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Developing Web-Based E-LKPD with PjBL Model to Enhance Student Competence in Scripting

Fadiyatul Muqtashidah[1], Ekohariadi[2]

[1*,2]*State University of Surabaya, Surabaya, Indonesia*
[1]fadiyatul.20009@mhs.unesa.ac.id , [2]ekohariadi@unesa.ac.id

Abstract. This study aims to develop a website-based Electronic Student Worksheet (E-LKPD) integrated with the Project-Based Learning (PBL) model and to evaluate its effectiveness in enhancing students' competencies in the *Web Programming* subject, specifically on client-side scripting materials. The research employed the Research and Development (R&D) method using the ADDIE development model. The study was conducted at SMKN 1 Cerme with 30 students from Class XI TKJ 2 as research participants, utilizing a One Group Pretest-Posttest Design. The validation results indicated that the developed E-LKPD was highly valid, with media validation at 92%, material validation at 93%, lesson plan validation at 87%, and assessment validation at 89%, resulting in an average overall validity score of 90%. The effectiveness of the media was further demonstrated through a significant improvement in students' performance, with average scores increasing from 63.6 (pretest) to 83.8 (posttest). A Paired Sample t-test analysis yielded a significance value of < 0.001, leading to the rejection of the null hypothesis (H_0) and acceptance of the alternative hypothesis (H_1). These findings confirm that the website-based E-LKPD with a PjBL approach is effective in improving students' competency in Web Programming.

Keywords: *Client-Side Scripting; E-LKPD; Project Based Learning; Web Programming; Website*

1. Introduction

In this digital era, technology is growing so fast. The development of technology must be supported by qualified human resources. The best education is essential for producing high-quality human resources. In accordance with Agus Mustofa's opinion, education can be used as an instrument to help humans live effectively in daily life within society (Junaidi 2019).

The learning process can establish education. Learning is shown by a change in behavior as a result of experience. To accomplish learning targets, teachers and students are continually involved in the learning process. Teachers play a crucial role in achieving learning goals. To keep students engaged and convey the material effectively, teachers must maintain an enjoyable classroom environment throughout the learning process. Therefore, teachers need media as a tool to deliver the material. This is in line with (Zaini 2017) in (Wulandari et al. 2023) who argue that a student needs an intermediary, commonly called learning media, where learning media can distract students, in order to prevent their rapid boredom during the teaching and learning process. Teachers must choose the right media so that learning goals can be achieved effectively. Teachers must carefully select their media to support students' learning, as the media's role in the classroom is crucial and can aid in learning.

One of the learning media that can be used as a support for activities is the Student Worksheet (LKPD). Teachers can use LKPD as an auxiliary medium to facilitate learning activities so that the

interaction between teachers and students can run effectively. LKPD contains activities that must be carried out by students to deepen and develop their knowledge, so that students can improve their learning activities and achievements. This is in line with the opinion (Khasanah & Fadila 2018) that for teachers, the purpose of LKPD is to enable students to learn at their individual pace, with the content tailored to fulfil their specific needs. However, the LKPD that is still used at this time does not provide a meaningful experience for students because the questions contained in the current LKPD are still rarely related to problems in daily life, so that students cannot develop their insights and thoughts to understand the concepts studied (Yustianingsih et al. 2017). Therefore, innovation is needed so that students' interest in learning can grow, so that they can improve learning outcomes.

As an educator, teachers should pay attention to students' interests. With an interest in learning, students can foster motivation to approach the learning process seriously, thereby achieving good learning results. When students have an interest, they will be encouraged to be more active in participating in learning and will be serious about trying to achieve the desired goals. Interest helps motivate learning change and determine the learning success of students, therefore teachers certainly need to understand students' interests as best as possible (Setiawan et al. 2022).

Information technology is one factor that can impact students' interest in learning. One of the information technologies that can be used is a website. Websites are one of the most reliable information technology media to use, because a website page can store a lot of information. This is in line with the opinion (Andriyan et al. 2020) that the website is the most precise, fast, and accurate information medium to use because the website contains information on text data, still image data or motion images, animation data, sound, video, and a combination of all of them, both static and dynamic.

