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Developing Virtual Web as Learning Media for Web Programming in SMK

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ABSTRACT

The purposes of this research are (1) to generate virtual web as learning media subject specifically for web programming, (2) to find out the appropriateness of the product developed as a learning medium, and (3) to determine the effectiveness of the use of the e-learning for web programming subject. This research was through three stages: (1) the initial product development refers to the steps developed by Ivers& Barron namely Decide, Design, Develop, and Evaluate, (2) the testing ofthe product refers to the design of the test developed by Alessi&Trollip namely alpha testing, beta testing, and validating, and (3) the test ofthe effectiveness of using virtual web for the subjects of web programming by comparing the gain of pretest / posttest experiment group at XA TKJ class that uses virtual web, and the control class XB TKJ who do not use virtual web. Technical data analysis to the eksperiment product (test) using descriptive statistical in the form of statement very good, good, less good, less, much less which is converted in to quantitatif data at scale 5. The average result assesment categorizing ussing the assesment criteria by Widoyoko.The result of this research is a e-learning which is used speciallyfor web programming subject.The results of alpha testing phase, beta testing and summative test show that the e-learning is in the category of "very good" that deserves to be used. Effectiveness test results through a pretest / posttes show an increase in the mean score of the experiment class of 37.50 which is greater than the control class that the increase only amounted to 30.16, it can be concluded that there is an increase of learning outcomes for using e-learning.

Keywords: *virtual web, e-learning, web-based learning, teaching media, web programming*

INTRODUCTION

The birth and development of e-learning in the world of education are expected to be able to increase effectiveness and efficiency as well as overcome three major problems of education, especially in Indonesia as written in the National Education Strategic Plan (Renstra) 2005-2009, namely: (1) equity and access to education; (2) quality, relevance and competitiveness of graduates; and (3) governance, accountability and public image of education. The use of e-learning is very necessary in developing the education sector in Indonesia, especially with regard to the issue of equity and access to education. Shmerling and Linda from the University of Massachusetts, USA have researched online education, the results of their research show that most students tend to have a high level of comfort (99%) in using a Learning Management System (LMS).

Vocational High School (SMK) is an education at the secondary level that prioritizes the development of student skills. The skills possessed are the result of learning at school and in the industry. Adiati A. Sudrajad in Kuswana suggests that since 1984 the development of areas of expertise in the vocational secondary education environment includes six groups, namely: (1) industrial technology group; (2) agriculture and forestry groups; (3) business and management groups; (4) tourism groups; (5) community welfare groups; and (6) arts and crafts groups. In SMK there are majors related to technology, including RPL (Software Engineering), TKJ (Computer and Network Engineering), and Multimedia. Each of these majors has web programming subjects. The teaching and learning process for web programming subjects certainly discusses how to build a website, both building static and dynamic websites.

A Static web is a web whose contents do not change. The technology used for the static web is a type of Client-Side Scripting such as HTML, Cascading Style Sheet (CSS). Changes to the content/data on a static web page can only be done by changing the contents directly in the raw web file, for example, if a web page is created using an HTML script, then the content changes are made by opening the raw web document file (with the extension .html), and then immediately change it. Examples of static web include a company profile web that only uses flash animation or HTML, and a collection of animated product webs. A Dynamic web is a type of web whose content and contents can change at any time. This is because dynamic web uses a database whose contents are taken from the database and can be changed such as adding data, editing data, and deleting data by web admins. Nguyen suggests the use of Dynamic Scripting Language in the development of dynamic websites where the use of several programming languages in the web development process (HTML5/CSS3/JavaScript/JQuery/Perl/Ruby/Phyton) will result in a dynamic website platform and compatible with desktops, laptops, and mobile devices.

From the observations during the pre-survey at 4 schools in Kab. South Minahasa namely SMK N 1 Amurang, SMK N 1 Tumpaan, SMK N 1 Motoling, and SMK N 1 Tareran, there are several problems faced by each school to support the teaching and learning process related to web programming. These problems include: The school does not subscribe to the internet network, does not have competent teachers in web programming, does not have adequate computers to support the learning process of web programming and the presentation of material only uses presentation media.

The Utilization of websites and e-learning for SMK in the South Minahasa Regency is still very lacking, this can be seen from the fact that SMK N 1 Tumpaan and SMK N 1 Motoling only

have school blogs utilizing the blogspot.com feature, each of which is located at http://smkneg1tumpaan.blogspot.com/ and http://smkmotoling. blogspot.com/. For SMK N 1 Amurang, they had a website but the hosting and domain were not extended. For SMK N 1 Tareran does not have a school website. All of the schools listed above have never used or developed e-learning. In fact, the existence of e-learning will be very helpful to condition students to learn independently as stated by Rusman that students can learn according to their own characteristics because web-based learning (e-learning) makes learning individual..

During the learning process of web programming when observing, often arise such as, there are some students who have difficulty in writing program codes due to the use of text editors that do not support the details of writing programs. Errors in writing periods or commas greatly affect the results of the program. The presentation of material that only uses presentation media makes students disturbed and asks the teacher a lot of questions regarding program writing. According to Rudyanto, in general, there are two types of web programming, namely Client-Side Scripting (CSS) and Server Side Scripting (SSS). The difference in this type of script is in how it works and the processing is carried out whereas a web-based application is an application whose architecture is Client-Server based. This means that web applications can be processed on the client-side and on the server-side.

Sheson gives an opinion regarding the presentation of web programming material by suggesting that a website that collects excerpts of program codes stored in a database will be a useful resource for web developers. In this case, it can be concluded that Sheson provides a solution that for learning web programming can make the website a learning resource and this is equivalent to what was stated by Hughson in his research stating that Web-Based Education makes a large number of learning resources within the reach of everyone who accesses it. Internet.

The development of school e-learning in general only uses templates that are already available such as Moodle and then modified based on the needs and objectives of the development. However, there are no e-learning templates available that support the web programming learning process. It should be noted that the learning process for web programming is related to writing program codes that are practiced using a text editor. There are also text editors that support writing content in web programming languages and some don't. Notepad and wordpad are standard text editors that can be used for writing program code, but they have the disadvantage of not being able to display an error message when a writing error occurs. Wordpad++ and phpEd are applications that fully support the process of writing program code and are widely used by web programmers.

