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The Development of Web Learning as Media to Deliver Web Programming Materials

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Abstract—This study aims to produce a decent web learning product as a medium for delivering web programming courses for students at the Education and Information Technology Education study program at Engineering Faculty, Manado State University. This is a Research and Development type of research with reference to the model developed by Borg and Gall (1983). The product in the form of software was validated by one instructional material expert and one media expert each before being tested to the students. The pilot comprises four students in individual trial sessions 12 students in small group trials, and 30 students in large group field trials. Three questionnaires were used to collect data: firstly, the media expert feasibility test, secondly, the material expert feasibility test, and thirdly, the student feasibility test. Based on the results of the assessment of both material and media experts and students, it can be stated that the web learning developed was perceived as useful. Furthermore, it can be concluded that web learning which is developed effectively might improve the quality of web programming courses.

Keywords—web learning; web programming materials; research and development research

I. INTRODUCTION

Education is the main and important thing to build character and human personality. Challenges and changes that occur in the effort to face the wave of changes brought about by the 4.0 industrial revolution currently have an impact on the perspective of the education sector. The trend of changes that need to be anticipated in the field of education one of them is the change from industrial society to the information society [1]. Education will experience change, one of which is from illiteracy to activities that are against blind technology, culture and computers [2]. Meanwhile, education will be influenced one of them is the use of various science and technology innovations, which are related to electronic media, informatics and communication [3]. Education decline is basically not caused by the curriculum but by the lack of professional capacity of educators and students' reluctance to learn [4]. In line with the change in perspective on education, this rapidly changing situation requires education managers to prepare themselves to anticipate an increase in public expectations of educational institutions [5,6]. For educators the integration of computer reliability is both an obligation and a challenge to be

able to apply in their duties as educators in order to improve the quality of learning by utilizing computer applications. Education has a very significant role in giving birth and forming certain individuals [7]. Everything depends on the philosophical basis and value above which educational institutions are built and what educational praxis are developed.

According to the Law of the Republic of Indonesia Number 18 of 2002 "development is an activity of science and technology that aims to utilize the principles and theories of science that have been proven true to improve the functions, benefits, and applications of existing science and technology, or produce new technologies". Development means the process of interpreting or parsing the design into physical form [8]. In particular, development is a process of producing learning materials. Learning to use computer facilities is based on theories motivated by several experts. Learning is behavior that can be observed and is caused by an external stimulus [9]. A person can be said to undergo a process of learning which behavior can be described not from what is in the minds of students [10]. In line with that, learning focuses on problem-based scenarios or activities, prioritizing work in teams, project-based, simulation, and utilizing technology [11]. Learners will learn well if something learned will be beneficial to their lives that is the things learnt have benefits as it is related to the application in daily life. Therefore, teaching and learning activities should be able to motivate learners by using various teaching techniques in applying concepts that have meaning to learning [12]. Learning is an effort to make students learn or is an activity to teach students [13]. In other words, learning is the creation of conditions in such a way that learning activities can occur. There are five types of interactions that can be carried out in learning and learning activities, namely "1) interaction between students and educators, 2) interaction among peers or among students, 3) the interaction between resource persons with students, 4) the interaction between educators with students and learning resources developed intentionally, and 5) the interaction between educators, students and the nature and social environment [14]. The essence of the learning process should be able to be implemented into learning components, including the process of developing web-based learning.

Web-based learning is a teaching and learning activity that uses media website facilities via the internet access. Web-based learning is one part of the application of e-learning or learning that utilizes electronic media. E-learning is the use of internet technology to improve knowledge and performance. E-learning technology offers control over content, learning sequence, learning speed, time, and media to meet learning goals [15]. Learning has been widely adopted as a promising solution [16]. E-learning is a very interesting concept with wide variations and has become a general model of education. The use of internet technology in education to facilitate the entire learning cycle from the beginning to the end of the study, without or little physical interaction with students, because students can learn anytime and anywhere with relatively affordable costs [17]. E-learning in this case is used as a support for the use of information and communication technology that supports the educational process [18]. There are several aspects to consider to implement web-based learning applications namely: (1) integration of user interface design, instructional design and (2) development of an evaluation framework to improve the overall environmental quality of supporting Web-based learning [19]. Web-based learning involves more than just composing colorful web pages. A key step in developing an effective education website is: Perform a needs analysis and determine goals and objectives; determine resources and technical needs; evaluate pre-existing software and use it if it meets your needs; safe commitment from all participants, identify and overcome potential obstacles in implementation; develop content in close coordination with website design and follow the program flow [20]. The success of web-based learning depends on the loyalty of students, namely the continued use [21]. Web-based learning systems can be developed to facilitate learning activities to interpret, observe, see, and teach subject training [22]. All in all, however great and sophisticated the features are prepared to facilitate learning through the web, the most preferred are students, because the learning web that is developed to facilitate learning activities is only a tool or means of supporting learning. Web Programming courses are one of the courses in the curriculum of the Information and Communication Technology. Education Study Program of Engineering Faculty of State University of Manado. Through this course, students are expected to have basic knowledge about internet and web programming and have the ability to design and implement website creation with static and dynamic content. This course presents basic concept material and the use of HTML (Hyper Text Markup Language) elements, basic structures, how Cascading Style Sheets (CSS) work, basic concepts, JavaScript, Database, MySQL functions, basic concepts and use of PHP, and building web with CMS. To achieve the goals and objectives that have been determined, it is necessary to plan, prepare and control the process when carrying out learning activities by compiling Semester Learning Plan (SLP). With this SLP, it is expected that the implementation of web programming lectures can run well in accordance to the curriculum and syllabus developed.

