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Development of a Web Based Learning Media Using HTML and CSS in the Subject of Programming Engineering, Microprocessors, and Microcontroller

Arum Setyowati, Muhammad Fikri, Jusuf Bintoro
Education Electronics Engineering Study Program, Universitas Negeri Jakarta
Jakarta, Indonesia
muhammadfikri135@gmail.com

***Abstract*— Web based learning media uses HTML and CSS in the TPMM class X Mechatronics subject at SMKN 69 Jakarta. The research was developed using the Visual Studio Code application with HTML and CSS programming which can be accessed on the website so that students can understand the material well. The aim of this research is to develop Web Based Learning media using HTML and CSS in TPMM subjects and determine the level of feasibility of Web Based Learning media using HTML and CSS in TPMM subjects based on the results of assessments by instructional design experts, media experts, material experts and class X mechatronics students at SMKN 69 Jakarta. The research method used in this research uses Research and Development (R&D) with the ADDIE development model which is limited to three stages, namely Analyze, design and development. The final product produced is a website that has been validated by instructional design experts, media experts and material experts, and has been tested on X mechatronics students at SMKN 69 Jakarta. The feasibility test results by instructional design experts were 97.91%, media experts were 83.82%, material expert 1 was 80% and material expert 2 was 87.25%. Assessments by students in individual trials obtained an overall average percentage of 82.01% and in small group trials obtained an overall average percentage of 84.56%. So that Web Based Learning media using HTML and CSS in TPMM subjects as a whole is very suitable for use by students in learning activities.**

***Index Terms*— Learning Media, *Web Based Learning*, TPMM**

I. INTRODUCTION

The development of science and technology is increasing so rapidly, that humans must be able to keep up with developments in science and technology. Science and technology are always ongoing and learning media have an important role in helping learning, because these activities can help convey the material being delivered, with the existence of this media it is hoped that it can help convey the material. The media can help teaching staff in conveying certain words or sentences and even the abstractness of the material can be made concrete by the presence of learning media.

Web based learning is a distance learning system based on information technology via *web pages* [1]. Programmed Learning is a learning system in which the use of materials is programmed to achieve educational goals. Meanwhile, individual learning is a learning system that takes into account the needs and characteristics of students [2]. So, *Web Based Learning* is a learning system that uses *Web Based Technology* with the aim of meeting learning needs according to the characteristics of students. *Web-* based learning presents learning material displayed via *the web browser*, and the actual learning material is provided in *web format*. In a journal written by Moch. Sukardjo and Lipur Sugiyanti (2017) entitled *Usability Criteria for Multimedia Interactive Learning Based on Websites*, that there are 3 things that need to be considered when creating an educational website, namely:

1. Can be used to achieve certain goals with effectiveness, efficiency and satisfaction in the context of use
2. The use of the web as an interface and an easy way to learn
3. Users will return to websites that provide useful, easy-to-use information and are presented in a well-structured layout.

From the results of observations carried out from July to November 2021, due to the implementation of restrictions on community activities, schools have to implement a *hybrid system*, only half of the students come to school and half of the students study from home or online. It is also known that the learning process for technical subjects programming, microprocessors and microcontrollers are less than optimal with textbooks not being provided and students having to search for material on the internet, so that in the learning process there is no detailed and clear reference to serve as a guide in the process of learning activities. Based on observations made, the teaching staff used learning media that did not attract the attention of students, so that the material provided when the teaching staff were giving the material was not optimal, so that students could not follow the lesson well when the teaching staff asked a question.

Researchers distributed the questionnaire on July 13 2022, the questionnaire was filled in by 19 students out of a total of 35 students. The results of distributing a questionnaire to find out whether the learning media used such as Power Point and Google Classroom to understand learning material on programming techniques, microprocessors and microcontrollers can help the learning process. From the results of the questionnaire regarding Power Point learning media, it shows that 52.63% (10 students) Power point learning media is not enough to understand the material and 36.84% (7 students) choose neutral, where it is very likely that these students also

have difficulty understanding the material with the learning media used, then 10.52% (2 students) choose not to agree if the learning media used is not sufficient to understand the material. From the results of the questionnaire regarding Google Classroom learning media, it shows that 47.38% (9 students) Google Classroom learning media is not enough to understand the material and 47.38% (9 students) choose neutral, where it is very likely that these students also have difficulty in learning. understand the material with the learning media used, then 5.26% (1 student) chose not to agree if the learning media used was not enough to understand the material.

