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2tailed)	Mean Difference	Std. Erro Difference	Lower	Upper
Hasil Belajar	Equal variances assumed	.023	.879	2.383	58	0.020	4.933	2.070	.790	9.077
	Equal variances not assumed			2.383	57.234	0.020	4.933	2.070	.789	9.078

From Table 2, it can be seen that the Sig. (2-tailed) of 0.02. It is known that the statement 0.02 <0.05, it can be concluded that from the psychomotor aspect, there is also a significant influence on the difference in the treatment given to each class. This means that there is an influence of web programming using web learning

media on web programming learning outcomes.

Based on the description of the pre-test and post-test knowledge results data and the skill scores of students in the experimental class and control class, it shows that the average learning outcomes of student web programming using web learning media are higher than students who use conventional teaching using textbooks and lectures. This can be seen from the average pre-test score of students using conventional teaching using textbooks and lectures which is 40.10 with the highest score being 60 and the lowest score being 13. Meanwhile the average pre-test score of students using web learning media, namely 40.47 with the highest score of 65 and the lowest score of 20. Furthermore, the results of the average post-test scores of students in classes using web learning media are 85.50 with the highest score of 97 and the lowest score of 70.

Meanwhile, in classes that use conventional teaching using textbooks and lectures, the average post-test score is 80.03 with the highest score being 93 and the lowest score being 63. The results of the average score for students' skills in the experimental class are 85.17 and the average score is 85.17. The average skill in the control class was 80.23. In this way, an increase in the average student learning outcomes from pre-test and post-test knowledge scores and student skill scores in the experimental class and control class was obtained. The learning model used in the control class, namely conventional teaching using textbooks and lectures, and the learning model used in the experimental class, namely web learning media, can both improve student learning outcomes.

Next, analysis requirements were tested in the form of normality tests and homogeneity tests. This test was carried out to determine the normality and uniformity of the data as a condition for conducting experiments on both classes. The normality test was carried out using the Shapiro-Wilk test with the help of the SPSS application at a real level of $\alpha = 0.05$. The normality test for the pre-test data in the experimental class showed a significance value = 0.378, and the post-test data for the experimental class showed a significance value = 0.06. Because 0.378 > 0.05 and 0.06 > 0.05, the sample from the experimental class population is normally distributed. The normality test obtained from the pre-test data in the control class showed a significance value = 0.245, and the post-test data in the control class showed a significance value = 0.17 because 0.245 > 0.05 and 0.17 > 0.05, the sample from the control class population was normally distributed. Furthermore, the skill value in the experimental class shows a significance value = 0.33 and the skill value in the control class shows a significance value = 0.351. Because 0.33 > 0.05 and 0.351 > 0.05, the samples from both classes are normally distributed. In testing homogeneity of variance with SPSS on the pre-test data from the experimental class and control class, the significance value obtained was Based On Mean = 0.444, which shows that 0.444 > 0.05. In the post-test data from the experimental class and control class, the significance value obtained was Based On Mean = 0.496, this shows that 0.496 > 0.05. The data on the skill scores of experimental and control class students shows a significance value of Based On Mean = 0.879, this shows that 0.879 > 0.05. Therefore, it can be concluded that the variances of the two classes, namely the pre-test and post-test knowledge scores and the skill scores of the experimental class and the control class, are the same or homogeneous.

Hypothesis testing of student learning outcomes shows that there are differences between the experimental class and the control class from the knowledge aspect, namely at the real level $\alpha = 0.05$ obtained $t_{hitung} = 2.654438$. Because $t_{hitung} > t_{tabel}$ namely 2.654438> 1.671553 then the test statistic falls in the critical area, so reject Ho and accept H_1. Likewise, the skill aspect shows that there is a difference between the experimental class and the control class, namely at a significant level $\alpha = 0.05$ obtained $t_{hitung} = 2.386613$. Because $t_{hitung} > t_{tabel}$ that is 2.386613 > 1.671553 Then the test statistic falls in the critical area, so reject Ho and accept H_1. Furthermore, the significance was tested using the help of the IBM SPSS Statistics 26 application, showing in the cognitive aspect that the value of Sig. (2-tailed) = 0.01. It is known