Based on observations, experiences and observations, the process and results of learning web programming courses are not in accordance to what is expected. Students are often passive and feel learning web programming is very difficult, takes a long time, and boring. This causes students' motivation

and learning achievement low. Teaching materials and strategies that can trigger new ideas are very limited and not varied, so that the density of material and limited time make it difficult for students to learn. Looking at the conditions of the implementation of web programming learning that seems to be routine and as it is, it requires a study that aims to produce an effective learning system that makes it easy for students to learn. If students get learning convenience, it will increase motivation to learn. The successful implementation of web programming lectures can be achieved optimally, one of which is done by implementation a learning model that is carried out comprehensively from lecturers by optimizing the use of learning web. The model for implementing learning through web learning is expected to manifest the learning administrator who can attract interest and generate student motivation to be able to learn independently. "

The main problems are formulated as follows: 1) what is the procedure for developing learning web to teach web programming courses. 2) Is learning web developed appropriate to be used to teach Web Programming, and 3) is the development of learning web effective in improving the learning outcomes of web programming courses? This study aims to produce learning web application products to teach Web programming and also to test the product's effectiveness in improving learning outcomes.

II. RESEARCH METHOD

This type of research is development research, which is a research whose orientation is to develop and validate educational products [23]. Research and development methods are research methods used to produce certain products, and test the effectiveness of these products [24]. The products developed in this study are learning web programs that are worth mentioning as learning resources for web programming courses. In order to produce a product in accordance to the needs, a valid development basis is called the development model. The development model used in this study is a procedural model. This model was chosen because researchers in this development followed the development steps in accordance to the existing development model.

The steps of research and development were adapted from Borg & Gall [23], including the stages of needs analysis, instructional design, product development, and product evaluation, formative evaluation and summative evaluation. Formative evaluation consists of individual evaluations, small group evaluations, and field evaluations. Summative evaluations are carried out after the program has been formally evaluated.

The initial stage of development research is defining the problem or preliminary assessment of the problem, reviewing the curriculum and CS (Competence Standard) – BC (Basic Competence), reviewing potential development locations, reviewing the characteristics of lecturers, reviewing student characteristics, initial abilities and student activities and components and procedures for learning web development. In this initial investigation phase, the researchers also conducted observations to obtain information relating to the use of web

learning that had been carried out. Starting from the purpose of observation, the activities carried out are as follow:

The first stage is examine the problems regarding the preparation and procedure of lectures on web programming courses, the availability of internet networks, the use of web learning, computer laboratory facilities, the readiness of lecturers and students, the use of practicum rooms and evaluations to be used. Next, examine what components that must be included in the learning web. The next step is to design alternative solutions to a complete and integrated system. Realization is carried out by compiling the stages of implementation, expert validation, evaluation and revision and full implementation

The second stage, is develop learning design. At this stage a learning syllabus was developed consisting of eight steps, namely: (1) determining competency standards, (2) determining basic competencies, (3) conducting learning analysis, (4) formulating indicators, (5) developing assessment instruments, (6) developing learning materials, (7) developing learning strategies, and (8) designing evaluations.

The third stage is produce web learning with method which consists of 6 stages: concept, design, material collection, manufacture, testing, and distribution [25].

The fourth stage, formative evaluation consisting of validation, trial and product revision. The learning web is validated by material experts covering aspects of content and presentation. Validation by media experts includes aspects of software engineering, learning and visual communication. The trial was carried out through individual trials, small group trials, field trials followed by data analysis, and product revisions based on the results of the trials.

The fifth stage, summative evaluation, to find out the effectiveness of learning web in the form of increasing the achievement of learning outcomes.

The learning web validation involved 1 material expert and 1 media expert. The trial subjects at the individual trial stage were 4 people, the small group trial subjects were 12 people, and the field trial subjects were 30 people.

Data obtained in the form of qualitative and qualitative data. Qualitative data were in the form of suggestions / entry from media experts, expert learning materials, and students are used to improve learning web products. Quantitative data were obtained through questionnaires with Likert scale were analyzed with descriptive statistics. Whereas the assessment of learning web quality is based on the results of the conversion of values with a scale of five [26]. The score is derived from the results of the tests to see the effectiveness of learning web

A. Research and Development Results

1) *Expert validation:* The media expert's assessment of the quality of learning web products in terms of software engineering shows a score of 3.33 (good category), from the learning aspect of 3.44 (excellent category), from the visual communication aspect of 3.20 (good category), average 3, 32 (good category). The complete data can be seen on table 1.