Based on the problems that occur in the web programming learning process, the researchers developed e-learning as a web programming learning medium and could be used as a Learning Management System template that supports the web programming learning process. This e-learning is named "Virtual Web" which elevates the concept of "learning the web on the web". The e-learning developed is web-based and has two pages, namely the teacher and student pages. The teacher page is a page for teachers to manage the content of e-learning, and the student page is a page for students to log in and learns with e-learning. This e-learning can be used as a virtual class that provides online attendance, presentation of material according to the characteristics of the writing program equipped with a simulator so that the code can be directly tried, online quizzes, online assignments, online study groups equipped with a place to share material, chat rooms, a place for class discussions. , and online exams. Iglesias, et al. Investigated the usefulness of web-based learning and showed that web-based learning systems can provide educational benefits in terms of usage and user satisfaction. Li, et al researched the use of virtual classrooms and showed that giving assignments in virtual classrooms can stimulate students' interest in learning.

The development of e-learning uses the DDD-E development model or Decide Design, Develop - Evaluate (Ivers & Baron, 2002). In general, the Decide stage focuses on determining program objectives and content, the Design stage focuses on determining the program structure and design, and the Develop stage is the process of developing project elements and programming. In this development model, each stage must be evaluated, and if necessary, revised immediately. The final evaluation occurs when the project has been developed. At this stage, the evaluation process is carried out by calculating the average rubric given from each stage starting from the decide stage to develop.

Alessi and Trollip provide an interactive multimedia development model that has three attributes and three phases, each attribute and phase consists of various problems to be discussed and actions to be taken. The three attributes are the standards attribute; ongoing evaluation; and project management. The three phases in the development model are planning, design, and development. Alessi & Trollip's development design can be seen in figure 1.

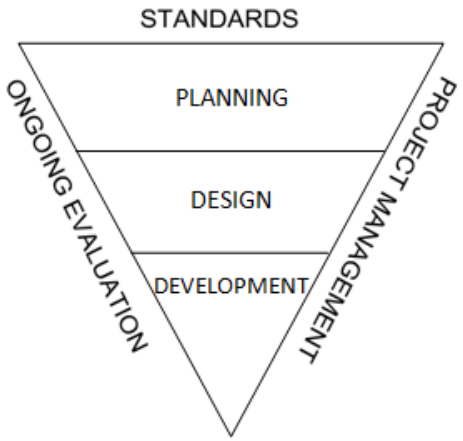


Figure 1. Alessi & Trollip Development Design

The standards attribute is the starting point and the basis of the project to be developed. The ongoing evaluation attributes are an evaluation standard carried out on a project which is only useful if the developer applies it consistently throughout the project. Attribute project management is the stage where the developer exercises precise control over all aspects of project development.

The planning stage is the stage carried out by the developer to determine the goals and directions of project development. The design stage is the stage that relates to the idea of developing initial content, describing the introduction of the program, preparing prototypes, and making flowcharts and storyboards. The development stage is the implementation of the design stage wherein this stage the things that are done are preparing materials, preparing supporting applications for development, making audio and video materials, writing program code, and conducting trials consisting of alpha tests, testing the beta, and implementation. Alpha testing, beta testing, and implementation are carried out after the initial product is completed.

The alpha test is a formal internal test, involving developers with a team, in this case, media experts and material experts. This test is to identify and eliminate problems with products, procedures, conformity with the goals, and the flow of communication from e-learning. The process of collecting data from media experts and material experts is carried out by providing instruments.

The instrument for media experts was developed from the web development assessment rubric proposed by Ivers & Barron (2002) which consists of (a) target visitors; (b) design; (c) technique; (d) presentation of information; (e) interaction, (f) usability, and (g) feedback. The instrument for material experts was developed from a creative guide to developing innovative teaching materials by Prastowo (2015) which consists of the following aspects: (a) material aspects, (b) learning aspects, (c) additional information aspects, (d) feedback aspects. Feedback, and (e) evaluation aspects.

Beta tests are tests that are entirely conducted by students and developers. The beta test was carried out after the revision of the alpha test. Based on the information obtained after the beta test, it is continued with the revision of the final product so that the product is ready to be used in the real class at the time of product implementation/summative evaluation. The aspects assessed at this stage were developed from the concept of web-based learning (Rusman, 2013) which consists of:

(a) clarity of instructions for using media, (b) clarity of learning objectives, (c) clarity of material descriptions, (d) freedom of students in choosing menus/materials, (e) easy-to-understand materials, (f) completeness of materials, (g) The material provided is interesting, (h) the material provided is useful, (i) the quality of the media display, (j) the clarity of the text display, (k) the clarity of the language used, (l) the ease of access to the media, (m) the ease of use of the media, (n) the suitability of the task with the material, (o) the suitability of the quiz/evaluation question with the material, (p) the clarity of the instructions for working on assignments and questions, (q) the media motivates students to learn, and (r) the quality of feedback on the answers/student learning outcomes. Product implementation or summative evaluation is carried out formally to find out whether the product can be used more broadly, outside the situation as the previous test implementation. But the steps and things that are observed are relatively the same as the implementation of the beta test.

Wang from Dakota State University, USA researched the development of e-learning interactivity design and the results showed that the interactivity design of e-learning can change the way people interact with e-learning or others so as to produce a more enjoyable learning process interactive. The existence of e-learning is expected to be useful for students, teachers, schools, and science. Students are expected to be able to make learning anywhere if e-learning is published via the internet, and can learn according to their abilities and interests, as well as exchange ideas or download information related to the subject matter via the internet and share with classmates via e-learning. The benefits for teachers are expected to help the learning process of web programming and increase teacher knowledge about the design of e-learning development systems. E-learning can also add learning media for schools and can be used as an LMS for further e-learning development.