One of the learning outcomes in the Network Administration System Subject is that students are able to configure and test web server configurations. Therefore, knowledge of the basics and structure of websites is essential for Computer and Network Engineering students. XI TKJ students at SMKN 1 Cerme received website programming materials through Web Programming Elective Subjects.

Web programming can be divided into two, server-side scripting and client-side scripting. Server-side scripting runs on the server side, which functions to process user input, interact with the database, and control the content displayed on the user side. PHP, Python, JavaScript, and Ruby are a few of the programming languages used in server-side. Client-side scripting runs on the user side. In order to display the data that has been processed by the server-side, client-side data will be downloaded when a user accesses the website. HTML, CSS, and JavaScript are a few of the programming languages used in client-side (Panitro 2016).

Client-side scripting is one of the few materials learned by grade XI TKJ students in the Web Programming Elective Subject in SMKN 1 Cerme. This material is also an early part of web programming. To learn server-side, it is important for students to understand the structures of websites that appear on the client side. Based on the Learning Outcomes in the Web Programming subject, at the end of the learning, students are able to understand the concepts and apply HTML, CSS, JavaScript programming, server-side programming languages and framework implementations in creating static and dynamic websites for various contextual needs. In addition, students are also able to document and present the static and dynamic web that has been developed.

Based on the results of the observation, the subject teacher uses video media to deliver the material, and then the students were given an assignment to try the code independently. However, this results in a lack of interaction between students and teachers. According to (Hsieh Chang & Smith, 2008) in (Salamah 2020), interaction contributes to students' satisfaction and interest in learning in the learning

environment. With the description of this situation, the researcher intends to develop an educational media in the form of a website-based E-LKPD for client-side scripting material. The learning media is expected to be a means of interaction between teachers and students to improve students' psychomotor competence.

2. Methods

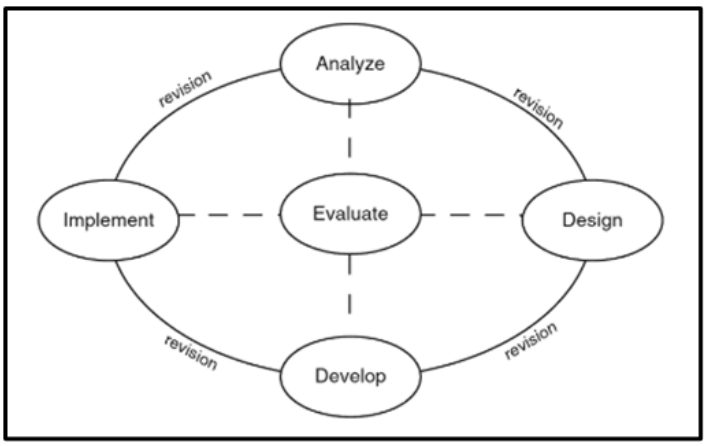

Figure 1. ADDIE (Branch 2009:2)

The website-based E-LKPD will be designed using the ADDIE method because this method has a series of systematic stages. Table 1. is an ADDIE stage carried out in the website-based E-LKPD design process.

Table 1. Addie Stages

Stages	Process
Analyze	Determine the causes of the need for development, determine learning outcomes and learning objectives, and analyze application needs.
Design	Determine the scope of the material, design the application design.
Develop	Developing an E-LKPD then conducting a validation process.
Implementation	Applying the app to students
Evaluation	Determine strategies to evaluate and revise media quality improvements.