that the statement is 0.01 < 0.05. And on the psychomotor aspect the value of Sig. (2-tailed) = 0.02. Known statement 0.02 < 0.05. So it can be concluded that there is a significant influence on the differences in treatment given to each class. This means that there is an influence of the web learning media model on web programming learning outcomes. So, in general, it can be concluded that the results of experimental research carried out at Manado State University by providing treatment using the web learning media learning model get higher learning outcomes compared to classes using conventional learning models using textbooks and lectures through an increased in average - average learning outcomes, and the difference in learning outcomes between the two classes seen from the hypothesis test, namely the t-test and then the significance test is known to have the influence of the learning model of web learning media on learning outcomes of web programming at universities.

The results of this study are in line with the findings of other researchers who found that Teaching Web Programming in Higher Education is very important to improve teaching web programming at the undergraduate level. The main challenges in teaching web programming, such as the high level of abstraction, the complexity of web programming languages, and technological changes (Vishtak et al., 2022). Apart from that, Web Learning Media, which is the concept and definition of web learning media, is an important thing to pay attention to. This is due to the advantages of web learning media in teaching web programming, such as accessibility, interactivity, and flexibility (Wu et al., 2022). In addition, the Effectiveness of Web Learning Media obtained from previous studies has evaluated the effectiveness of using web learning media in the context of teaching programming (Brereton et al., 2022).

Findings that measure the increase in understanding, skills, and student engagement through web learning media. Student involvement in online learning is required, such as paying attention to factors that influence student involvement in online learning, such as motivation, course design, and interactions with lecturers and fellow students (Polito & Temperini, 2021). In addition, tools and techniques are used to increase student engagement in web learning media. Effective teaching strategies are needed for teaching web programming, including constructivist approaches, project-based problem-solving, and practical approaches (Lin et al., 2020). In addition, Design effective learning materials and logical learning sequences in the context of web programming. The next thing that is important to pay attention to is adjustments to students with different backgrounds, such as how previous programming backgrounds can influence web programming learning (Park et al., 2020). Strategies for providing appropriate support to students with varying levels of understanding.

The results showed that the experimental group who received instruction with web learning media showed a significant increase in understanding and web programming skills compared to the control group. Web learning media is considered effective in presenting material interactively and supporting active student involvement in the learning process (Manggopa et al., 2019). In addition, students in the experimental group also showed a higher level of satisfaction with teaching web programming with web learning media (Batmetan et al., 2019). They feel more helped in understanding complex concepts and have the opportunity to interact more directly with learning material.

This research provides valuable implications for the development of information technology education, especially in the context of teaching web programming at the undergraduate level. The use of web learning media in an innovative approach can significantly increase student understanding, skills, and involvement. The results of this research also guide for higher education institutions to effectively adopt and integrate web learning media in web programming curricula. Based on research findings, it is recommended that information technology educational institutions consider using web learning media in teaching web programming. Web learning media content development must consider aspects of interactive design, layout, and content variations that can increase student engagement. Lecturers and instructors must receive

training and support in implementing web learning media effectively in the learning process. Thus, this research provides evidence that an innovative approach using web learning media can be an effective solution in improving the teaching of web programming at the information technology undergraduate level. This research provides valuable implications for the development of information technology education, especially in the context of teaching web programming at the undergraduate level. The use of web learning media in an innovative approach can significantly increase student understanding, skills, and involvement. The results of this research also guide for higher education institutions to effectively adopt and integrate web learning media in web programming curricula. Based on research findings, it is recommended that information technology educational institutions consider using web learning media in teaching web programming. Web learning media content development must consider aspects of interactive design, layout, and content variations that can increase student engagement. Lecturers and instructors must receive training and support in implementing web learning media effectively in the learning process. Thus, this research provides evidence that an innovative approach using web learning media can be an effective solution in improving the teaching of web programming at the information technology undergraduate level.