The development research objectives to be achieved are: (1) producing e-learning for web programming subjects, (2) knowing the feasibility of e-learning as a learning medium, and (3) knowing the effectiveness of using e-learning in web programming subjects..

METHOD

This research is included in the R&D procedure because the research results are product-oriented. If e-learning has been successfully evaluated at the initial product development stage with the DDD-E model (Ivers & Barron, 2002), then a trial is carried out using a trial design from Alessi & Trollip namely alpha test, beta test, and test summative or product trials.

Development Method

The development model was used by the researcher in the development and design model developed by Ivers & Barron (2002). This development model is known as 3Ds and E, or DDD-E (Decide, Design, Development - Evaluate). The reason for using this development model is because the DDD-E model is specifically devoted to developing learning, multimedia, and e-learning which will be developed as web-based that supports the placement of multimedia elements such as text, images, sound, animation, and video (Rusman, 2013). The design of the DDD-E development model can be seen in Figure 2.

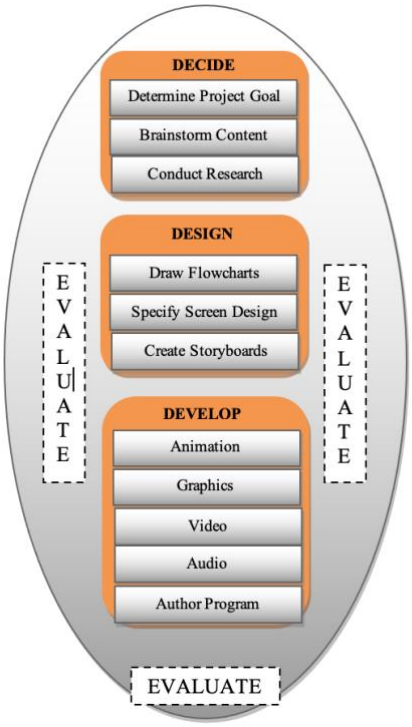


Figure 2. Ivers & Barron DDD-E Development Model

Research Time and Place

This research and development are carried out in stages. The initial product development was carried out from November 2018 to February 2019. While product trials were carried out in March and April 2019. Alpha tests related to media experts and material experts were carried out from 2 March 2019 to 8 March 2019, for the beta test and the summative test was conducted from March 10 to April 29, 2019.

Subject Research

This study used three experimental subjects, namely: (a) 3 students for the beta test were taken from students with high, medium, and low abilities who were selected by the subject teacher; (b) 20 students of class XA TKJ SMK Negeri 1 Amurang as the experimental class; and (c) 20 students of class XB TKJ SMK Negeri 1 Amurang as the control class.

Development Procedure

The DDD-E development model consists of three main stages, namely Decide (determine), Design (design), Develop (development) which is then surrounded by Evaluate (Evaluation) before entering the Final Evaluation which is the last stage in the development of the initial e-learning product. The procedure for developing e-learning can be seen in Figure 3.

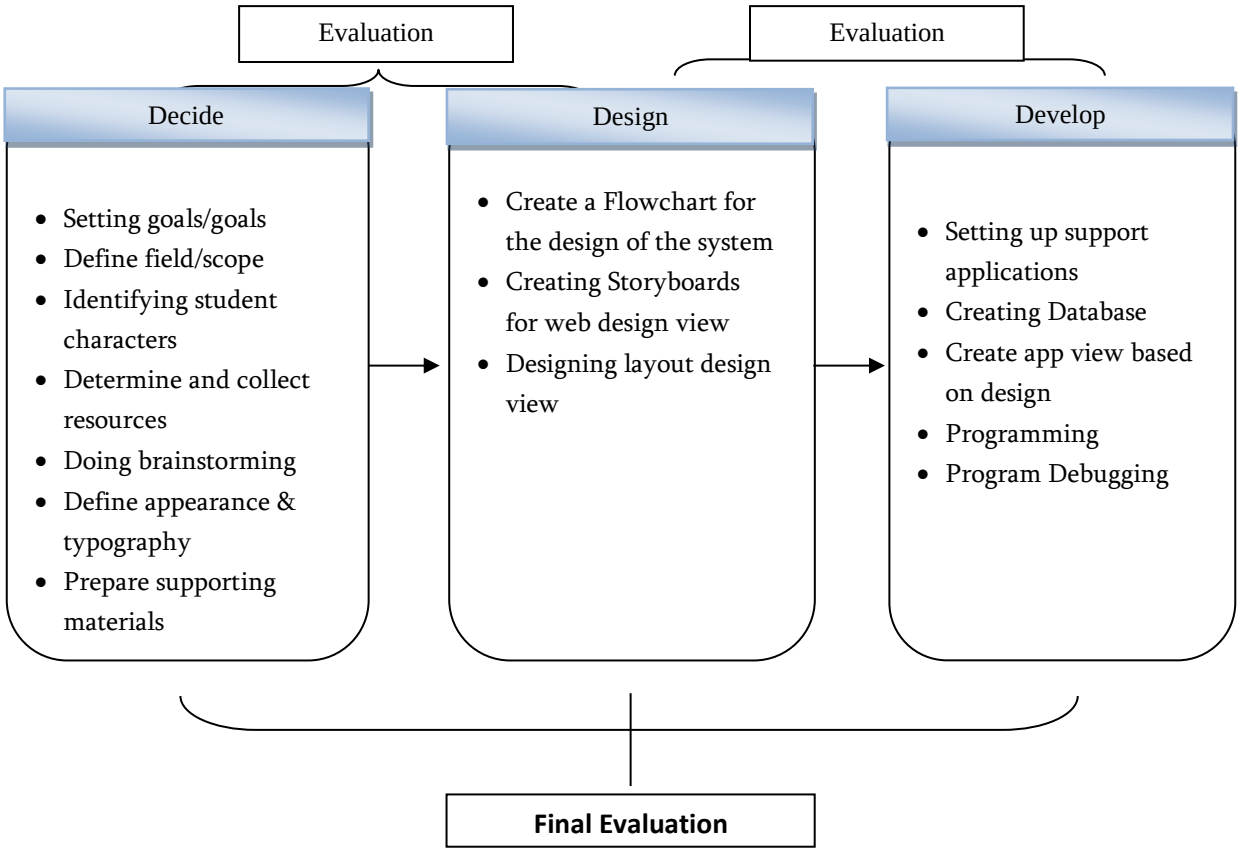


Figure 3. DDD-E Model Adaptation Development Procedure

Data, Instruments, and Data Collection Techniques

There are two types of data generated in this study. Qualitative data were obtained when collecting data for system development needs at the decide stage, namely by interviewing teachers, and laboratory assistants using interview guidelines and distributing student needs analysis questionnaires. Quantitative data were obtained from the results of pretest/posttest and product trials. The pretest and post-test instruments intend to determine the effectiveness of the use of e-learning in the experimental class by comparing the increase in the gain in learning outcomes from the control class. The pretest instrument was given before the first meeting and the posttest was

