Design of Learning Media Physics based on Website

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Abstract. The Introductory of Physics course is one of the compulsory subjects that must be followed by students of the physics education study program at the Department of Physics at the State University of Medan. This course examines the various materials of physics that begin with the introduction of physics, into the concept of kinematics material, dynamics, temperature, heat, effort, energy, impulse, momentum, dynamics of rotation, fluid mechanics, gas kinetic theory and terminated thermodynamics. In the achievement expectations that students will have is that students can master the physical concepts, especially physical material taught in schools, master the ways to overcome misconceptions, provide remediation in learning physics and be able to explain the application of physical concepts in everyday life. So it is necessary to compile a learning media that makes the physical material into an easy-to-understand science, including using existing facilities such as the use of computer technology. The subject of this study is computer-based physics learning materials with the topic of dynamics of motion in the Introductory of Physics course by using WordPress software as a maker of media and Macromedia Flash as an add-on animation. Media developed concerning the ADDIE development model of Analysis, Design, Development, Implementation, and Evaluation. The program is tested by media experts to determine the feasibility of the media (program), and get a good category based on criteria/indicators that have been determined, then the results of media effectiveness on student learning outcomes get a good category, which means the use of media on students has a significant influence.

1. Introduction

The progress of the Information and Communication Technology (ICT) field has been so rapid and has helped many human activities. Utilization of ICTs allows humans to escape from the boundaries of space and time. Humans can exchange information from and to various parts of the world at any time by the wishes. This development in the field of ICT is an opportunity for the world of education in Indonesia to improve the dynamics of learning activities by providing resources online learning resources that can be accessed anytime and anywhere. In fact, not many practitioners in the world of education have made use
of the advancement of ICT, especially the internet in optimal learning activities. That is, not many educational practitioners have developed a portal as an online learning resource that can be accessed by students around the world.

Online learning resources can be devised to present learning modules. Especially now in Indonesia, numerous people is using Android as a platform for their smartphone. Andreas Rompis (2012) states, the development of smartphone products with Android operating system experienced remarkable growth, while the growth of Android users in Indonesia reached 40% per year. Telkomsel customers who use Android gadgets also continue to increase. Ririn Widaryani (2012), Head of Strategic Marketing Group of Telkomsel, stated that Telkomsel currently has 18 million subscribers and 2 million of them are Android smartphone users. Also, in 2012 the number of Telkomsel subscribers of Android users reached 2.5 million devices, the number increased 15-fold compared to the previous year which only 170 thousand devices (Gideon Edie Purnomo, 2012)

Chaeruman (2005) in Teknodik Journal argues that to encourage human resource readiness in the global era through education in schools, ICT integration in the learning process needs to be done to (1) develop students' high-level thinking skills; (2) develop skills in information technology and communication literacy itself, and (3) to improve the effectiveness, efficiency, and attractiveness of the learning process.

Miarso (2004) in his book has stated that the development of information and communication technology (ICT) has provided various possibilities for improving the quality of education, namely among others to: (1) increase access to obtain information from anywhere, anytime, at any time, (2) increase in effectiveness communication with various forms of sensory stimulation, (3) increasing relevance to increasingly diverse needs, (4) adjustment to changing environmental conditions, and (5) increasing efficiency by saving time, effort and cost.

Physics as a science that is considered sufficiently plays an important role, both its mindset in the making a qualified student's and its application in everyday life because physics is a means of thinking to study things logically and systematically. Therefore, it is considered necessary that physics can be mastered as early as possible by the students. Based on its development, the problems faced in physics learning are getting more complicated and require a perfect analysis structure. Not only the ability to analyze that needs to be improved but to understand the concept of physics must also be improved to be able to understand the physical phenomena that exist in the environment.

The vision of the Department of Physics, Faculty of Mathematics and Natural Sciences Unimed is to be an excellent major in physics education and applied physics nationally hinted at the importance of curriculum relevance of physics majors with employment and improving the standard of graduates through curriculum improvement (Renstra Prodi Pendidikan Physics: 2011).

To improve the quality standards of graduates and curriculum improvement of physics majors regularly and periodically evaluate and develop programs such as lecturing, the results achieved and the material presented is still efficient, effective and relevant to market demands.

The teaching and learning process in the physics department needs to utilize the advancement of information technology by presenting website-based learning media easily accessible from hand. Especially for Physics education practitioners. Physics as one of the subjects that by most people considered difficult, should be presented creatively and follow the lifestyle (life Style).
2. Research methods
This type of research includes research development, namely the development of the website-based learning media. Subjects in this study is a website-based learning media on the topic of dynamics of motion. Equipment taken in this study include hardware, computer software, and questionnaires.