From the results of distributing questionnaires to students at SMKN 69 Jakarta, it is clear that the learning media used such as Power Point and Google Classroom are still not enough to understand the material on programming techniques, microprocessors and microcontrollers. Therefore, researchers are interested in proposing the title "Development of Web Based Learning Media Using HTML and CSS in Programming Engineering, Microprocessor and Microcontroller Subjects."

II. BASIC THEORY

A. Development of The ADDIE Approach

The ADDIE model is an abbreviation of *Analyze, Design, Develop, Implement* and *Evaluate*. The ADDIE model is a learning model that is often used, ADDIE is a product development concept. The ADDIE model is a general learning model and is suitable for use in development research. When used in development, this process is considered sequential but also interactive [3]. According to Benny A (2009: 128 – 132), there is one learning design model that is more generic in nature, namely the ADDIE model shown in figure 2.1.

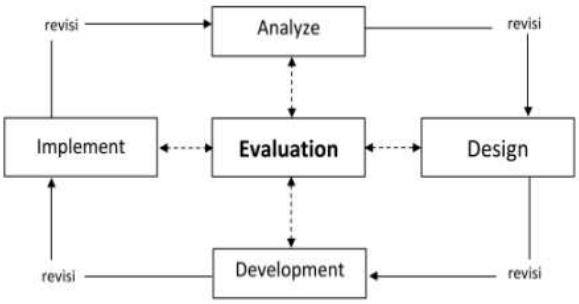

Fig. 1. ADDIE Research Method

1) Analyze

Analysis is collecting data regarding information needs. The analysis stage is used to determine the need and availability of learning media for the development of student education. In the analysis stage, determine media needs, availability of learning media, material analysis and target learning objective analysis

2) Design

This stage is a systematic process that starts from setting learning objectives, designing teaching and learning activities, designing learning tools, designing learning materials and tools for evaluating learning outcomes. Learning design is carried out to be an effective and interesting activity.

3) Development

Development is the process of design becoming real. The development stage carries out trials before being implemented (implementation). The development step includes activities to create, provide and modify teaching materials in order to achieve predetermined learning objectives.

4) Implement

This stage is the stage of conducting research using learning media on a large scale. After the learning media is developed at the *development stage*, and the learning media has been declared valid, after being declared valid by experts, the learning media can be applied in the classroom.

5) Evaluate

The evaluation stage aims to determine whether the objectives of the learning media are in accordance with the targets to be achieved. The evaluation stage determines which learning media need to be developed to increase project efficiency and success rate.

B. Intructional Media

Learning media according to the Latin word media means between or intermediary, whereas learning is a process that helps students and students learn so that students can get the knowledge they are looking for. According to many experts, there are many opinions about the meaning of learning media. The researcher. Reiser views learning media as physical equipment to present learning to students[4]. This definition emphasizes that any physical equipment used to present learning, whether textbooks, visual equipment, audio, computers, or other equipment, is classified as learning media. The learning media in question include traditional media consisting of chalk, handouts, diagrams, slides, overheads, real objects, and video recordings, or films and cutting-edge media such as computers, DVDs, CD-ROMs, the Internet, and interactive video conferences. [5]. According to H. Malik (1994) in [5], the definition of learning media is anything that can be used to transmit messages (learning materials), so that it can stimulate attention, interest, thoughts and feelings.

According to the definition above, it can be concluded that learning media is learning that uses tools as a medium for delivering material to make it easier for teaching staff to deliver material to students. Learning media were widely used in ancient times, such as media that could be used such as whiteboards, practice tools and games, with increasingly advanced times, namely technology becoming more advanced, many learning media have emerged with many new variations using computer or internet technology so that Students are not bored with the way the material is delivered, students can tell them that technology is now increasingly advanced and can be utilized.

Learning media is used during the learning process, using learning media can create interest and desire within students to learn. Learning media must be used effectively and efficiently, learning media is used by teaching staff to convey learning material in a more interesting way that helps students like the material that will be presented. Learning media can also help improve understanding, present data in an interesting and reliable manner.

C. Web Based Learning

Web based learning or also known as Web based learning with the application of electronic or internet learning (*E-Learning*), *E-Learning* is the use of various electronic media for learning purposes ranging from additional functions in

conventional classroom learning to replacing face-to-face learning in online form [6].

