Development of web-based learning media for physics materials using Moodle in high school

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Abstract. Education systems in various countries have experienced massive transformation since the development of information technology. The learning environment has shifted from face to face learning to web-based education or e-learning. There are multiple free online learning platforms available on the internet, one of which is Moodle. The main aim of this study is to develop physics learning media with Moodle to improve student's motivation in learning physics. The ADDIE model framework is used to create web-based physics learning media, which consists of four stages, namely analysis, design, develop, implement, and evaluation. The product was validated by material and media experts, as well as two physics teachers as practitioners. The validation and practicality test results show that the web-based learning media is valid and practical as teaching media to improve student's motivation in learning physics. The results of the effectiveness test using the design of one class pre-test and post-test showed an increase in students' motivation with an N-gain value of 0.80 with categories high. The results of this study give insight for physics teachers on how to design technology-based learning to increase student motivation in learning physics.

1. Introduction

Advances in science and technology have a significant impact on the current education system. Issues regarding the emergence of a knowledge society, changes in society and globalization have influenced the learning process in various types of education. The teaching system undergoes a transformation from face to face to virtual learning. Among a wide range of online learning platforms, Moodle is one of the most popular platforms used by teachers and other education practitioners with more than twenty-two million courses around the world [1]. Moodle is an open-source learning management system that enables teachers to create a virtual classroom, share material courses, and discussing with students. Research in the field of education proves that Moodle provides many advantages for distance learning, including flexibility for teachers in designing virtual learning and ease of use of features that support the learning process [2,3].

Physics is a part of science that is difficult to learn and to teach. The low motivation, misconception, and student’s naïve beliefs about the content of physics knowledge are the main obstacles that students faced in learning physics [4-6]. A similar problem occurs at Islamic State Senior High School (MAN) 1 Batanghari, Jambi, Indonesia. Based on the interviews with physics teachers revealed that so far the teacher only uses learning media in the form of textbooks and student motivation in learning physics is
low. To overcome these problems, innovation is needed through the use of technology-based learning media. The main key to the success of teachers in technology-based learning lies not only in the choice of technology that will be used but in how teachers design various learning activities that can train engagement. Moodle is one of the most famous online platform that used by physics teacher. Much of the current literature on Moodle pays particular attention to students’ cognitive development, such as problem-solving skills and conceptual understanding [7,8]. However, affective domains such as motivation, self-efficacy, beliefs, task values, and interests are important parts that will determine the student's engagement in various learning activities [5,9]. Through case study, Ramma, Bholoa [10] shows that the use of technology in the teaching and learning of physics in high school can accommodate students' affective domain mastery. Ramma, Bholoa [10] further explained that students' interest and motivation have increased because students get direct feedback through the online learning platform used in learning physics. According to Chaubey and Bhattacharya [11], online portals provide opportunities for teachers to design learning based on constructivist approaches without the restriction of time and distance, accommodate various learning styles, and promoting lifelong learning. The major objective of this study was to develop web-based learning media for physics materials using Moodle in high school and investigated the effectiveness of this media to improve student’s motivation in learning physics.

2. Methods

This research was conducted at MAN 1 Batanghari, Jambi. This research used The ADDIE model as a framework of development. This model has adaptability guideline that helps researchers in develop web-based learning media in five stages called analysis, design, development, implementation, and evaluation [12] as can see in figure 1. The first stage called analysis. At this stage, researchers conduct a needs analysis including analysis of the potential and problems faced by students in learning physics, analysis of student characteristics, and curriculum analysis. The second stage called design. At this stage researchers design the media, determine media specification, and media development schedule. When the design stage is completed, web-based learning media was created using Moodle in the development stage. The prototype media was then validated by a team of experts, including media experts and material experts.