given at the last meeting. The trial starting with the alpha test was carried out by giving specific instruments to media and material experts, the beta test was carried out by giving the instrument to three students of class XA TKJ who became the control class, and the summative test was carried out by giving the instrument to all students of class XA TKJ as the control class. These instruments had previously been validated by the lecturer.

Data Analysis Technique

In research, R&D did not test the hypothesis. The data analysis technique in this study used descriptive statistics in the form of very good, good, poor, not good, very bad statements which were converted into quantitative data on a scale of 5, with a score of 1-5. The steps in data analysis include: (1) collecting raw data; (2) calculating the average score; (3) looking at the average results of the assessment using the assessment criteria from Widoyoko. See table 1.

Table 1. Assessment Criteria On a 5 Scale

Value	Range	Category
5	> 4,2 s/d 5,0	Very good
4	> 3,4 s/d 4,2	Well
3	> 2,6 s/d 3,4	enough
2	> 1,8 s/d 2,6	Not good
1	1,0 s/d 1.8	Very Not Good

The assessment reference above is used to determine the eligibility criteria for the developed e-learning product. The developed e-learning product can be said to be feasible as an e-learning web programming subject if the results of field trials are at least included in the "Good" criteria.

Analysis of e-learning in improving student learning outcomes will be carried out by comparing the value of student learning outcomes (posttest), between classes that use e-learning media and classes that use presentations. The assessment reference will see the gain from the results of the pretest and post-test of the two classes (Hake, 1998) whether e-learning is able to increase the post-test score of the pretest when compared to the post-test results of the class pretest using presentations. Because the material provided is in the form of theory and practice, the practical value will be added in the posttest for data analysis of student learning outcomes.

RESULTS AND DISCUSSION

Early Product Development Results

The result of the initial product development using the DDD-E development model is an e-learning product. The development process starts from the decide stage which consists of (1) determining development goals; (2) determine the method of presenting the material; (3) determine teaching tools; (4) analyzing the characteristics of students and teachers; and (5) analyzing web programming learning support facilities. The development then proceeds to the design stage by making flowcharts of teacher and student pages. See Figure 4.5. Teacher and student page screen design. See Figure 6.7. Storyboard one of which can be seen in Figure 8.