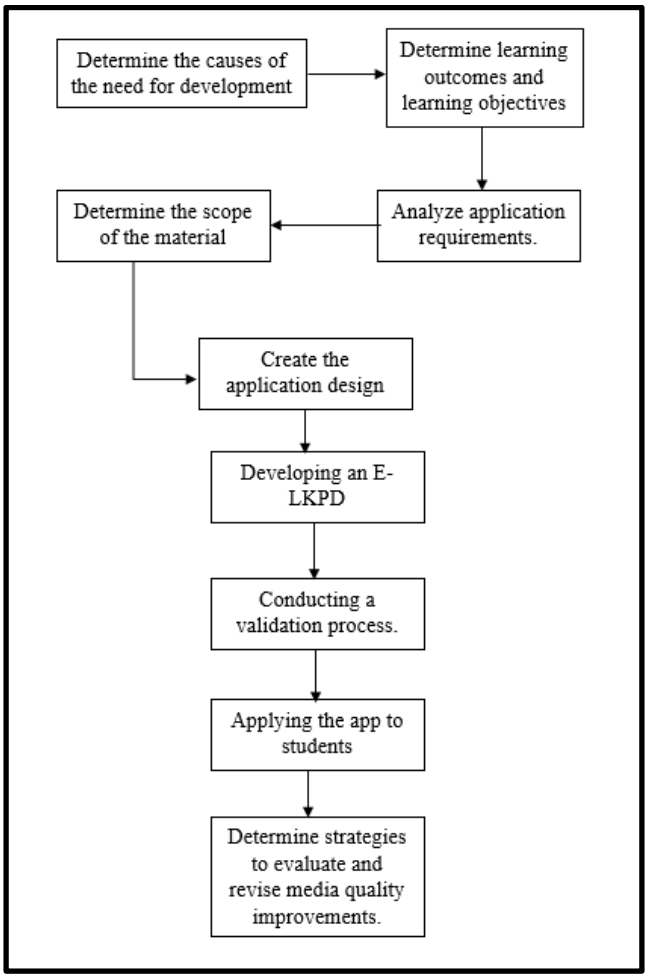

Figure 2. Research Process

Before implementation, the website-based E-LKPD will be validated by several experts, including: a) media experts; b) material experts; c) assessment experts; and d) teaching module experts. The validators consisted of lecturers of the Information Technology Education Study Program and teachers of Web Programming subjects at SMKN 1 Cerme. After being validated, the E-LKPD will be implemented on grade XI TKJ 2 students at SMKN 1 Cerme.

To test the effectiveness, the learning outcomes before and after implementation will be compared. One group pretest-posttest design is used in this study.

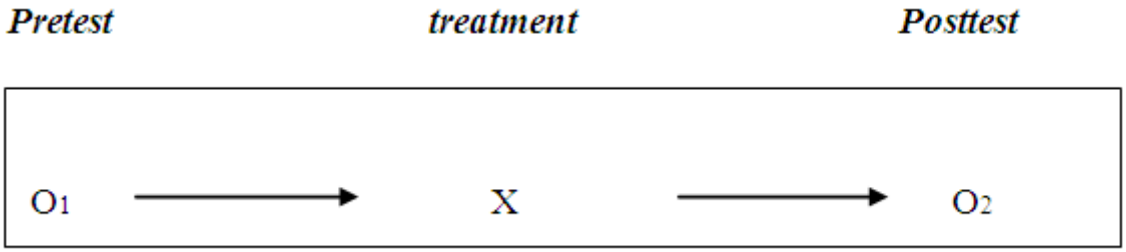

Figure 3. Research Design (Utami & Yuliyanto 2020)

Descriptions:
X = Treatment in the experimental Group
O_1 = Pretest results
O_2 = Posttest results

Based on the research diagram, the research procedures are: Pretest before treatment in the experimental group (O_1); Treatment in the experimental group about client-side scripting (X); Posttest after the experimental group receiving the treatment (O_2).

2.1. Validation Assessment Analysis

The results of validation will be calculated using the formula below.

$$Validity\ score\ = \frac{total\ score\ obtained}{total\ maximum\ score}\ x\ 100\%$$

The results will be adjusted to several categories according to (Arikunto 2010).

Table 2. Criteria for Validation

Percentage	Category
20%	Very invalid
21%-40%	Invalid
41%-60%	Less valid
61%-80%	Valid
81%-100%	Very valid

2.2 Pretest-Posttest Result Analysis

The results of the student competency test are then calculated to measure the student's competency before and after the treatment. Here is the formula used to calculate student test results.

$$Score\ = \frac{total\ score\ obtained}{total\ maximum\ score}\ x\ 100$$

The results will be analysed to determine whether the distribution is normal, and effectiveness is measured using SPSS software.

2.2.1 Normality Test

The Normality Test is used to find out the normality of data distribution. The normality test will be calculated using the Shapiro Wilk formula because the number of samples is less than 100. If the significance value < 0.05, the data is not normally distributed. On the other hand, if the significance value > 0.05, then the data is normally distributed.