Web based learning media can be said to be a form of programmed and individual learning. Programmed learning is a learning system in which the use of materials is programmed to achieve educational goals. Meanwhile, individual learning is a learning system that takes into account the needs and characteristics of students [2].

Web based learning or web-based learning presents learning material displayed via a web browser and actual learning material is sent or entered into web format. Web-based learning is divided into three types, namely: *Web based instruction, web enhanced instruction,* and *web supported instruction. Web based instruction* is a form of distance education where learning is delivered completely online. In *web-based instruction,* students and teaching staff never have face-to-face interactions or meetings, all learning materials and exams are sent via the web. *Web enhanced instruction* is a form of learning where some of the material or class sessions are sent or conducted via the web and others are taught face-to-face. *Web supported Instruction* is learning that is carried out in a traditional, face-to-face way in regular classes, but with additional tests or online activities.

D. HTML and CSS

HTML (*Hypertext Markup Language*) is a protocol used to create a web document format that can be read in browsers from various computer platforms. It is called *Hypetext* because the HTML script can make text into a link that can move from one page to another just by clicking on the text. And it is also called *Markup Language* because HTML scripts use ' *Mark* ' signs to mark parts of the text so that the text has a certain function (Jubile, 2019).

The nature of the HTML language is client script, where the document can be opened on a stand-alone computer which does not require a server to be able to display it in a browser. An HTML document is a file with the extension .htm or .html, where the HTML language is composed of formatted tags (S ugiri, 2007). HTML is a standard language used to display website page content [8]. According to (Ilham, 2014) HTML is a standard display language used to display web documents, here are several things that HTML can do:

1. Control the display of web pages and their content.
2. Publish documents online so they can be accessed by the whole world.
3. Create online forms that can be used to handle registration and online transactions.
4. Add objects such as photos, audio and video.

CSS (*Cascading Style Sheets*) is a way to separate content from layout in created web pages. CSS introduces templates in the form of styles to create and make it easier to write designed pages. CSS is able to create pages that look the same at different visitor screen resolutions without the need for tables. By using CSS, it will be easier to manage the overall appearance of the entire web by simply replacing the attributes or commands in the CSS style without changing one by one the attributes of each element on the site being created (Sugiri, 2007).

CSS can separate the layout from the contents of the document, CSS can determine a more powerful layout than HTML, here are the advantages of CSS:

1. Determines the appearance of web pages in a place without going back to the HTML script.
2. Easily change the appearance and appearance of web pages even after the web pages have been created.
3. Determine font size and similar attributes with the same accuracy without limitation.
4. Determine the content down to the pixel size of each web page accurately.
5. Redefine all HTML tags.
6. Determine the desired style for a link.
7. Determine the layers that can be positioned above other layers.
8. pages will load faster.

The downside is that CSS only works in browser version 4 or above, but all browsers now support CSS. So, the shortcomings in displaying sites that have been created in CSS can be minimized.

III. METHODOLOGY

A. Place and Time of Research

The research carried out was carried out at SMKN 69 Jakarta at Jalan Swadaya Rawabadung No.32-66, RT.008/ RW.007, Kel. Jatinegera, District. Cakung, East Jakarta City, Special Capital Region of Jakarta 13930, July 2021 to August 2023.

B. Developments Methods

The development method used in this research is the development of the ADDIE model. This research uses 3 research stages of the ADDIE development model, namely the Analysis stage, Design Stage and Development Stage.

This analysis stage is carried out in order to analyze potential problems that occur to students when learning programming, microprocessor and microcontroller techniques. Specifically with the learning media used during learning activities, analysis obtained from observations of learning, questionnaires about the learning media used and student learning outcomes.

1) Design

At the design stage, it is necessary to create a flowchart design, prepare material, questions, answers and design website products.

2) Development

At the development stage, the product that has been designed will be created and developed, the resulting product is in the form of learning media that has been validated by several experts. In the validation stage, the learning media that has been developed will be assessed by experts using a questionnaire as a research instrument. The research instrument was assessed by instructional design experts, media experts, material experts and students. This research instrument uses a Likert scale assessment system with 4 answer choices, namely " STRONGLY AGREE ", " AGREE ", " DISAGREE " and " STRONGLY DISAGREE ", with a measurement scale of 4,3,2,1.