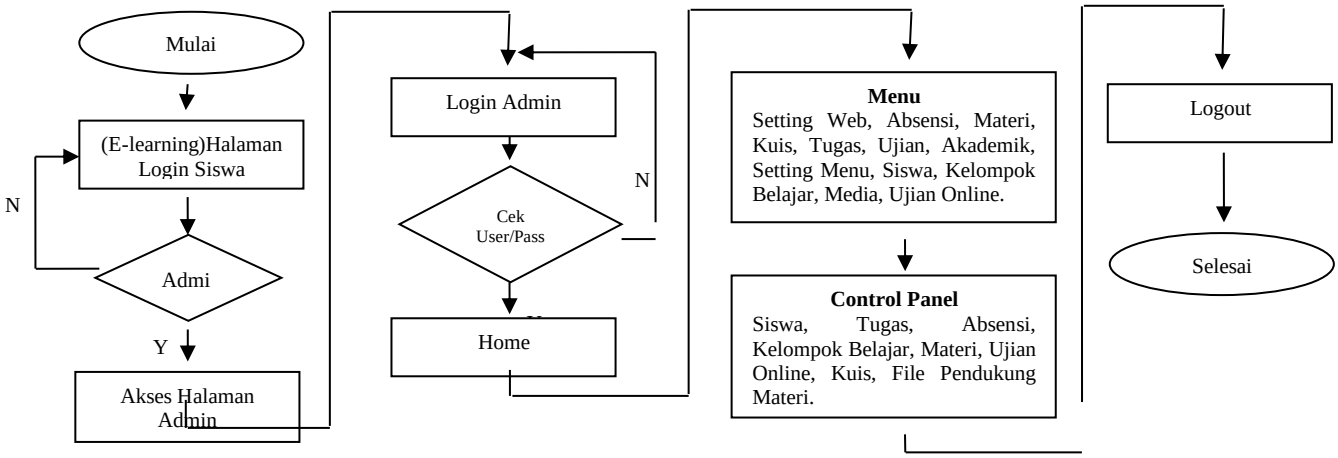


Figure 4. Flowchart of Teacher's Page

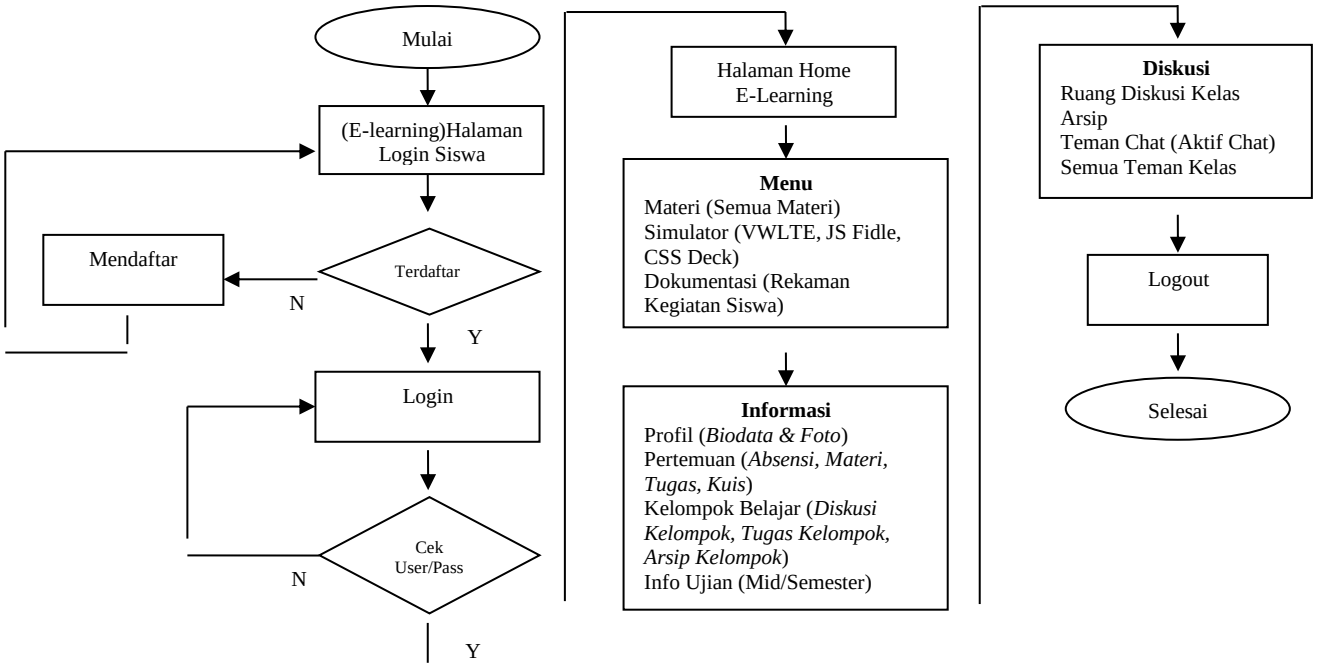


Figure 5. Student Page Flowchart

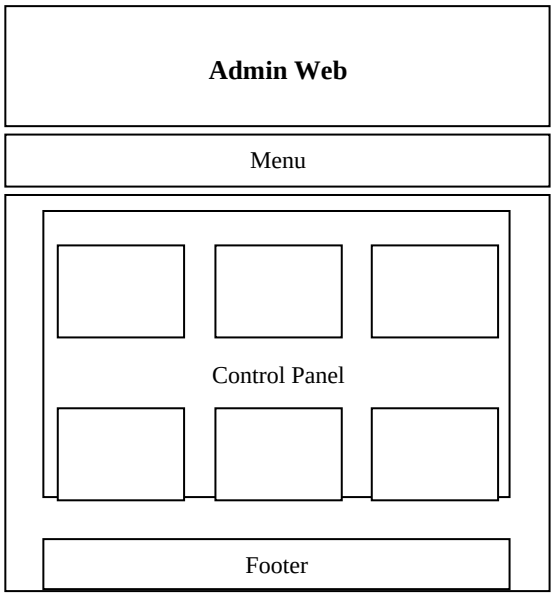
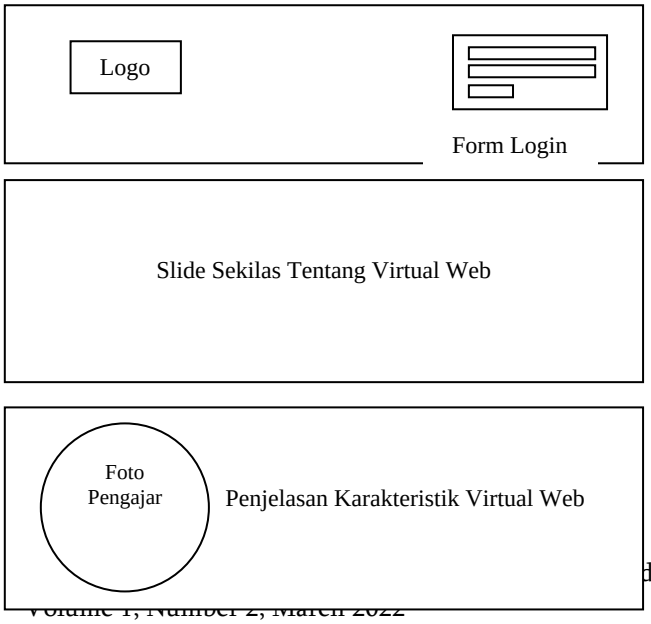


Figure 6. Teacher's Page Screen Design



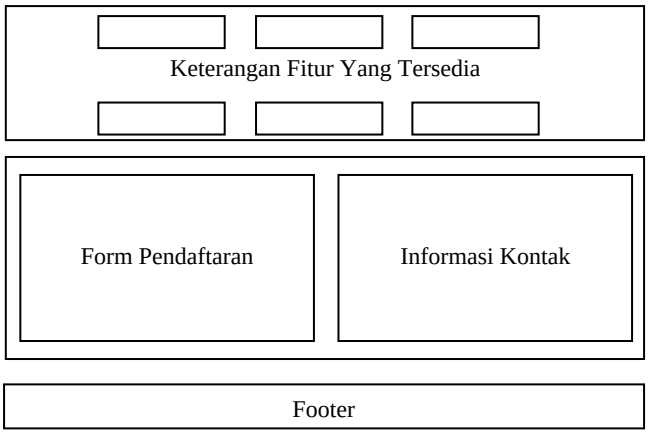
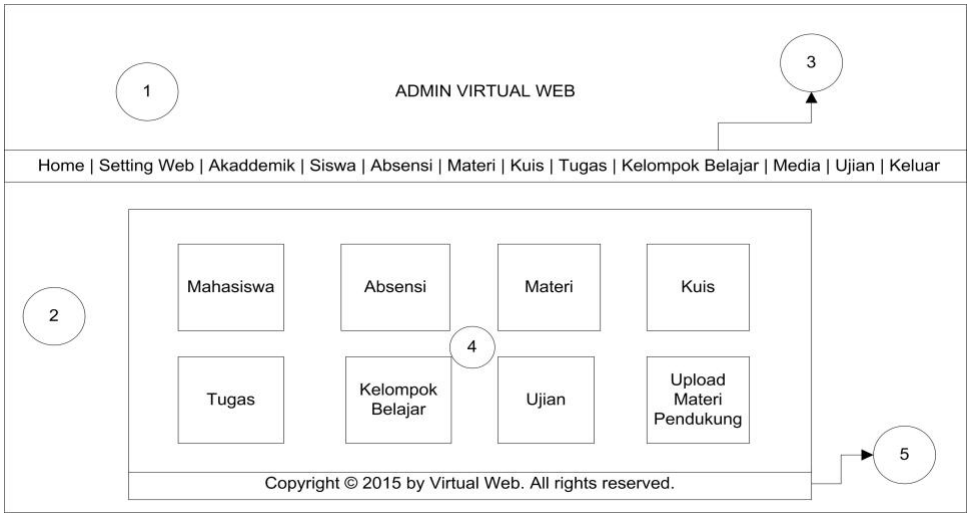