2.2.2 T Test

The T test is used to determine the effectiveness of the application of media. The T test used is paired samples t-test. The hypotheses of this research are:

H_0: There is no significant improvement in students' competency in *Client Side-Scripting* after the implementation of the website-based E-LKPD using the Project-Based Learning approach.

H_1: There is a significant improvement in students' competency in *Client Side-Scripting* following the implementation of the website-based E-LKPD with the Project-Based Learning approach.

The T test will be administered in SPSS. If the significance value is less than 0.05, H_1 is accepted and H_0 is rejected.

3. Results and Discussion

3.1. Development Result of web-based E-LKPD

The stages carried out in "Design and Development of a Web-Based Electronic Student Worksheet with Project Based Learning Model to Improve XI TKJ Students' Competency in Client-Side Scripting Material at SMKN 1 Cerme" are as follows:

3.1.1. Analyze

At this stage, researchers investigate the causes of the need for development. The observation results show that the use of traditional learning and the lack of interaction between students and teachers are the main problems faced. This often confuses students and makes them passive participants in their learning. Learning Objectives will refer to the Learning Outcomes quoted from the Badan Standar, Kurikulum, dan Asesmen Pendidikan (BSKAP) Ministry of Education, Research, and Technology, Indonesia. At the stage of analysing application requirements, the website business process, user identification, and functional and non-functional requirements were determined.

3.1.2. Design

3.1.2.1. Usecase Diagram

There are two actors, teacher and student. Teacher can manage CRUD material, project, and student's data. Student can access materials, manage groups, and access code editor.