TABLE I. VALUE CONVERSION OF MEDIA VALIDATION EXPERT VALUE CONCERNING LEARNING WEB QUALITY

No	Aspect of Media Evaluation	Media Expert	Category
1	Software engineering	3.33	good
2	Learning	3.44	very good
3	Visual communication	3.20	good
Average		3.32	good

Assessment results from the Material Expert on the quality of web learning web in terms of the Content aspect shows that the mean score is 3.94 (very good category), from the Presentation aspect of 3.88 (excellent category), and the mean score aspect of the content and presentation of 3.91 (very good category) The complete data can be seen on Table 2.

TABLE II. CONVERSION VALUE OF EXPERT VALIDATION RESULTS LEARNING WEB QUALITY

No	Aspect of Material Evaluation	Material Expert	Category
1	Content	3.94	very good
2	Presentation	3.88	very good
Average		3.91	very good

2) *Trials:* Learning web product testing activities produce data regarding the feasibility and effectiveness of the products being developed. The results of individual trial activities can be explained as follows: the value of the test results of all sub-subject matter obtained an average value of 2.67, students who are successful were 4 people or 100%. Furthermore, the results of the assessment of the quality of learning web products in individual trials showed that for the aspect of Utilization obtained a score of 3.46 (Very good category), Visual Communication aspects was 2.91 (good category), aspects of Software Engineering was 3.25 (good category), the average of the three aspects was 3.21 (good category). The complete data is explained on Table 3.

Small Group Trial. Based on the results of individual trials, a number of revisions have been made which were then conducted by a small group trial involving 12 students. The results of small group trial activities can be explained as follows: the value of the test results of all sub-subject matter obtained an average value of 2.69, student who is not successful is 1 person or 8.34%. While students who are successful are 11 people or 91.66%. Furthermore, the results of the assessment of the quality of the learning web products in the small group trials showed that the utilization aspect was 3.00 (good category), Visual Communication aspect was 3.09 (good category), Software Engineering aspect was 3.44 (very good category), the third average aspect of 3.18 (good category). The complete data is explained on Table 3.

TABLE III. CONVERSION OF THE VALUE OF STUDENT TRIAL TEST ON WEB QUALITY

Subject	Aspect	Average	Category
One to one evaluation	Utilization	3.47	very good
	Visual Communication	2.90	good
	Software Engineering	3.24	good
Average		3.20	good
Small group evaluation	Utilization	3.10	good
	Visual Communication	3.19	good
	Software Engineering	3.42	very good
Average		3.23	good
Field trial	Utilization	3.56	very good
	Visual Communication	3.02	good
	Software Engineering	3.30	good
Average		3.29	good

III. RESULT AND DISCUSSION

Research and development has been carried out. Learning web products to teach web programming materials have been developed in accordance to procedures and are suitable for use in learning. Web learning products to teach Web Programming are said to be effective if they are able to show a minimum of 75% of students who have successfully achieved a minimum passing grade of 2.0. Based on the results of the Web effectiveness learning test, it is known that 90.6% of students who take part in learning successfully achieve a minimum 2.0 graduation standard. This means effective learning Web products and can be used in Web Programming learning.

Selection of the right learning media will improve student learning outcomes. Therefore, lecturers are required to be able to choose and apply the appropriate learning web so that learning objectives can be achieved optimally. Learning using web learning is an alternative learning media that is suitable for use and has proven effective in improving learning outcomes.

Several other researchers revealed that student learning outcomes showed significant value. So that the development of web-based learning can improve learning achievement [27]. There was a positive relationship between the use of learning web and student involvement and learning outcomes [28]. The learning experience experienced by students brings about a positive attitude change in relation to the use of the Web in learning [29]. Web-based learning systems can be developed to facilitate learning activities to interpret, observe, see, and teach subject training [30].

From the results of this study it can be concluded that there is a positive relationship between the use of web learning with student involvement and learning outcomes. The learning experience experienced by students brings changes in positive attitudes, it makes students feel happy as they can give more contribution, provides better learning outcomes, and it can improve learning achievement.

IV. CONCLUSION AND SUGGESTIONS

A. Conclusions

First, the learning web development procedure to teach courses Web programming is carried out through five stages: needs analysis, developing learning design, producing learning multimedia, conducting formative evaluation, and conducting summative evaluation. Web programming lecture materials developed through web learning include: basic concepts and the use of HTML elements (Hyper Text Markup Language), basic structures, the way to Cascade Style Sheets (CSS) work, basic concepts, JavaScript functions, Database, MySQL, concepts basic and use of PHP, and build a web with CMS.

Secondly, the development of learning web is feasible to be used to teach web programming courses

Third, effective learning web development results can improve the learning outcomes of Web Programming courses.

B. Suggestions

- For lecturers who will use the learning web, they should prepare supporting facilities and student needs
- For students, group learning will make it easier to learn thoroughly than individually
- For further development, it is expected that the scope of teaching materials is broader or in other words it may involve other materials, even it is also possible to involve other courses

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