Development of website on General Physics subject to increase analytical skills of students

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Abstract. This research aims to develop a website on General Physics subject to increase analytical skills of students. Developed website can be used by using computer or smartphone. The ADDIE research method which are Analyzing, Designing, Developing, Implement, and Evaluating. Research was conducted in Laboratory of Media Digital at State University of Jakarta for six months, starts from November 2018 until May 2019 with students of Physics Education Program, State University of Jakarta as object of research. Indicators of analytical skill measured in this research are giving a reasoning, making a conclusion, evaluating a conclusion, predicting a conclusion, considering the validity of an argument, and explaining something using data. Students’ analytical skill improvement test was conducted by pre-test and post-test in two classes (class A and class B) with n-gain result of class A was 0.66 (medium) and class B was 0.28 (low). Results of validation test showed score 92.30% for material validation, 91.85% for media validation, and 90.37% for learning validation. According to this research result, can be concluded that developed website on general physics subject can increase students’ analytical skill. All of the instruments in this research can be seen at website http://vinnarrai.com

1. Introduction

Globalization and information disclosure give a positive impact on education. Education is not focused on processing data substance and fact, but also challenged to find an approaching, strategy, and learning method that able to answer education needs. Thus, using technology of communication and information in education has developed so fast. Development of research in education hinted that a learning process should be active, which means two-way communication between teacher and students should be occurred [22]. The learning process can be used to measure students’ skill in observing, asking, conducting experiments, associating and communicate experimental results that are the ‘5M’ stages in scientific approach [14].

One of benefit from contribution of ICT is internet. Internet was used a lot as a source of information to support education. Besides the internet, smartphones were also developed fast. This supported by data which shows that smartphone user in Indonesia has increased by 43%. Cited from kominfo.go.id, according to Emarketer, in 2018 estimated number of active smartphone user in Indonesia is more than 100 million people [6].
Development of smartphones utilized in education by development of mobile applications. Mobile applications make students possible to access multimedia resources easily and learn almost everywhere. Technology has an important role in learning activity. According to Pujiriyanto [11], development of technology affects the development of learning process especially in application of media. So that, with development of technology, material delivery in learning can be more variative and innovative.

By the development of technology, education is no more limited by space and time. Homeschooling is an informal education that be able to be an alternative in learning on elementary and junior level. E-learning that developed university can be accessed by students of high level education. Website is an internet application which can connect teachers and students in an online study room. Students can use website as learning source and instructional media with time flexibility. Website gives a chance for students to hold control on their own learning success [13].

Online learning has increased fast for past fifteen years with students participating in a course. One of early development which enables hundred and thousands students to participate at the same time in a course is an E-learning that offered by institutions also has spread throughout the world.

Education is a continuous effort done by human in order to achieve a certain goal in their life. Education experienced a big development by the development of information communication and technology, as well as human needs for a high quality and effective education. Development of technology in past few years has changed society’s paradigm in searching and achieve an information, which is not limited to printed media, but also internet. Website based media can connects students and teacher in an online classroom [9].

Meanwhile, the development of technology in education has triggered a shift of conventional face to face learning to online learning that can be accessed through computer and internet by everyone regardless the place. This online learning has also developed in Indonesia.

Analytical skill is an ability to identify, separate, and distinguish components or elements of a fact, concept, opinion, assumption, conclusion and to check every components to see whether there is a contradiction. Students are expected to show the relationship between various ideas by comparing those ideas with standards, principles or procedures learned [20].

Analytical skill becomes an important thing that is needed by students and the improvement of analytical skill is necessary. In order to improve analytical skill, learning must have a constructive characteristic, determine a problem, and create a supportive environment [8]. According to Veermans, improvement of students’ analytical skill must have orientation of learning, create a hypothesis, test a hypothesis, make a conclusion and evaluation [4].

According to analysis of needs with 55 respondents of Physics Education students at State University of Jakarta, 94,5% stated that they have ever used E-learning and 98,1% stated that students need a website E-learning. 94,5% of respondents have studied general physics and 83,6% stated that general physics is difficult. 98,2% of respondents stated that analytical skill improvement is necessary and 94,5% stated that students’ analytical skill can be improved with website usage.

According to argumentation above, this research is conducted to develop website that gives positive benefits for anyone who want to study independently, discussing with another user, and access the information more freely. Developed website can also increase analytical skill of students.