CONCLUSION

This research concludes that the use of web learning media significantly increases students' understanding and skills in web programming. Students who take part in teaching using web learning media experience greater improvements in their understanding of web programming concepts and practical abilities in building web applications. In addition, web learning media creates a more interactive and interesting learning environment. Students who use web learning media show a higher level of involvement in the learning process. They are more active in discussions, more motivated, and better prepared to face the challenges of web programming. Even though web learning media can provide good flexibility and accessibility, the role of lecturers is still important in providing guidance and support to students. Lecturers must monitor student progress, provide feedback, and respond to questions and problems that arise in learning. Thus, it can be concluded that the use of web learning media can be an effective tool in teaching web programming at the information technology undergraduate level. Web learning media can improve student understanding, skills, and involvement. However, the development of good learning content and the role of effective lecturers are also important factors in the success of teaching with this approach. Additionally, it is necessary to consider variations in student programming backgrounds to provide an optimal learning experience for all students.

REFERENCES

Batmetan, J. R., Katuuk, D. A., Lengkong, J. S. J., & Rotty, V. N. J. (2023). An Investigation of E-Learning Readiness in Vocational High School During the Post Pandemic Covid-19: Case from North Sulawesi. International Journal of Information Technology and Education, 2(3), 77–92.

Batmetan, J. R., Koessoy, H., Kalalo, D., Lolong, R., & Jacobus, S. (2022). Techno-Entrepreneurship Learning Model in Higher Education. International Journal of Information Technology and Education, 1(4), 82–88.

Batmetan, J. R., Mintjelungan, M. M., Manggopa, H. K., Kilis, B. M. H., & Kembuan, D. R. E. (2019). Usability evaluation of adaptive features in e-learning. 5th UPI International Conference on Technical and Vocational Education and Training (ICTVET 2018), 127–129.

Batmetan, J. R., & Palilingan, V. R. (2022). Management Model Development for The Techno-Entrepreneurship Learning Sustainability in Higher Education. Indonesian Journal of Business and Entrepreneurship (IJBE), 8(3), 345.

Brereton, S., Curtin, M., Greene, E., Hardie, P., Szafranska, M., & Kirwan, C. (2022). A blended learning perineal suturing programme for midwifery students: An evaluative descriptive study. Nurse Education in Practice, 64, 103453. https://doi.org/https://doi.org/10.1016/j.nepr.2022.103453

Cabada, R. Z., Estrada, M. L. B., Hernández, F. G., Bustillos, R. O., & Reyes-García, C. A. (2018). An affective and Web 3.0-based learning environment for a programming language. Telematics and Informatics, 35(3), 611–628. https://doi.org/https://doi.org/10.1016/j.tele.2017.03.005

Gordon, C. S., Pink, M. A., Rosing, H., & Mizzi, S. (2022). A systematic meta-analysis and meta-synthesis of the impact of service-learning programs on university students' empathy. Educational Research Review, 37, 100490. https://doi.org/https://doi.org/10.1016/j.edurev.2022.100490

Ho, H. C. Y., Poon, K.-T., Chan, K. K. S., Cheung, S. K., Datu, J. A. D., & Tse, C. Y. A. (2023). Promoting preservice teachers' psychological and pedagogical competencies for online learning and teaching: The T.E.A.C.H. program. Computers & Education, 195, 104725. https://doi.org/https://doi.org/10.1016/j.compedu.2023.104725

Islam, M. M., Adil, M. A. A., Talukder, M. A., Ahamed, M. K. U., Uddin, M. A., Hasan, M. K., Sharmin, S., Rahman, M. M., & Debnath, S. K. (2023). DeepCrop: Deep learning-based crop disease prediction with web application. Journal of Agriculture and Food Research, 14, 100764. https://doi.org/https://doi.org/10.1016/j.jafr.2023.100764

J R Batmetan, V. R. P. (2018). Higher Education Students' Behaviour to Adopt Mobile Learning. The International Conference on Innovation in Engineering and Vocational Education,The 2nd ICIEVE 2017, 2(2017).