Figure 7. Student Page Screen Design

VIRTUAL WEB STORYBOARD			
Halaman	: Admin	No Storyboard	: 2
Keterangan	: Modul Home		



Navigasi :
Semua Link mengarah ke detail masing-masing modul.
Untuk menu yang ada di control panel, sebelum mengarah ke detail modul, akan diarahkan terlebih dahulu melewati link angkatan (Pilih Angkatan) selanjutnya ke link kelas (Pilih Kelas), baru berada pada detail modul. Ini di buat untuk mengantisipasi setiap content yang berbeda kelas/angkatan.

Keterangan Desain:

1. Header
2. Background
3. Menu Utama dari admin (Memberi akses ke semua modul yang ada di admin virtual web)
4. Control Panel (dikususkan untuk menjangkau modul pembelajaran) masing masing menu akan dilengkapi dengan icon terkait
5. Footer

Text & Background :			
Text-color	: #fff dan #000	Size	: 12 Pixel
Font	:Tahoma	Background Color	: #37ba7a

Figure 8. Storyboard Home Module Admin Page

The develop stage is the e-learning development stage. The development process refers to the decide and design stages which are then applied at the time of writing the program code. The development stage starts from: (1) creating an e-learning database; (2) create an e-learning development file structure; (3) linking the e-learning project with the database that has been created; (4) create a teacher login page; (5) create each dynamic module based on the table design from the database available on the teacher's page; (6) Create add, edit, delete and activate actions in the teacher page module; (7) create a connection.php file with MySQL; (8) create pages for students; (9) debug programs, or find out coding errors and security holes in e-learning.

The results of this e-learning development have two login pages, namely the teacher and student pages which can be seen in Figures 9 and 10.

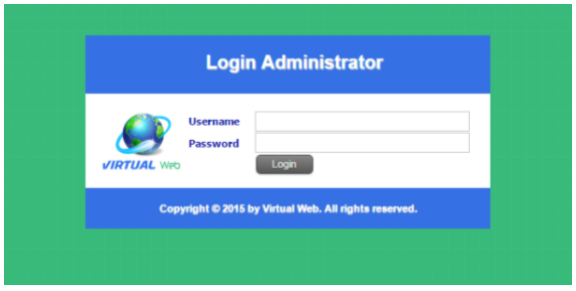


Figure 9. Teacher Login Page

Each page is created in two different folders. The admin page can be accessed by the teacher at the following address “nama_domain/admin_mvw” while the student login page becomes the main e-learning page that is displayed when you first access e-learning. The development of e-learning is carried out based on needs analysis at the decide stage and does not use LMS (Learning

Management System) templates. All modules depend on the needs developed based on the problems of teachers, students, and schools.

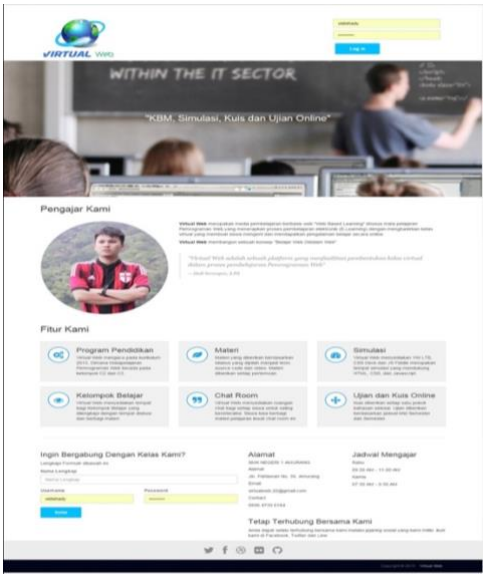


Figure 10. Student Login Page

The teacher's page is a place for teachers to process student data ranging from material, attendance, assignments, study groups, quizzes and online exams. The teacher's page can be seen in Figure 11.

Figure 11. Teacher's Page

While the student page is a page for students to learn web programming using e-learning as a virtual class that allows students to interact with each other and share assignments via the internet. Student pages can be seen in Figure 12.