The research method used in this research is Research and Development / Research and Development (R & D). The R & D model used in this study refers to the design developed by Borg & Gall (1983: 775), 1) Research and information collecting, 2) Planning, 3) Develop preliminary form of product, 4) Preliminary field testing, 5) Main product revision, 6) Main field testing, 7) Operational product revision, 8) Operational field testing, 9) Final product revision, 10) Dissemination and implementation, and this research is limited to the fifth part of the ten sections.

3. Results and discussion
This research produces a product of Interactive Learning Website (MPI) with WEBSITE based on Newton Dynamics material on Physics student of Semester I which is feasible to be used as learning media. This multimedia is packaged in the form of an interactive WEBSITE that allows the program to be used on a computer without having to install it first.

1. Analysis (Analysis)
   a. Curriculum analysis
      This curriculum analysis refers to the Indonesian National Qualifiers Framework (KKNI). The material developed in this media is the Dynamics of Newton's Law which is the material in the Introductory of Physics course. In the curriculum, the achievement of learning and learning outcomes is stated for the subject matter of the Dynamics of Newton's Law, namely as follows:
      1) Learning Output
         Apply the basic concepts and principles of kinematics and the dynamics of point objects.
      2) Learning Outcome
         Can apply Newton's law as the basic principle of dynamics for straight motion.
      From the achievement of learning and learning outcome, the indicators used in developing this multimedia are:
      1. Give an example of applying Newton's law
      2. Explain the concept of style
   b. Analysis of student characteristics
      Students who sit in the first half of the average has reached the age of a dozen years. By the cognitive development according to Piaget in Joseph (2006: 6), the cognitive development of children aged 11 years and over has reached the formal stage of operational meaning has increased from the concrete operational stage. The formal operational stage is a high-level mental operation. Here students have been able to relate to hypothetical or abstract events, not only with concrete objects. Thus, the ability of students to understand things - abstract things can show that students have been able to learn geometry by informal deduction.
From the above description, it appears that the students have been able to understand and interpret abstract symbols. Of the abstract things they encounter, they can make hypotheses that may exist. Until at last, they will reach a new understanding. The new understanding can also be obtained by testing all alternatives that exist in a problem. This is also by the stage of deduction in learning geometry. They have been able to conclude the general to the specific things. Thus, learners of that age have the possibility and opportunity to develop their knowledge and understanding. Therefore, the achievement of this stage allows students to study independently, and in the use of student learning technology, it is better to see and experience for themselves how the technology works independently of exploration rather than just told by lecturers.

c. Technology analysis

According to Riski Rahman J. (2008: 5), Macromedia Flash is a software that is widely used by professional Website because of its amazing ability in displaying multimedia, combining text, graphics, animation, sound, and interactivity for users of internet animation program. According to Astuti Salim (2011: 2), Macromedia Flash is one of the Future Splash Animator that facilitates the creation of animation on the computer screen in displaying audiovisual and more interesting images. Macromedia Flash also comes with tools (tools) to create images that will then be animated. Next animation compiled by combining animated scenes to be a movie. The final step is to publish the media to the desired media. From the description above, then Macromedia Flash 8 and WEBSITE suitable for use as a tool to improve the quality of physics learning.

d. Analysis of the use of computers as a medium of learning

Computers are technologies that have many advantages. According to Sutarman (2009), these advantages include the speed of accessing data, the ability to process data in large sizes, the ability to store data in large sizes, the process of processing data that is easy, and the number of computer applications that support and can be utilized. The many advantages of computers make the computer widely used for various purposes, including for the benefit of education.

Computers are not foreign to education. Many applications from computers that have been used for educational purposes, both for the sake of administration and technical learning. Therefore, it is not unfamiliar if almost all educational establishments have computer facilities. Especially for universities, they have computer facilities that are not only used for administrative purposes but are sufficient for the benefit of learning. All that can be seen from the addition of ICT education courses in the Faculty of Engineering at the State University of Medan.

Development of multimedia learning that can create an active interaction between students and multimedia can help achieve more effective learning. As Arsyad stated (2010: 9), multimedia attempts to display stimuli (stimuli) that can be processed with various senses. The more sensory devices used to receive and process information the greater the likelihood that the information is understood and retained in memory. Therefore, the development of computer-based multimedia learning can be an alternative to help improve learning effectiveness and help facilitate students learning independently.

2. Design (Design)

a. Setting up the framework in multimedia
This arrangement is in the form of a multimedia display design that includes the main page, learning page (content), and evaluation (quiz).