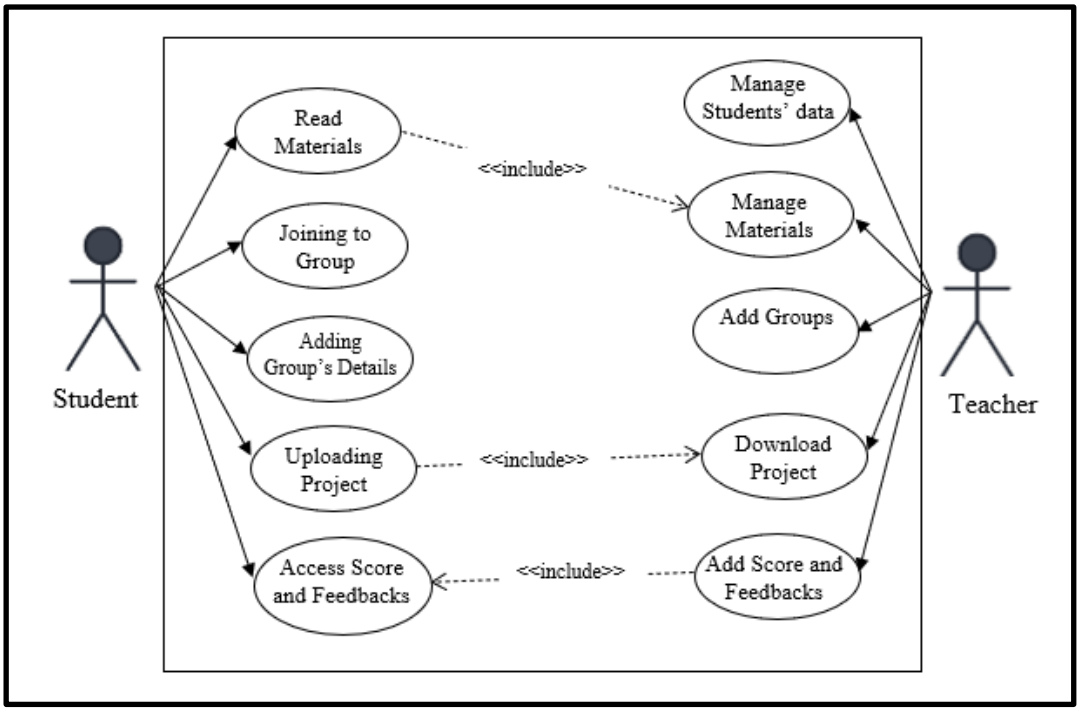

Figure 4. Usecase Diagram

3.1.2.2. Class Diagram

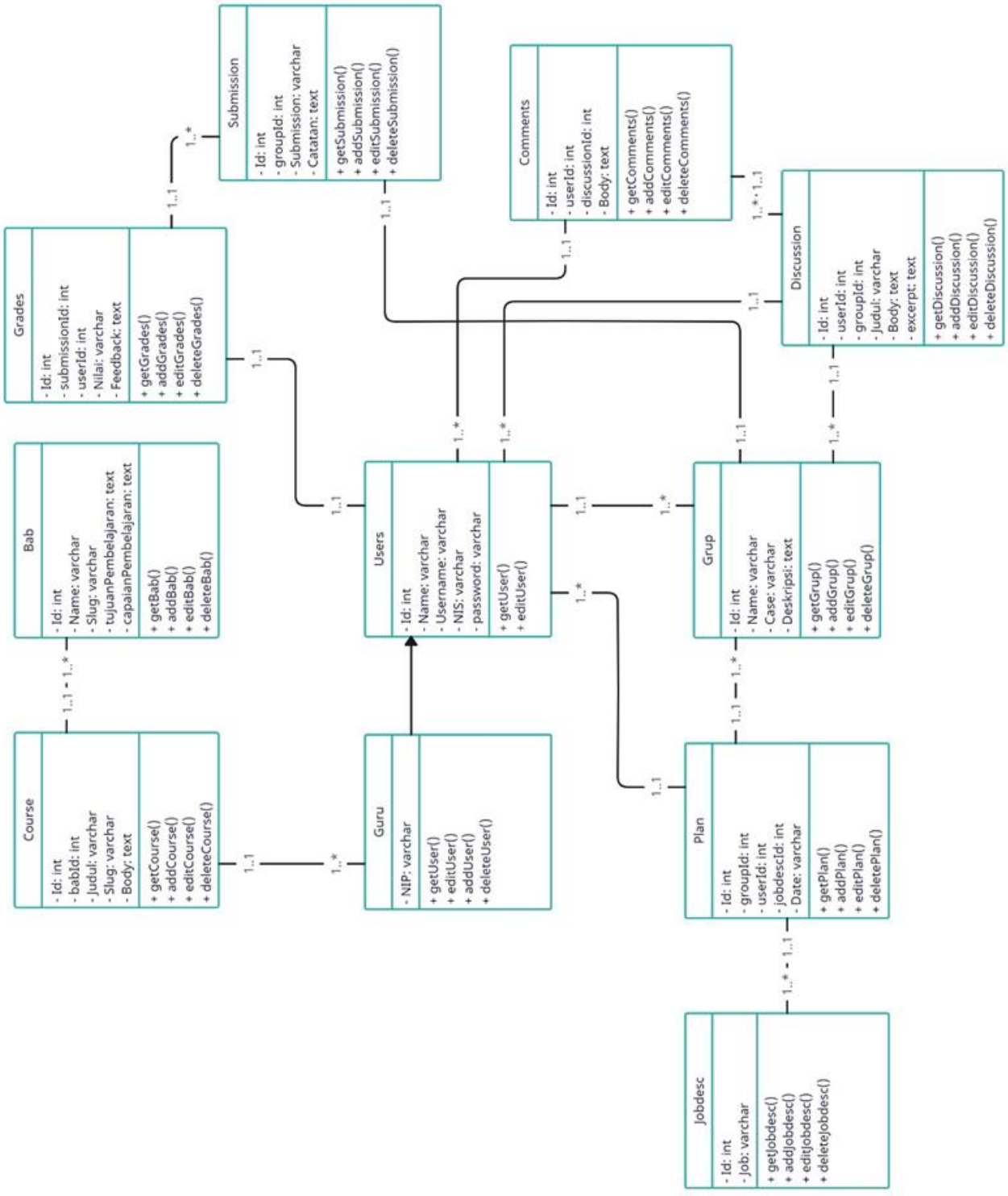

Figure 5. Class diagram

3.1.2.3. Activity Diagram

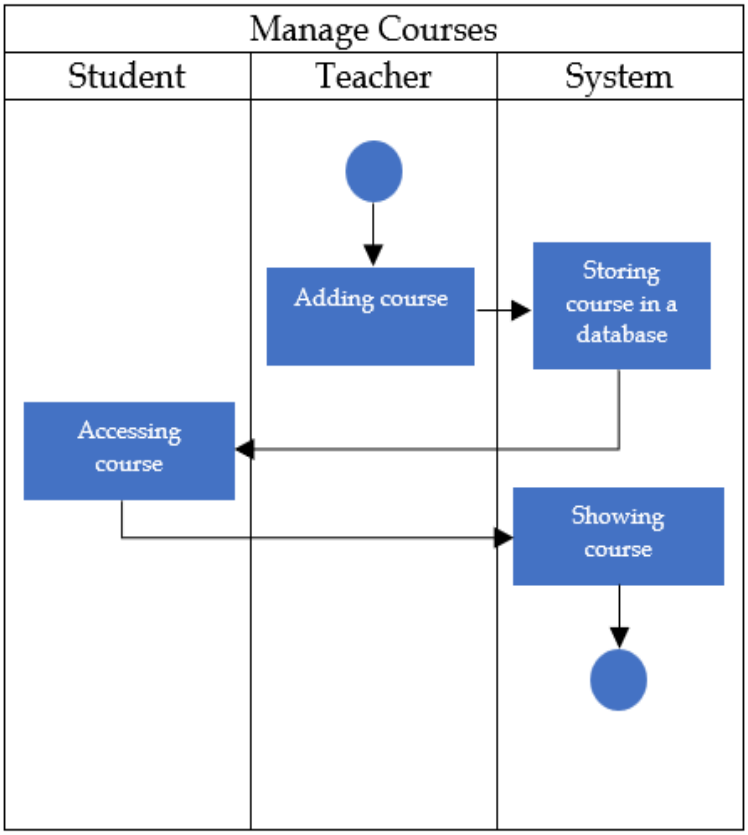

Figure 6. Activity diagram

3.1.2.4. Wireframe Design of Web Based E-LKPD

Figure 7. Dashboard Design

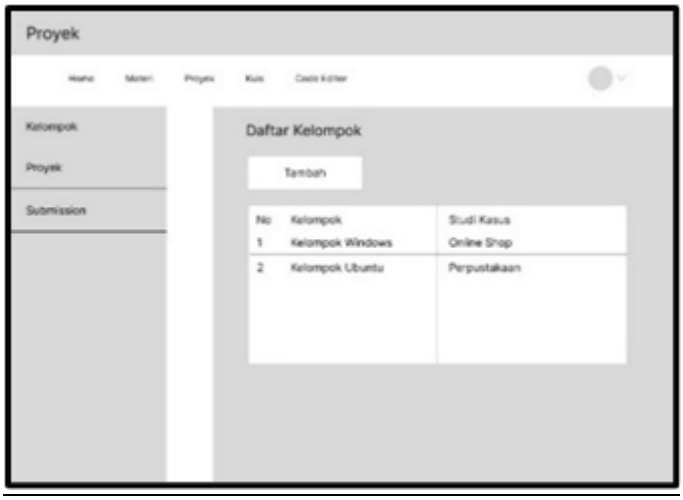

