Development of website for studying modern physics

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Abstract. The purpose of this study is to produce a website in modern physics courses in order to increase student interest in physics learning. To determine the feasibility level of learning media then feasibility test to the product. The feasibility test carried out on the product is divided into three parts: material feasibility test, media feasibility test, and student response test. Based on the results of the test conducted the material obtained an average score of 3.72 and categorized very well. The result of media test that was obtained got the average score of 3.25 and categorized well. The result of the analysis of student's response to the twenty students of class A (fifth semester) of physics education program FKIP Universitas Tadulako obtained an average score of 3.16 with the good category. The results showed that the website developed can be used as one of the learning media that can support the learning process of students.

1. Introduction
Science and Technology at this time have grown rapidly. The development of information and communication technology (ICT) today has brought many changes in human life. These developments are increasingly felt in various sectors, particularly in education.

Education is a process of communication and exchange of information from educators to learners related to education, which has elements of educators as a source of information, the media as a means of presenting ideas, ideas and educational materials and learners alone [1].

The development of the world of education at this time is a challenge to develop the ability in the world of education. The development of the world of education cannot be separated from the effective teaching and learning process. Teaching and learning process is characterized by the interaction between teachers as the transfer of materials and students as recipients of the material [2-3]. The occurrence of interaction and good communication can create a dynamic learning atmosphere. Educational interaction is one form of interaction in which a process of interaction takes place in a bond to achieve the goals of education and teaching.

In general, in the learning activities of educators only use printed materials, such as textbooks or textbooks. However, in learning activities using printed materials have a weakness that is the exposure of linear matter, teaching activities centered on the teacher, teaching materials are presented in the form of language that is difficult to understand by learners and the form of information presented in a limited form that is in the form of text and images. Each learning material has varying degrees of difficulty. Learning materials that have a high level of difficulty certainly difficult to understand by learners, especially by learners who do not like the material that is delivered learning. Therefore,
media is needed as a tool in the learning process with the aim to improve the effectiveness and quality of learning.

One way to improve the effectiveness and quality of learning is by utilizing technology on distance learning systems through learning electronically or better known as e-learning. E-learning can also be interpreted as learning through electronic media. Through e-learning, learning materials can be accessed anytime and from anywhere, besides that, the material can be enriched with various learning resources including multimedia can quickly be updated by the teacher.

E-learning learning media is a learning medium developed today. In this case, the increase in learning motivation is significantly found in students who use e-learning in the learning process. From the research results can be formulated that there is a significant correlation between motivation with the increase of learning outcomes in students using e-learning.

Learning media are the tools, methods, and techniques used in order to further streamline communication and interaction between teachers and students in education and teaching processes in schools [4]. This is agreed with Sudjana [5] which states that the learning media is a teaching tool, that is to support the use of teaching methods used by teachers. By using e-learning based learning media, learners easily understand what the content of a lesson of the lesson [5]. Palupessy's research [6] shows that the media is of good quality and it was applied in basic physics lecture [6]. E-learning is an applicable internet application that connects educators and learners in an online learning space [7]. E-learning turns out to overcome the limitations between educators and learners, especially in time and space. So it does not have to be in one dimension of time and space, it can mean anytime.

The use of e-learning-based learning media in the learning process allows educators and learners to communicate easily and quickly through internet facilities without being limited by distance, place, and time. This media also plays a role in fostering the creativity of learners in learning science.

Modern physics is one of the important courses for physics education students. This course discusses concepts developed in the 20th century, in which formulations in classical physics are no longer able to explain the phenomena occurring in the matter with atomic or subatomic scales and particles moving at speeds close to the speed of light. Students need to understand the material well and correctly, as the first step to understanding higher levels of science such as quantum physics, statistical physics, the introduction of solid-state physics and the introduction of core physics. The material of modern physics characteristic of the material is dominated by abstract and microscopic concepts if taught theoretically without supported examples that make it more leverage such as with the help of animation and video can cause different understanding to the students. Learning resources used in the form of reference books and teaching materials from lecturers felt not enough to understand the material of modern physics and as a source of independent learning outside the classroom. Meanwhile, the lecture room of physics education program is equipped with hotspot facility. However, this facility has not been fully utilized by the students. Students have not utilized the internet as a source of learning.

The description of the condition shows the importance of providing learning media that is practical, clear and interesting so as to increase student's interest in learning. Therefore, the purpose of this research is to develop an e-learning based learning media with materials, videos, simulations, and discussion forums that can help students in learning.

2. Methods
This includes the type of research and development or known Research and Development (R & D) is a research model used to produce a particular product, and test the effectiveness of the product [8]. The general research steps can be seen in Figure 1.
This research was conducted in Physics Education Study Program Faculty of Teacher Training and Education Universitas Tadulako. This research is conducted starting September 2016 until January 2017. The subject of this research is all students of semester V Physics Education Programme. Test of the feasibility of learning media was applied to 20 students.

The instrument used in this research is by questionnaire technique aims to measure the feasibility of content/material and media in learning. The questionnaire was given to experts, media experts, and students according to their needs and objectives. Data type consists of quantitative and qualitative data. Quantitative data in the form of scoring scores of all sections and content of teaching materials based on the results of questionnaires validity test with Likert scale in the form of numbers 1, 2, 3 and 4. Qualitative data is an evaluation of the validator (feedback, input, suggestions, and criticism) contained in the questionnaire and discussion directly used as a consideration in making revisions to the media learning. The analytical technique used to analyze the data of the validation result is the calculation of the average value [9].