![Figure 1. The ADDIE model flowchart.](image-url)
According to figure 1, the next stage is implementation. The implementation stage is the stage to collect data about the quality of the media prototype that has been developed. The data gathered from this stage is used to improve the quality of the media. Once this stage completed, the prototype is tested in small and large groups of students in the evaluation stage. The evaluation phase is an important stage in the development of web-based learning media. This stage is used to determine the quality of media and whether the media is following the goals we want or not. The next step is investigating the effectiveness of web-based learning media to improve student’s motivation in learning physics using a pretest and post-test one-group design. In this phase, researchers using The Motivated Strategies for Learning Questionnaires (MSLQ) to assess students’ motivation in learning physics. The motivation components that researchers used from MSLQ consist of five components, namely intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs, and self-efficacy [13]. The level of media eligibility is presented with a validation score. The greater the validation score, the better the feasibility level of the media. One Group Pretest-Posttest design is used to determine the effectiveness of the media. The sample consists of 30 students from class X MIA MAN 1 Batanghari, Jambi. Module effectiveness determined by statistical tests on increasing students’ motivation in learning physics

3. Results and discussion

This research and development (R&D) aim to develop web-based learning media to improve student's motivation in learning physics. The research began by analyzing the student's need, including analysis of student characteristics, analysis of existing learning media, analysis of motivation and obstacles faced by students in learning physics, and curriculum analysis (basic competencies and learning objectives of work and energy chapter). From the analysis stage revealed that, students' motivation in studying physics was still low; their main reason for studying physics was only to get good grades, not to master the concepts. The foremost impediment faced by students of MAN 1 Batanghari Jambi is problem-solving, and the media used by teachers in learning activities are only textbooks with tutorial strategy. Based on the results of the analysis phase, researchers designed and developed a web-based physics learning media using Moodle. The next step is validation based on the assessment conducted by media and material experts, as well as small and large group trials. The validation results can be seen in the table below:

| Validator               | Score  | Criteria    |
|------------------------|--------|-------------|
| Media Expert           | 80%    | Very Valid  |
| Subject Matter Expert  | 88.5%  | Very Valid  |
| Small Group            | 93.44% | Very Practical |
| Large Group            | 82.38% | Very Practical |

The result from expert and trial groups showed that web-based learning media about work and energy chapter is valid and practical to use in learning physics. The next step is to analyse media effectiveness to improve student’s motivation in learning physics. Researchers used pre-test and post-test one-group design to determine the effect of web-based learning media on student’s motivation in learning physics. The Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich in 1991 was used to assess student’s motivation before and after using media [13]. From statistical data analysis revealed that the N Gain value was 0.7 with high category and the motivation increasing can be seen on graphics below:
Figure 2. Student’s motivation before and after using web-based learning media.

Web-based learning media has proven to be effective in increasing student motivation in learning physics. The results of the data analysis show that there is a significant increase in student motivation, especially in two-scale, namely intrinsic motivation and self-efficacy. This happens because the web-based media developed are designed with a variety of attractive activities to make the learning process enjoyable. Also, there are various features in Moodle that make it easy for students to discuss learning with their friends without the restriction of time and distance. They can download the subject matter quickly and can repeat watching the learning videos sent by their teacher anytime and anywhere. It is in line with research conducted by Paragina, Paragina [3], Al-Ani [14], and Deng and Tavares [15] which revealed features on Moodle are easy to use in learning. Students can discuss the subject matter without limitation of distance and time. These results are also in line with research conducted by Ramma, Bholoa [10] which states that the use of web-platforms can increase students' motivation, interests, and values in learning physics as well as providing opportunities for parents to participate in encouraging their children to be active in learning and having communication with the teacher. On the other side, the teacher can use the feedback given by students and their parents to design online learning activities that can increase student independence in learning. So there is a mutually beneficial relationship between teachers, students, and parents.

4. Conclusion
Web-based learning media using Moodle is based on validation conducted by material experts and media experts, as well as small group and large group trials. Web-based learning media using Moodle have been shown to increase student motivation in learning physics. This happens because web-based media can visualize abstract concepts, as well as provide opportunities for students to be actively involved in learning, including free discussions with teachers and friends, without feeling ashamed if they make mistakes.

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