C. Data Analysis Technique

Data analysis uses the average score resulting from feasibility tests by instrument experts, instructional design experts, media experts, material experts, as well as respondents from SMKN 69 Jakarta teaching staff and SMKN 69 Jakarta students. The results obtained from the average of these questionnaires will be used as the basic value of the quality of the *Website application.*

Data analysis techniques using Quantitative analysis technique using a questionnaire, filling out the questionnaire using Sugiyono's book as a reference with a Likert scale assessment, to measure the attitudes and opinions of the questionnaire given by the researcher, the Likert scale uses 1-4 options, namely strongly agree, agree, disagree, strongly disagree. Perception of a person or group, for calculations using the percentage of success with a formula calculation [9]:

$$P = \frac{S}{N} \times 100\%$$

Information:
P = Success
S = Total Value Obtainer
N = Maximum Number of Data Values

The score weight for each assessment aspect can be seen in table 3.1 assessment scores [9] below this.

TABLE I. Assessment Score

No.	Alternative Answers	Score Weight
1	Strongly agree	4
2	Agree	3
3	Don't agree	2
4	Strongly disagree	1

The average score scale of validation tests by experts and students is the basis for assessing the quality of learning *websites* developed based on a Likert scale. Using a Likert scale, you can find out whether the learning *website that is being developed* is appropriate or not. The score can be seen from the interpretation score referred to in [9] in table 2 Interpretation Score:

TABLE II. Interpretation Score

Percentage	Interpretation
0% - 25%	Not really worth it
26% - 50%	Not feasible
51% - 75%	Worthy
76% - 100%	Very worthy

IV. RESULT AND ANALYSIS

The learning media product developed by researchers is the development of Web based learning media. This website development uses Visual Studio Code *software* with HTML and CSS programming and has been completed. Website-based learning media for Programming Techniques, Microprocessors and Microcontrollers containing materials, competency tests, power points and learning videos. Students can access this website's learning media in a browser using the internet network without having to install the application on electronic devices such as *cellphones* and laptops.

This research is an ADDIE development model with three stages of the research process, namely *Analyze*, *Design* and *Development*. At the *Analyze stage*, researchers analyzed students' needs in the subjects of programming techniques, microprocessors and microcontrollers by observing during learning and distributing questionnaires to students. In the *Design* Stage, researchers create flowcharts, prepare materials and design learning media. After carrying out the design stage, the final stage is *Development*. At the development stage, researchers began to design learning media in the form of a website and began uploading website data pages to web hosting at github.io, the website can be accessed by clicking the following link: https://ccifk1.github.io/Website-Media-Pembelajaran -TPMM

After the website learning media was developed, the researchers conducted a feasibility test with experts. Researchers compiled instruments that would be used by instructional design experts, media experts, material experts, and students. Researchers validated the instruments for experts and students with instrument experts.

The learning media produced in this research is website-based learning media in the subjects of programming techniques, microprocessors and microcontrollers which are accessed using the internet network via mobile phones or laptops. The learning media website has several Menu displays, namely home, instructions for use, KI KD, competency test, material, developer and contact the developer, on the KI KD menu there is a learning implementation plan, the competency test has practice questions with 10 questions in each material, and the material menu There are text materials, power points and learning videos that can be accessed by students to help them understand the material more easily.

In carrying out this research, there were limitations in the process, namely the ADDIE development model that researchers used only reached the *Development stage*. Research was only carried out at the stage of individual trials (*one to one*) and small group trials (*Small Group*). Meanwhile, field trials *have* not been carried out due to limited research time.

A. Instructional Design Expert Fasibility Test Results

The instructional design instrument consists of 12 statement items based on the results chosen by instrument experts.

The results of the feasibility test by instructional design are shown in table 3 below.

TABLE III. Instructional Design Feasibility Test Results

No.	Aspect	Maximum Score	Test Result Score
1.	Learning Objectives	12	12
2.	Learning Materials	20	20
3.	Instructional Media	16	15
Total Maximum Score and Test Results		**48**	**47**
Percentage		**97.91%**	
Eligibility Category		**Very Worth It**	

B. Media Expert Eligibility Test Results

The media expert instrument consists of 17 statement items based on the results of the instrument expert's choice. The results of the feasibility test by media experts are shown in table 4 below.