1. The main page contains a dynamic display that contains information on website content and features buttons and some latest post items study pages and quizzes.

2. The Newton study page contains three submenus of material, animation, and practice. Submission of the material in this learning is conditional, i.e., the user can access any material that wants to be studied and discussed, without any limit on the basic ability gained.

3. Halaman Evaluation (Quiz), contains a test of evaluation of learning outcomes.

b. Systematic determination of material presentation

Systematic presentation of material in multimedia by the KKNI that has been translated into indicators. The necessary materials are taken from relevant sources.

c. Instrument planning

The instrument in the form of a questionnaire is prepared to evaluate the multimedia that has been created. The preparation of the instruments is based on aspects tailored to the purpose of each questionnaire. The instruments include an evaluation questionnaire by media experts and material experts. The questionnaire was given to the expert when reviewing multimedia before being tested in the field. While the questionnaire after the test is given to lecturers and students in the form of a questionnaire response to multimedia. The questionnaires were adapted from the questionnaire used by Ratna (2011) in his research, then adjusted for this study.

Preparation of test questions to be presented in multimedia is based on competency standards, essential competencies, and indicators to be achieved, then adjusted to the entire contents of multimedia learning that has been prepared. Moreover, the form of test questions used is essay test form.

Instruments in the form of test questions that will be included in multimedia have previously been tested in a device that contains eight items that are of type essay test. The number of questions that will be presented in the making of this multimedia is as much as eight questions of essay type.

3. Development (Product Creation)

Development is the stage of making multimedia until the review of media experts and revisions. At this stage, multimedia starts to be made based on the making plan in the storyboard at the design stage. Making this multimedia using WordPress WEBSITE.

a. Multimedia Creation

1) Page menu

The main page contains buttons that serve as navigation. These buttons are the Home menu guide, Kinematics, Dynamics, Business and Energy, About Us.
2) Learning page

Newton's Law Study page contains three materials, namely Newton's Law, Newton's two Laws and Newton's three Laws. On the law page of Newton, one contains three submenus, where each menu shows about what is in the law of Newton one, while the three submenu is material, animation and example problem. Likewise on the Newton law materials page two and three. There is also a next button to proceed to the next page. At the end of the material will be given a button to return to the menu page.

After the process of making this multimedia is completed, the multimedia is reviewed by an expert who will assess the validity and multimedia, namely media experts and material experts. Each expert fills out an evaluation questionnaire that has been compiled based on predetermined aspects. In the questionnaire also provided a field to provide comments and suggestions for improvement. Therefore, the questionnaire will be obtained from the questionnaire to make revisions and improvements.

b. Expert Review Results

Data from the assessment of media experts and material experts in the form of suggestions, criticisms, mistakes, and suggestions for improvement can be detailed as follows:

1) Media Expert Assessment

| Topic  | Issues that need to be revised                                                                 |
|--------|-----------------------------------------------------------------------------------------------|
| Opener | Some inscriptions/letters are not clear with the colors and animations are too contrast          |
|        | Strive to use clear and easy-to-read colors and fonts by learners.                              |
|        | Do not have too many animated letters that are not so important.                                |
b. Revision

1) First Revision
   Based on data analysis of evaluation results of instructional media experts, researchers conducted several revisions. The revision results can be seen in the explanation below:
   a. Improve type, color and font size that are not clear.
   b. Fixed an image that does not match the material
   c. Replacing music with fast-paced music with slow-acting music to support the spirit of learning.
   d. Improve the order of presentation
   e. Add a separate evaluation problem in the main menu.
   f. Fixed the look and row of the content
   g. Silence the background music when the content is opened.

2) Second Revision
   Based on the analysis of the results of the assessment on individual trials conducted on three students semester 1 (state) State University of Medan, there is no suggestion of product improvement on Web-based learning materials material Newton's Law Dynamics.

3) Third Revision
   The third revision of Web-based learning media on Newton's Dynamics Law material does not exist because based on the results of small group trials conducted on nine students semester 1 (one) State University of Medan, all respondents do not recommend to be repaired.

4) Fourth revision
   Based on the analysis of the results of the assessment on field trials conducted on 34 students semester 1 (one) State University of Medan, there is no suggestion of product improvement on Web-based learning materials material Newton's Law of Dynamics.

c. Media Expert Results
   In addition to the results of the media expert review also obtained data about the assessment score of each statement in the questionnaire with a minimum score of 1 and a maximum score of 5. The assessment score is used to determine the validity of multimedia. The assessment score is used to determine the validity of multimedia.