Knudsen, L. R., Lomborg, K., & de Thurah, A. (2022). Design and development of an e-learning patient education program for self-management support in patients with rheumatoid arthritis. PEC Innovation, 1, 100004. https://doi.org/https://doi.org/10.1016/j.pecinn.2021.100004

Kwen, H., & Oh, P.-J. (2022). Development and Evaluation of a Mobile Web-based Food Allergy and Anaphylaxis Management Educational Program for Parents of School-aged Children with Food Allergy: A Randomized Controlled Trial. Asian Nursing Research, 16(5), 265–274. https://doi.org/https://doi.org/10.1016/j.anr.2022.10.002

Lamonge, A. S., & Baua, M. E. (2023). Development and evaluation of web-based Self-care Management Health Education e-Learning Program for type 2 diabetes patients: A pilot study. Enfermería Clínica, 33, S27–S32. https://doi.org/https://doi.org/10.1016/j.enfcli.2023.01.009

Lin, Y.-R., Fan, B., & Xie, K. (2020). The influence of a web-based learning environment on low achievers' science argumentation. Computers & Education, 151, 103860. https://doi.org/https://doi.org/10.1016/j.compedu.2020.103860

López-Soler, C., Vicente-Escudero, J. L., Alcántara, M., Martínez, A., Fernández, V., & Castro, M. (2023). Web-based self-regulation improvement program for children at psychosocial risk: Feasibility and acceptability assessment. Mental Health & Prevention, 31, 200293. https://doi.org/https://doi.org/10.1016/j.mhp.2023.200293

Manggopa, H. K., Kenap, A. A., Manoppo, C. T. M., Batmetan, J. R., & Mewengkang, A. (2019). The Development of Web Learning as Media to Deliver Web Programming Materials. 5th UPI

International Conference on Technical and Vocational Education and Training (ICTVET 2018), 504–508.

Nwaesei, A. S., Moye, P. M., Ndefo, U. A., & Pounds, T. I. (2023). An International Web-based Preceptor Development Program for Nigerian Pharmacists, A Pilot Study. American Journal of Pharmaceutical Education, 100027. https://doi.org/https://doi.org/10.1016/j.ajpe.2022.12.004

Park, M., Jeong, M., Lee, M., & Cullen, L. (2020). Web-based experiential learning strategies to enhance the evidence-based-practice competence of undergraduate nursing students. Nurse Education Today, 91, 104466. https://doi.org/https://doi.org/10.1016/j.nedt.2020.104466

Polito, G., & Temperini, M. (2021). A gamified web based system for computer programming learning. Computers and Education: Artificial Intelligence, 2, 100029. https://doi.org/https://doi.org/10.1016/j.caeai.2021.100029

Sigayret, K., Tricot, A., & Blanc, N. (2022). Unplugged or plugged-in programming learning: A comparative experimental study. Computers & Education, 184, 104505. https://doi.org/https://doi.org/10.1016/j.compedu.2022.104505

Takahashi, K., & Suzuki, N. (2022). Learning Status Report Tool for Programming Learning Services. Procedia Computer Science, 207, 1562–1570. https://doi.org/https://doi.org/10.1016/j.procs.2022.09.213

Tsai, C.-W., Lin, M. Y.-C., Cheng, Y.-P., Lee, L.-Y., Chyr, W.-L., Lin, C.-H., Lin, J.-W., & Tsai, M.-C. (2023). The effects of online peer-facilitated learning and distributed pair programming on students' learning. Computers & Education, 203, 104849. https://doi.org/https://doi.org/10.1016/j.compedu.2023.104849

Vishtak, O., Vishtak, N., Mikheyev, I., Ochkur, G., Lebedeva, Y., & Vinogradov, A. (2022). Interactive learning web applications: the main stages of development and software implementation. Procedia Computer Science, 213, 688–695. https://doi.org/https://doi.org/10.1016/j.procs.2022.11.122

Wu, X. V., Selvam, U. P., Wang, W., Ang, E. N. K., Devi, K. M., Chan, Y. S., Wee, F. C., Zhao, S., Sehgal, V., & Chi, Y. (2022). A web-based clinical pedagogy program to promote professional development for nurse preceptors: A quasi-experimental study. Nurse Education in Practice, 59, 103288. https://doi.org/https://doi.org/10.1016/j.nepr.2022.103288

Yilmaz, R., & Karaoglan Yilmaz, F. G. (2023). Augmented intelligence in programming learning: Examining student views on the use of ChatGPT for programming learning. Computers in Human Behavior: Artificial Humans, 1(2), 100005. https://doi.org/https://doi.org/10.1016/j.chbah.2023.100005