Figure 8. Project Management

3.1.3. Development

Web Based E-LKPD was developed using PHP and Laravel framework. Figure 7 shows project management page. Students will choose a group. A group with more than five members cannot accept a new member.

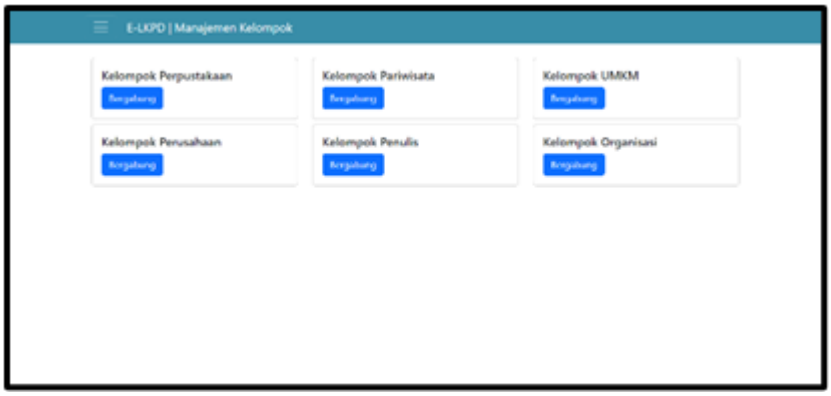

Figure 9. Project Management

Figure 8 shows submission page. Students can make one submission per group.