1) Score of questionnaire assessment from media expert
Assessment by 1 learning media expert on feasibility aspects of the display / graph includes: the feasibility of Flash learning display, feasibility programming of learning media material Newton's Law of Dynamics. The result of the validation of the instructional media experts shows that the feasibility display of instructional media, the feasibility of programming, in general, stated "Very Good".

From the two tables above can be seen that the multimedia has been developed to achieve valid categories with very good achievement. The assessment includes the feasibility aspect of display and programming feasibility. So that regarding the quality of the display/presentation of multimedia, the multimedia is feasible to be tested in the field.

4. Implementation (Trial of Product)

Multimedia that has been developed and has been declared valid and feasible test, tested to the Student. There are three stages of trials conducted, namely individual testing, small class trials, and spaciousness trials. The results of these trials can be seen as follows.

4. Analysis of Individual Trial Results Data

The following Table 4.1 shows the average percentage of assessment results in individual trials at Medan State University on aspects of the feasibility of learning materials by 96%, aspects of the feasibility of presentation display by 95% and aspects of media utilization by 93%, each of which is categorized "very good." Based on the results of the assessment on Web-based learning media material Newton Dynamics Law on individual trials.

| Categorization | Average Percentage | Criteria |
|----------------|--------------------|----------|
| 1 Aspects of the material feasibility of the pursuit | 96% | Very good |
| 2 Media Feasibility Aspect | 95% | Very good |
| 3 Aspect Utilization of media | 93% | Very good |
| 4 Average | 94, 67% | Very good |

The percentage of average results of the assessment of website-based learning media on individual trials conducted on three students of the State University of Medan can be seen in Figure 4.2.
Figure 4.1. Empirical Score Stem Diagram Evaluation of Website-Based Learning Media Material of Newton's Law Dynamics in Individual Trial at Medan State University

a. Analysis of Small Group Test Results Data.

The following Table 4.2 shows the average percentage of the results of the assessment on the Web-based learning media of Newton's Law Dynamics material in the small group trial at Medan State University on the feasibility aspects of learning material is 88%, the aspect of feasibility display is 91% and the aspect of media benefit amounted to 95%, each including the category "very good".

| No | Categorization                  | Average Percentage | Criteria   |
|----|--------------------------------|--------------------|------------|
| 1  | Aspects of the material feasibility of the pursuit | 88 %               | Very good  |
| 2  | Media Feasibility Aspect        | 91 %               | Very good  |
| 3  | Media Utilization Aspects       | 95 %               | Very good  |
|    | Average                        | 91.33 %            | Very good  |
The average percentage of the results of the assessment of Web-based learning media material Newton Dynamics Law on small group trials at the State University of Medan on the aspects of learning material feasibility, feasibility aspects of display presentation and media expediency aspects can be seen in the following figure.

![Figure 4.2. Empirical Score Acquisition Diagram Evaluation of Website-Based Learning Media Material of Newton's Law Dynamics in Small Group Trials at Medan State University.](image)

The results of the assessment conducted on Web-based learning materials Newton's Law of Dynamics materials on small group trials as a whole are "excellent."

a. Analysis of Field Trial Results Data

| No | Categorization                          | Average Percentage | Criteria       |
|----|----------------------------------------|--------------------|----------------|
| 1  | Feasibility aspects of learning material| 97 %               | Very good      |
| 2  | Media Feasibility Aspect               | 95 %               | Very good      |
| 3  | Media Utilization Aspects              | 93 %               | Very good      |

Table 4.3. Percentage of Average Results of Assessment of Website Based Learning Media Newton Dynamics Lesson Subjects On Field Trial at State University of Medan
Table 4.3 shows the average percentage of assessment results on Web-based learning media on the Dynamics of Newton's Law material in field trials at Medan State University, namely 97% aspects of the feasibility of learning material, 95% aspect of display feasibility and 93% aspect of media utilization. Each including the category "very good." The results of the assessment can be seen in Figure 4.3 below.

**Figure 4.3.** Empirical Score Acquisition Diagram Evaluation of Website-Based Learning Media Material of Newton's Law Dynamics in Field Trials at Medan State University

The results of the evaluation of the Website-based learning media on the Dynamics of Newton's Law material in the field trial on 34 semesters I (one) students of Medan State University showed that the products developed were very good or feasible to use, and there were no improvement suggestions submitted in this field trial, so that revision IV is performed.

5. Evaluation (Evaluation)

From the trial process to lecturers and students obtained the questionnaire data of teacher and student response. Results of questionnaire data analysis in the table above shows that in general lecturers and students provide a positive response to multimedia that has been developed.