Table 4. Feasibility Test Results by Media Experts

No.	Aspect	Maximum Score	Test Result Score
1.	Media Accessibility	16	15
2.	Design	40	32
3.	Quality	12	10
Total Maximum Score and Test Results		**68**	**57**
Percentage		**83.82 %**	
Eligibility Category		**Very Worth It**	

C. Material Expert Feasibility Test Result

The material expert instrument consists of 10 statement items based on the results chosen by the instrument expert. The results of the feasibility test carried out by 2 material experts are shown in table 4 and table 5 below.

TABLE 5. Feasibility Test Result by Material Experts 1

No.	Aspect	Maximum Score	Test Result Score
1.	Material	20	16
2,	Expediency	20	16
Total Maximum Score and Test Results		**40**	**32**
Percentage		**80%**	
Eligibility Category		**Very Worth It**	

Table 6. Feasibility Test Results by Material Experts 2

No.	Aspect	Maximum Score	Test Result Score
1.	Material	20	18
2.	Expediency	20	17
Total Maximum Score and Test Results		**40**	**35**
Percentage		**87.25%**	
Category		**Very Worth It**	

D. Student Trial

Testing on students was carried out in two stages of testing, namely individual testing (*one to one*) and small group testing (*small group*). The questionnaire used by students has been validated by instrument experts. The student instrument consists of 19 statement items with the highest score being 4 and the lowest score being 1. The results of individual trials for class X SMKN 69 East Jakarta are shown in table 7 below.

TABLE 7. Individual Student Trial Results

No	Learners	Assessment Aspects					
		Media		Material		Learning	
		Max Score	Test Results	Max Score	Test Results	Max Score	Test Results
1.	Sinta	36	29	20	19	20	17
2.	Hassan	36	29	20	16	20	15
3.	Rafael	36	30	20	17	20	15
Amount		**108**	**88**	**60**	**52**	**60**	**47**
Percentage		**81.48%**		**86.66%**		**78.33%**	
Information		**Very Worth It**		**Very Worth It**		**Very Worth It**	
Overall average		**82.01 % (Very Worthy)**					

After carrying out individual trials (*one to one*), then trial research will be carried out for small groups *with* 15 class X mechatronics students at SMKN 69 Jakarta. The following results from small group trials with students are shown in table 8.0

Table 8.. Results of Small Group Student Trials

No	Learners	Assessment Aspects					
		Media		Material		Learning	
		Max Score	Test Results	Max Score	Test Results	Max Score	Test Results
1.	Arva	36	30	20	16	20	17
2.	Nabilah	36	34	20	17	20	15
3.	Holy	36	33	20	18	20	17
4.	Aryan	36	34	20	17	20	18
5.	Shaskya	36	29	20	15	20	15
6.	Keisha	36	29	20	16	20	17
7.	Rifqi	36	34	20	17	20	18
8.	Lovely	36	34	20	18	20	18
9.	Samuel	36	27	20	13	20	20
10.	Star	36	27	20	15	20	17
11.	Rizky	36	30	20	16	20	16
12.	Achievement	36	29	20	15	20	18
13.	Faizal	36	34	20	20	20	17
14.	Priest	36	27	20	18	20	17
15.	Ahmad	36	27	20	20	20	15
Amount		540	458	300	251	300	255
Percentage		**84.81%**		**83.66%**		**85%**	
Information		**Very Worth It**		**Very Worth It**		**Very Worth It**	
Overall average		**8 4,56 % (Very Eligible)**					

V. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

Based on the results of the research carried out, the results of research on the development of *Web based learning media* using HTML and CSS in the subjects of programming techniques, microprocessors and microcontrollers are as follows:

1. *web-based learning* media on microprocessor and microcontroller programming engineering subjects was developed using the ADDIE development model. However, the development of learning media for this website only reached the *development stage*.
2. The results of the feasibility test by instructional design experts obtained an assessment percentage of 97.91%, media experts obtained an assessment percentage of 83.82%, material expert 1 obtained an assessment percentage of 80% and material expert 2 obtained 87.25%, Participants' trial assessment education was carried out in 2 stages, the first was individual trials (one to one) which obtained a percentage of 82.15%, the second was small group trials (small group) which obtained a percentage of 84.49%.

web based learning media developed as a whole is very suitable for use by students in learning activities.

B. Suggestion

Based on the conclusions and implications of this research, the researcher conveys several suggestions as follows:

1. This website's learning media can be converted into an application that can be used offline.
2. The display of learning media can continue to be developed with suggestions from website users to make the display of learning media more attractive.

Learning media can be added with an account feature that is integrated into email so that notifications of newly added material can be conveyed to students.

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