2. Literature Review
2.1. Website
Website is a generic term for all technologically supported learning using an array of teaching and learning tools as phone bridging, audio and videotapes, teleconferencing, satellite transmissions, and the more recognized web-based training or computer aided instruction also commonly referred to as online courses. Website is a combination of learning process in social means and electronic device [18]. Ong defines website as asynchronous learning activity through computer device where students gather learning material
necessarily [5]. Website is a teaching and learning method using electronic devices (LAN, WAN, or Internet) to deliver the learning material, interaction, or consultation [7].

Website can shorten the learning time and make the study accommodation more economic. Website also make students’ interaction with learning material, teachers/lecturers, or another students easier. Students can share the information and access learning material every time and continuously.

Website also reduces teachers'/lecturers’ attendance factor, since their role is replaced by the website itself. Teachers/lecturers will be able to enhance learning materials, do a self development or a research, and control students’ learning activity.

2.2. Analytical Skill

According to Bloom, instructional goal in learning process can be grouped to three domains which are cognitive, affective, and psychomotor [17]. Bloom developed a cognitive learning goals that distinguished to six levels, knowledge, comprehension, application, analysis, synthesis, and evaluation. In Bloom’s taxonomy, analysis is higher than aplication and understanding.

Analytical skill is an ability to identify, separate, and distinguish components or elements of a fact, concept, opinion, assumption, conclusion and to check every components to see whether there is a contradiction. Students are expected to show the relationship between various ideas by comparing those ideas with standards, principles or procedures learned [21].

Trianto states that cognitive process in analytical skill level involves concluding [19]. Students are said to have analytical skill if they have already able to decipher concepts and theories into its forming elements. Therefore, analytical skill is a part of cognitive learning goals which is an ability to identify, separate, and distinguish components or elements of a fact, concept, opinion, assumption, conclusion and to check every components to see whether there is a contradiction.

2.3. General Physics

Physics is an experimental science. Physicists observe the phenomena of nature and try to find patterns that relate these phenomena. These patterns are called physics theories or, when they are very well established and widely used, laws of physics or principles [2].

Physics is based on experimental observations and quantitative measurements. The main objective of physics is to find the limited number of fundamental laws that govern natural phenomena and to use them to develop theories that can predict the results of future experiments. The fundamental laws used in developing theories are expressed in the language of mathematics, the tool that provides a bridge between theory and experiment [15].

The science of physics has developed out of the efforts of men and women to explain our physical environment. These efforts have been so successful that the laws of physics now encompass a remarkable variety of phenomena, including planetary orbits, radio and TV waves, magnetism, and lasers [1]. In general physics, students will learn about measurements, kinematics, forces and Newton’s law of motion, work and energy, rotational kinematics, and simple harmonic motion.

3. Research method

Research and development (R&D) method is used in this research that the model of the method ADDIE [10]:

1) Analysis

The first step of ADDIE model is analysis. In this step, program designer have to do a need analysis to collect information related to problems faced by students in undergraduate degree.

2) Design
Second step of ADDIE model is design where researcher designs the website with E-Learning characteristic. So, students are expected to achieve competence and goals of following subject.

3) Development
The third step of ADDIE model is development. Researcher produces and develops learning materials for website.

4) Implementation
The fourth step of ADDIE is implementation. In this step, the website is implemented by instructor in class based on teaching plan.

5) Evaluation
The last step of ADDIE model is evaluation. Evaluating of website is in this step, website is evaluated in order to improve its efficiency and effectiveness. Based on this evaluation results any improvements are done to perfects the website.

Researchers used research instruments which are: Learning material expert validation sheet, media expert validation sheet, learning expert validation sheet, pre-test and post-test questions.

4. Results and Discussion
4.1. Results
Website http://vinnarrai.com as general physics e-learning is product of this research. This website is open access for the public anywhere and anytime. This website has main components that are:

1) Administrator. Students data, hire teachers, teachers data, and updates website organized by administrator.

2) Lecturers. Learning data, organizes test questions and score, and updates learning materials apply by lecturers.

3) Students. Students have to online learning in phydu.com such as taking quizzes, discussion forum, information sharing with another user through social media and final exam. Student have to regist to login vinnarrai.com.

Features in http://vinnarrai.comare: 1)Main page, 2)Register, 3/Login, 4)Learning Materials, 5)Exercise.