3. Results and discussion

3.1 Test the material experts

Experts test the material done to obtain the data from the material content experts in the form of qualitative data in the form of comments and suggestions on the contents of modern physics concepts. In the material feasibility testing phase conducted by a lecturer of Physics Faculty of Mathematics and Natural Sciences. Table 1 shows validation results obtained in this research result.

The level of achievement obtained from the results of the expert-administered questionnaire test-administered questionnaire calculated. By using Hake formulation, it was obtained the total value of 3.72 value indicates that the material included in the category is very good.
Table 1. Results of physical examination experiment analysis of modern physics concept

| No | The Topics                                      | Score | Category    |
|----|------------------------------------------------|-------|-------------|
| 1  | Introduction                                    | 3.33  | Very Good   |
| 2  | Relativistic                                    | 3.21  | Good        |
| 3  | The nature of the particles from the waves      | 4.00  | Very Good   |
| 4  | The nature of the waves of particles            | 4.00  | Very Good   |
| 5  | The models of the atom                          | 3.87  | Very Good   |
| 6  | Quantum mechanics                               | 3.81  | Very Good   |
| 7  | Quantum theory of hydrogen atoms                | 3.53  | Very Good   |
| 8  | The atom with many electrons                    | 4.00  | Very Good   |
|    | Average                                         | 3.72  | Very Good   |

3.2 Validation result from media experts

An experimental test of e-learning based learning media is done by showing the design of e-learning based learning media along with the administered questionnaire to the expert of e-learning based learning media. In the feasibility phase of media conducted by a lecturer of Physics Education. The results of the assessment by the media experts, as seen in Table 2, was 3.25 (good category).

Table 2. Results of website design expertial experimental test analysis

| No | Aspects of the Assessment | Average Scores | Quality Category |
|----|---------------------------|----------------|-----------------|
| 1  | Media View                | 3.42           | Very Good       |
| 2  | Learning                  | 3.00           | Good            |
| 3  | Programming Technique     | 3.43           | Very Good       |
|    | Average                   | 3.25           | Good            |

3.3 Analyzing of student response from questionnaire

At this stage, a limited trial was conducted in the Physics Education Study Program of Tadulako University. The results of tests conducted on 20 students of semester V showed that e-learning based learning media is feasible for use in modern physics learning process. Average analysis results based on student response showed the achievement level of 3.16 and it is included in good criteria.

3.4 Developing website for studying modern physics

Research on the development of e-learning based learning media in modern physics course aims to produce a useful learning media used in the process of physics learning. It can be used as an alternative in selecting learning media that will be used in teaching and learning process and is was much bigger to be an additional reference for further research on the development of e-learning based learning media on other materials. The function of making this learning media is a source of independent learning and facilitate the students in getting a reference in doing the task and can enrich the learning materials. In this study the development of e-learning based learning media in the modern physics course is an argument cogently learning activities acres poured in digital format by utilizing the media sites (websites) that can be accessed through the Internet network. E-learning based learning media is made to facilitate the interaction between learners with materials or subject matter. Learning media based on e-learning is developed by utilizing Content Management Service (CMS) module that is moodled. Moodle is one of the open source applications that matter is a software package produced by internet-based learning activities and websites, using heading Moodle is was much bigger to receiving complain fouling and effectiveness (of teacher performance and understanding of learning materials).

The data analysis result of the development of this resource is based on the validation result and limited trial. The test design used in this research is the feasibility test for the product. The trial was conducted by a lecturer of physics Faculty of Mathematics as a material expert, a lecturer of physics
education as a media expert, and twenty semester students of Physics Education Study Program of Tadulako University.

The assessed aspects of this instructional medium acres some items of the subject matter respectively. The indicator that the conformity value of the content of the material with sub-subject, the suitability of the image on the subject sub and completeness of the contents of the material. From the experimental results of material experts obtained average achievement level obtained by 3.72 indicating that the material included in the criteria "Very Good". From the results of the material experts stated that this e-learning learning media worthy tested in the field with a revision.

From the experimental results of media, experts obtained the average level of achievement on aspects of the display media of 3.42 acres categorized very well. In the learning aspect, the average achievement rate of 3.00 is categorized as good. Then on the aspect of programming, obtained an average level of achievement of 3.43 acres categorized very well. Overall assessments of media experts obtained an average achievement rate of 3.25 indicating that the media were included in the "Good" category. From the results of media, experts stated that e-learning learning media is feasible tested in the field with a revision.

After the validation of media experts and material experts, the next step is a small-scale installation design test or a limited test. This limited test aims to find out the student's response to the use of e-learning learning media. The e-learning learning media development outcomes were tested in small-scale installation design the field trials to 20 students. The purpose of small-scale installation design field trial is to get a picture of the students' response to the national learning media. Students respond to aspects of learning, material aspects, display aspects and aspects of programming in e-learning based learning media.

The developed website contained experiment information about technology, such as solar cells, photocatalyst, and other experiment results [11-13]. By using a website developed with moodle [14], the students can ask the lecturer/teacher about modern physics problem and discussion was done.

4. Conclusion
The website for studying modern physics has been developed by using research and development methods. In the experimental material test results obtained a scoring average score of 3.72 and categorized "excellent", media expert scoring analysis obtained an average score of 3.25 and categorized "good", while the results of the assessment of student response scores obtained score average of 3.16 and categorized as "agree". This result shows that e-learning based learning media is feasible to be used and used as one of the learning media for students.

Acknowledgment
This work was supported by Research Grant from Teacher Training and Education Faculty, Tadulako University in the fiscal years of 2016.

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