Figure 10. Submission Page

3.1.4. Implementation

The website-based E-LKPD that has been developed and tested for validity will be implemented at SMKN 1 Cerme for 30 students in grade XI TKJ 2. E-LKPD can be accessed through

https://elkpd.my.id. The product was tested by giving a test in the form of practical questions on Client-side Scripting material. Students were given an overview of case studies that occur in society. One example is that students were asked to create a website to promote a library in a city where there are few people interested.

3.1.5 Evaluation

This stage aims to evaluate the quality of the product. Evaluation is carried out using a questionnaire given to the validator. When validating the media, the researcher received an evaluation to add a website guideline for students and teachers so that users could operate the website easily. When validating the material, there were ineffective sentences and too long-winded, researchers were also asked to add videos to make it easier for students to use the audio-visual learning method.

3.2 Validation Result

Validation is performed once the media and supporting materials have been produced. Validation aims to assess eligibility according to predetermined criteria. The validation test in this study was carried out to test the feasibility of media, materials, teaching modules, and pretest-posttest questions. The following are the validation results obtained.

Table 3. Validation Result

Validation Assessment	Validity	Description
Teaching Module	87%	Very valid
Media	92%	Very valid
Learning Material	93%	Very valid
Test	89%	Very valid

3.3. Psychomotor Test Result

The scores from both the pretest and posttest were evaluated using the following assessment criteria: (1) project preparation, (2) final outcome, (3) time management, and (4) teamwork. The score was calculated using the formula:

$$Score = \frac{total\ score\ obtained}{total\ maximum\ score}\ x\ 100$$

Subsequently, the average score was determined. The average posttest score was **83.8**, which is notably higher than the pretest average of **63.3**.

3.3.1. Normality Test

The normality test is calculated using the Shapiro Wilk formula because the number of samples is less than 100. If the significance value < 0.05, the data is not normally distributed. On the other hand, if the significance value > 0.05, then the data is normally distributed.

The results of the normality test of the posttest value showed a significance of 0.179. It can be concluded that the data is normally distributed.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.126	30	.200*	.948	30	.153
Posttest	.136	30	.163	.951	30	.179

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 11. Normality Test

3.3.2. Hypothesis Test

The hypothesis test produced a significance value of **p < 0.001**, which is below the standard significance level of 0.05. As a result, H_0 was rejected and H_1 accepted, indicating that there is a significant improvement in students' competency in *Client Side-Scripting* following the implementation of the website-based E-LKPD with the Project-Based Learning approach.

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Pretest - Posttest	-20.46667	4.47008	.81612	-22.13582	-18.79751	-25.078	29	<,001	<,001

Figure 12. Hypothesis Test

4. Conclusions

Based on the results of the data analysis carried out, it can be concluded that:

1. A website-based E-LKPD was designed using the Project-Based Learning model for use in the *Web Programming* subject. The developed media underwent validation, resulting in the following percentages: **media validity at 92%**, **material validity at 93%**, **pretest-posttest question validity at 89%**, and **teaching module validity at 87%** all falling within the *very valid* category. Based on these results, the overall average validity score was **90%**, indicating that the media is *highly suitable* for use in the learning process.
2. The application of website-based E-LKPD with the Project-Based Learning method was effective in improving students' competency. The Paired Sample T-Test analysis produced a significance value of < **0.001**, leading to the rejection of H_0 and acceptance of H_1. These results demonstrate a statistically significant improvement in students' competency following the intervention.

4.1. Suggestion

Based on the results, the following suggestions are expected to be beneficial:

1. E-LKPD can be used by teachers in Web Programming subjects. Users are advised to use a computer or laptop to get the best learning experience.
2. The media can be further developed by teachers to include more advanced materials, such as JavaScript, Server-Side Scripting, or other specialized topics in Web Programming.
3. For future researchers, it is hoped that they can incorporate several features to enhance the learning process, including a learning process tracker, cognitive tests, and live chat discussions related to project-based learning.

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