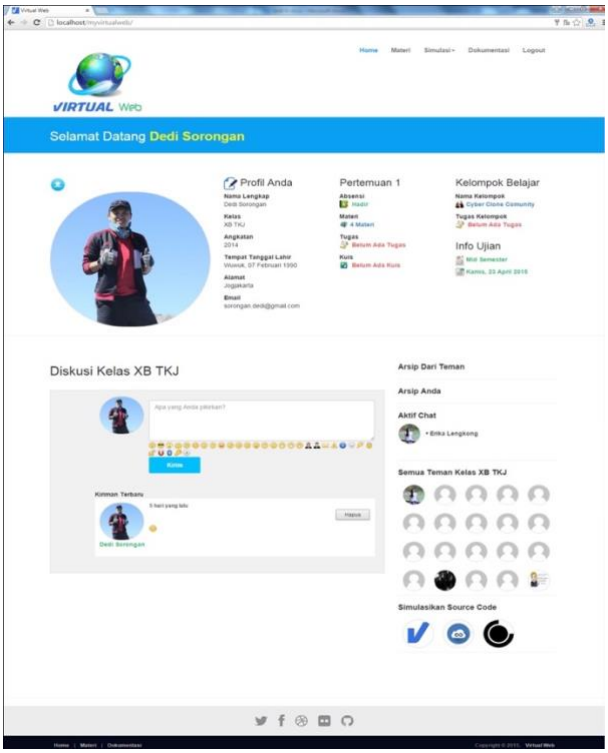


Figure 12. Student Page

The evaluation process begins by assessing each stage of development from decide, design, and develop. The assessment process is carried out at the end of each stage by reviewer Rudy H.W Pardanus, MT. M.Eng, a lecturer at the Faculty of Engineering, UNIMA, who is competent in web development. The initial product development process was carried out from November 2018 to February 2019. The values that have been taken from each stage are then stored for final evaluation. The Final evaluation is the final assessment process of the initial e-learning product before entering the product trial stage.

The result of the final evaluation of the initial product development using the rubric is 2.56 which is quite high. The final evaluation is carried out after the research process at each stage has been completed. The stages assessed are: decide, design, and develop. The values for each stage are then summed and averaged using the final evaluation rubric as can be seen in Table 2.

Table 2. *Final Evaluation*

Criteria	Value
Research Design	2,6
Flowchart	2,8
Storyboard	3
Design	2,6
Content	2,5
Total	**2,56**

Alpha Test Results

The alpha test stages are divided into two parts, namely, the media expert validation test and the material expert validation test. The media expert validation test is the process of assessing the feasibility of e-learning while the material expert validation test is to assess the feasibility of the material to be given before being tested on students. Based on the validation carried out by media experts and referring to the assessment criteria (Table 1), it can be seen that the assessment of the developed e-learning is "very good" with an average of 4.35. The media expert's assessment can be seen in Table 3.

Table 3. Media Expert Validation Results

Category	Frekuention.	Percentage (%)
Very good	8	40,00
Well	11	55,00
Enough	1	5,00
Not good		
Very Not Good		
Total	**20**	**100**

The quality of e-learning based on the assessment of media experts can be seen in Figure 13.

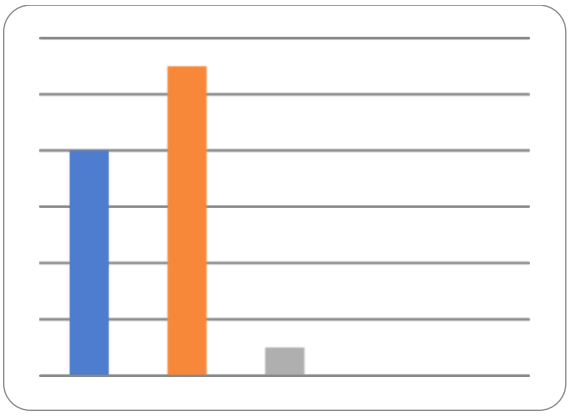


Figure 13. Graph of Media Expert Validation Results

Based on the results of data analysis, it can be seen that the quality of e-learning according to media experts is very good and suitable for use in learning web programming. However, there are suggestions from media experts, namely to improve the registration form by adding information after sending data and giving signs for online and offline students.

Based on the validation from material experts and in accordance with the assessment criteria (Table 1), it is known that the evaluation of the quality of the e-learning developed is included in the "good" criteria with an average rating of 4.05. Data on the assessment of material experts can be seen in Table 4.

Table 4. Material Expert Validation Results

Category	Frekuention.	Percentage (%)
Very good	2	10,00

Well	17	85,00
Enough	1	5,00
Not good		
Very Not Good		
Total	**20**	**100**

The quality of e-learning based on the assessment of material experts can be described in Figure 14.

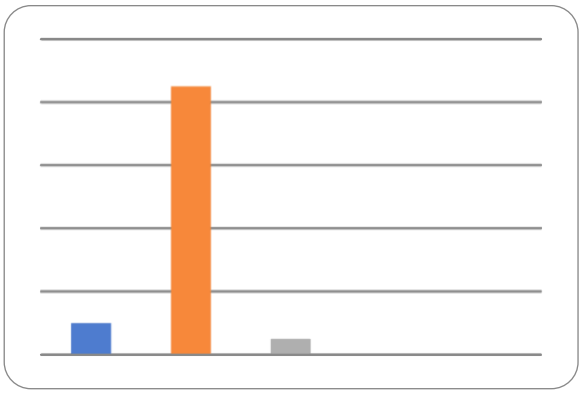


Figure 14. Graph of Material Expert Validation Results

The results of data analysis indicate that the quality of e-learning according to material experts is good and feasible to use in learning. Based on suggestions from material experts that every meeting must include a glossary.

Beta Test Results

Based on the results of the beta test and referring to the assessment criteria (Table 1), it can be seen that the e-learning assessment is in the very good category with an average of 4.51. This information can be seen in Table 5.

Tabel 5. Hasil Validasi Uji Beta

Category	Frekuention.	Percentage (%)
Very good	30	55,56
Well	22	40,74
Enough	2	3,70
Not good		
Very Not Good		
Total	**54**	**100**

The quality of e-learning based on beta testing can be depicted through the graph in Figure 15.

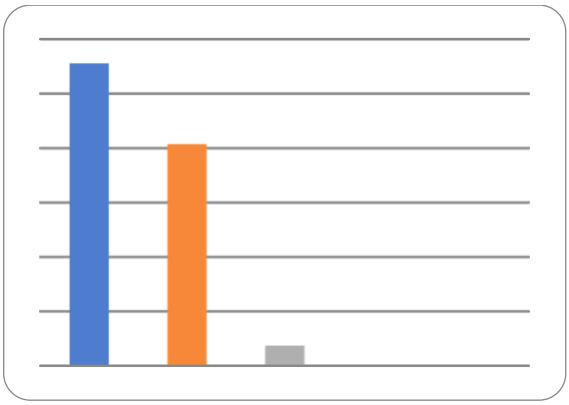


Figure 15. Graph of Beta Test Validation Results

The results of data analysis show that the quality of e-learning according to the beta test is "very good" and feasible to use in learning. However, based on the advice given, the time to complete the quiz should be increased, because it does not match the level of difficulty and the number of questions.