Figure 1. Main Page
Figure 2. Register Page
Figure 3. Login Page

Figure 4. Learning Materials

Figure 5. Exercise Page

Table 1. Learning Material Expert’s Validation Results

| ASPECT                          | Expert 1          | Expert 2          | Expert 3          |
|---------------------------------|-------------------|-------------------|-------------------|
| Accuracy of Material            | 88,00%            | 92,00%            | 92,00%            |
| Delivery of Material            | 93,33%            | 93,33%            | 93,33%            |
| Language usage                  | 86,67%            | 93,33%            | 100%              |
| Basic Competencies on Curriculum| 90,00%            | 90,00%            | 100%              |
| Average Percentage              | **89,23%**        | **92,30%**        | **95,38%**        |
| **Overall Percentage**          |                   |                   | **92,30%**        |

Validation by experts referred to Likert scale interval. Likert scale is used to measure behavior, opinion, and perception about social issue or phenomena [12]. Obtained data then interpreted as follows:

Table 2. Likert scale [16]

| Average Score | Interpretation |
|---------------|----------------|
| 0%-20%        | Very Bad       |
| 21%-40%       | Bad            |
| 41%-60%       | Enough         |
| 61%-80%       | Good           |
| 81%-100%      | Very Good      |
Validation result by experts showed by score 89,23% according to material expert 1, 92,30% according to material expert 2 and 95,38% according to material expert 3. Overall validation result was 92,30%. Based on this result, the developed website is considered worthy of use for general physics. Media expert’s validation result was shown on table 3.

| Table 3. Media Expert’s Validation Result |
|------------------------------------------|
| ASPECT       | Category | Expert 1 | Expert 2 | Expert 3 |
|--------------|----------|----------|----------|----------|
| Display      | 1        | 4        | 5        | 4        |
|              | 2        | 5        | 4        | 4        |
|              | 3        | 4        | 5        | 4        |
| Media Usage  | 4        | 5        | 5        | 4        |
|              | 5        | 4        | 4        | 5        |
|              | 6        | 5        | 4        | 5        |
|              | 7        | 4        | 5        | 5        |
|              | 8        | 5        | 5        | 5        |
|              | 9        | 5        | 5        | 5        |
| Average Score|          | 91,11%   | 93,33%   | 91,11%   |
| Overall Score|          |          |          | 91,85%   |
The result of media expert’s validation are 91.11% by expert 1, 93.33% by expert 2, and 91.11% by expert 3. Overall validation result obtained is 91.85%. From this result can be concluded that the developed website can be used in general physics learning.

By referring to Likert scale, the result of learning expert’s validation at table 4.

**Table 4. Learning Expert’s Validation Result**

| INDICATOR                                           | EXPERT 1 | EXPERT 2 | EXPERT 3 |
|-----------------------------------------------------|----------|----------|----------|
| Website creates an effective learning environment   | 4        | 5        | 4        |
| Website makes students experience an exciting learning process | 5        | 4        | 4        |
| Website accelerates the learning                    | 4        | 5        | 4        |
| Website increases students’ understanding           | 5        | 5        | 5        |
| Website increases students’ confidence              | 4        | 4        | 4        |
| Website increases students’ success rate in solving HOTS questions | 5        | 4        | 5        |
| Website makes students understand General physics easily | 4        | 5        | 4        |
| Website makes students more focus                   | 5        | 5        | 5        |
| Website makes students catch the concepts easily    | 5        | 4        | 5        |
| **Average**                                         | **91.11%**| **91.11%**| **88.89%**|
| **Overall Score**                                   |          |          | **90.37%**|
4.2. Discussion

Learning validation consists of nine indicators. Validation score by learning expert 1 was 91.11%, by expert 2 was 91.11% and by expert 3 was 88.89%. Average validation result obtained 90.37%.

From this result can be concluded that development of website on the general physics subject has a very good result and can be implemented in general physics learning.

From the result of pretest and posttest, N-gain for class A was obtained by 0.66 (medium) and class B by 0.28 (low). According to Hake [3]. N-gain was in good category (0.3 ≥ g ≥ 0.7). N-gain is normalization that obtained from pretest and posttest result [3]. N-gain calculation is used to find the improvement using web based media before and after usage.

4.3. Documentation
5. Conclusion

92.30% given as expert material validation results with very good category. 91.85% given as media expert validation results with very good category. 90.37% as given learning validation results with very good category. This website can increase students' Analytical Skill, verified by N-gain result = 0.66 (medium category) for class A and 0.28 (medium category) for class B. So, development of website on the general physics subject can increase analytical skill of students. All of the instruments in this research can be seen at website http://vinnarrai.com

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