Various inputs, comments, and suggestions were obtained from both lecturers and students. The input is intended for improvements or enhanced multimedia perfection. In general, students give a positive impression to the multimedia they have used during the trial. The impression is in the form of their attraction to the multimedia that has been developed and their desire to learn other materials using similar multimedia. As with lecturers, lecturers commented more technically on multimedia. The input is to re-develop the material presented in its entirety to make the resulting multimedia more perfect.

Limitations in research development of website-based learning media and test the effectiveness of this product include 1. Trial product-based learning media website is only done on a limited trial with a sample of 34 students of State University of Medan TA 2011/2012. Extensive trials were not conducted, so the
possibility of bias factors still affected the results of the study. Therefore, the sample in the study must be represented so that the results of the study can be generalized.

Limitations of facilities and infrastructure in the making of website-based learning media especially audio facilities owned by researchers. This will inhibit many researchers to develop a website-based learning media in the State University of Medan.

The readiness of students to engage in a different learning media with the learning media they used to use. Student unpreparedness can be overcome by giving learning CDs to be used as a tool for independent learning.

Unprepared lecturer of Introductory of Physics course in using Web-based learning media in the learning process. There needs to be training for every lecturer in making, developing and using the media so that student learning outcomes can be achieved as expected.

5. Results of Product Effect of Product Effectiveness

Based on the research that has been done on the results of Newton Law Dynamics learning on students who were taught by the media based on website learning, found that the score of student learning outcomes from 34 respondents spread in the range 107-158. From the calculations show that the lowest score of 107 and the highest score of 158.

The effectiveness of website-based learning media is obtained in the following manner:

\[
x = \frac{\text{obtained score number}}{\text{ideal score number}} \times 100\%
\]

\[
x = \frac{4634}{5780} \times 100\%
\]

\[
x = 80.45\%
\]

The value of the effectiveness of this Website-based learning mediabelongs to the very good category with the assessment criteria as listed in the table below 5.1

| Value | Criteria       | Percentage          |
|-------|----------------|---------------------|
| A     | Very good      | 80% <X <100%        |
| B     | Good           | 60% <X <80%         |
| C     | Medium         | 40% <X <60%         |
| D     | Not good       | 20% <X <40%         |
| E     | Very Less Good | 0% <X <20%          |
6. Conclusion

Based on the results and discussion of the development of multimedia-based learning media that can be concluded as follows:

1. Development of audiovisual based learning media is indeed needed by lecturers and students in the learning process. Search results from the questionnaire were found that 88% of the lecturers stated that they need learning media in the learning process to make the learning process run more effectively, and 100% of students stated that they need flash media to make them as individual and classical learning tools.

2. That; (1) the feasibility of the display of learning media is considered very good with the average percentage of 86%, (2) the feasibility of media programming is considered very good with an average percentage of 8.88%. Based on the validation result, it is concluded that multimedia-based learning media of Newton's dynamics material developed is included in very good criterion (87.40%), so it is acceptable and feasible to be used in the learning process.

3. According to the response of the third semester students of tertiary country universities in the individual trials stated that the media of learning based multimedia developed by the Website including the category of excellent where the aspects of learning materials assessed with an average percentage of 96% and the presentation feasibility of 95%, and the aspect of media usefulness of 93%. Based on the results of individual trials it was concluded that multimedia-based learning media material dynamics of Newton law developed included in the criteria very good (94.67%), so it is acceptable and feasible to be used in the learning process.

4. According to the response of Medan State University students in small group experiment, it is stated that multimedia-based learning media developed with Website is very good category (88%), where the aspect of learning material is assessed by the average percentage amounting to 91% and the feasibility of display presentation at 95%, as well as aspects of media utilization by 91.33%.

5. According to the response of Medan State University students on field trials stated that multimedia-based learning media developed with the Website including excellent category (97%), in which the aspects of learning materials were assessed with an average percentage of 95% and the presentation feasibility of 93%, and the aspect of media benefit of 95%.

6. The learning media developed by the researcher is feasible to be used as a medium of learning for the students of Medan State University in the third semester (3) because it has an average value (80.2) higher than the determined KKM (75).

7. Website-based learning media has an effectiveness of 80.24% with a very high category.
   a. Available facilities and time, and the ability of in-house facilities adequate media production.
   b. Expected further research or trials of other populations to obtain more accurate results.
   c. Because of limited time and fund of the researcher, so there are still some uncontrollable influences, so it is necessary to do further research on the more representative sample.
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