Summative Test Results

Based on the results of the summative test, it can be seen that the e-learning assessment developed is very good with an average assessment of 4.37. Information on the results of product trials can be seen in Table 6.

Table 6. Summative Test Validation Results

Category	Frekuention	Percentage (%)
Very good	149	41,39
Well	195	54,17
Enough	16	4,44
Not good		
Very Not Good		
Total	**360**	**100**

The results of the summative test analysis show that the quality of e-learning is in the "very good" category and is suitable for use in learning web programming.

Pretest and Posttest Data Analysis

The pretest and posttest were given to two classes, namely the experimental class XA which used e-learning, and the control class XB which used presentation media to see the increase in student learning outcomes. The post-test scores for both classes were taken from the average

theoretical (posttest) and practice scores from the final project "Creating a Web Design Template With CSS". The analysis of the experimental class pretest data can be seen in Table 7.

Table 7. Data Analysis of Pretest/Posttest Experiment Class

No	Pre-test	Post-test	Gain
1	36,63	82,46	45,83
2	39,96	79,96	40,05
3	33,3	68,3	35
4	33,3	74,13	40,83
5	43,29	78,29	35,05
6	46,62	84,12	37,50
7	43,29	69,96	26,67
8	39,96	81,62	41,66
9	39,96	79,96	40,05
10	46,62	78,29	31,67
11	46,62	71,63	25,01
12	46,62	86,62	40,05
13	36,63	80,79	44,16
14	39,96	75,79	35,83
15	33,3	78,29	44,99
16	43,29	69,96	26,67
17	39,96	79,13	39,17
18	36,63	74,13	37,50
19	43,29	84,96	41,67
20	39,96	80,79	40,835
Average	40,45	77,96	37,50

Based on Table 7, it can be seen that the average difference between post-test and pre-test is 37.50.

Table 8. Analysis of Pre-test/Post-test Data for Control Class

No	Pre-test	Post-test	Gain
1	36,63	73	36,37
2	39,96	69,7	29,74
3	39,96	72,15	32,19
4	43,29	68,85	25,56
5	43,29	78	34,71
6	39,96	74,65	34,69
7	36,63	70,5	33,87
8	39,96	72,15	32,19
9	39,96	64,7	24,74
10	43,29	73,85	30,56
11	46,62	68	21,38
12	36,63	68	31,37

13	39,96	73,8	33,84
14	39,96	73	33,04
15	39,96	71,3	31,34
16	39,96	72,15	32,19
17	46,62	68,85	22,23
18	43,29	68	24,71
19	43,29	78,8	35,51
20	43,29	66,35	23,06
Average	41,12	71,29	30,16

Based on Table 8 above, it can be seen that the average gain between the posttest and pretest is 30.16.

The results of the analysis of the experimental class and the control class show that the experimental class using e-learning can increase the posttest score from the pretest by 37.50, which is an increase from 40.45 to 77.96. Meanwhile, for the control class that uses presentation media, the increase in the posttest value from the pretest value is only 30.16, from an increase of 41.12 to 71.29. Thus, it can be seen that the average increase in the experimental class students was 37.50, which was higher than the control group, which increased by 30.16. The results of the pretest and posttest can be seen in Figure 16.

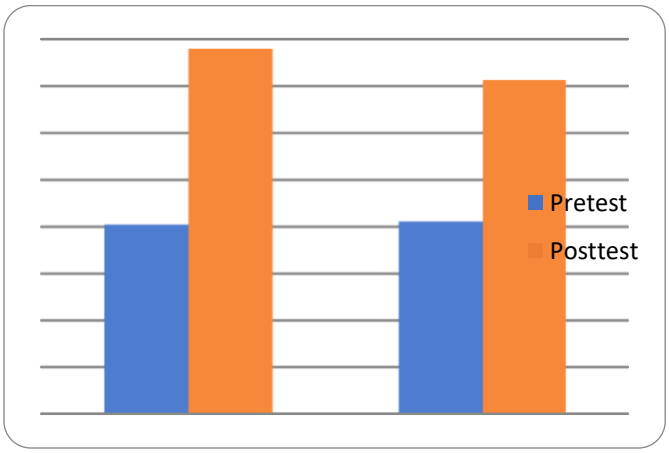


Figure 16. Graph of Average Evaluation Results of Pre-test and Post-test Scores

CONCLUSION

The results of this development research are e-learning products which are web-based learning media "Web-Based Learning" on web programming subjects that apply an electronic learning process by presenting virtual classes that make students understand and gain online learning experiences. The developed e-learning product builds on the concept of "Learning the Web on the Web". The final e-learning product provides several features that support the learning process that is lifted from learning activities in the real classroom. These features are (1) Providing materials for each meeting; (2) Online attendance; (3) Online assignments; (4) Quiz online; (5) Online study groups; (6) Discussion Room; (7) Online exams; and (8) Documentation of student activities. The

initial e-learning product was developed using the DDD-E model from Ivers & Barron (2002), then tested using a trial design from Alessy & Trolip, namely alpha test, beta test, and summative test. From the results of the product trial assessment, e-learning is in the "very good" category and is feasible to use. E-learning has been tested and succeeded in improving student learning outcomes. The results of the pretest/posttest showed that the average increase of the experimental class students was 37.50, which was greater than that of the control class, which only increased by 30.16. Suggestions for using e-learning in learning can pay attention to the following things; Teachers must take advantage of every module in e-learning It is recommended that you read the user manual before using it. E-learning can be used for distance learning via the internet and can also be used as Blended Learning because it can be a substitute learning medium for conventional learning media. For further product development of e-learning, efforts need to be made to create value processors automatically on the admin page. This developed e-learning can be used as an LMS (Learning Management System) template for further e-learning development according to the needs and development goals.

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