

Needs Analysis for Developing Problem Solving-Based E-Module for Projectile Motion to Train High School Students' Conceptual Understanding in Pekanbaru

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Abstract. The conceptual understanding of high school students in Pekanbaru is still low. This is due to: 1) the need for students' active involvement in problem-solving activities and 2) the lack of interactive learning resources in motivating and strengthening students' conceptual understanding. Students' low conceptual understanding can be overcome by using a learning media in the form of a problem-solving-based e-module in the learning activities. This research is survey research—the first step in developing a problem-solving-based e-learning module. The purpose of this research is to find out what the students need in learning physics which results in the need to develop a problem-solving-based e-module on physics learning. The results of the analysis of 102 students suggested that 63.7% of the students use printed books in learning, which, according to students, are less practical. Moreover, as many as 61.8% of the students experience problems in problem-based learning, meaning that students have problems in analysing problems as well as interpreting and evaluating problem-solving; therefore, problem-solving-based learning is needed. As many as 59.8% of the students don't learn independently, meaning that students are very dependent on the role of the teacher. Furthermore, based on the results of the survey, 53.9% of the students feel more enthusiastic if the learning uses technology, and 66.7% considered the concept of projectile motion as difficult. These results indicate that it is necessary to develop teaching material in the form of problem solving-based e-module for projectile motion as a physics learning medium to train students' conceptual understanding in the city of Pekanbaru.

1 Introduction

The development of a better learning process plays an important role in improving the quality of education [1]. Therefore, it is necessary to improve the quality of the lessons. One of the lessons that need to be improved is physics. Physics is one of the subjects where the material being taught requires a high level of student understanding.

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Factors that cause the less successful physics learnings are students' motivation and interest. A method that is often found in learning that results in passive students is the lecture method. In this method, most of the learning process is dominated by the teacher, and the students merely listen and record the main points of the materials the teachers deliver. Therefore, students need more participation in the learning process, which results in a decrease in student's motivation and interest. In teaching physics, it is expected that the students are really active so that the learning has an impact on the students' memories—what they have learned will last longer. A concept is easier to be understood and remembered by the students if the concept is presented through appropriate, clear, and interesting procedures and steps [2].

Factors that influence the success in learning are students' activity. Problem-solving accommodates students' activity so that the learning process runs smoothly. In practice, however, students' activity level is still low. The indicators found are 1) students tend to be less active in learning physics because the teacher does not involve the students to actively participate 2) the teachers have less than optimal efforts in guiding the students in solving problems 3) the students' desire to ask questions in each lesson is still lacking. An effort is needed to overcome this problem. The solution to this problem might be the use of the right media in learning [3].

Learning media has the same important role as other educational factors, but sometimes it gets less attention from the teacher. There are many media that can be used in learning, one of which is e-module. E-module can be an alternative learning media with multimedia capabilities. It includes elements of text, images, audio, animation, and video that make the learning process easier and interactive. The use of e-modules in learning is carried out by integrating technology which will have a major influence on improving the quality of education [4]. Based on the problems above, this study aims to address students' needs in the learning process so that the difficulties encountered can be overcome.

2 Research Method

This research is a qualitative descriptive study that aims to analyze the students' needs for e-modules so that they can improve their conceptual understanding. This needs analysis includes analysis of the implementation of learning, problem-solving, and e-modules. Students of class XI MIPA (of math and science major) are the subjects of this study. A total of three schools in the city of Pekanbaru and a number of 102 student respondents were sampled. Needs analysis data were obtained through a problem-solving-based e-module development needs questionnaire given to the students. In the research, the instrument is given through Google Forms, and the data obtained from Google Forms is then analyzed descriptively.

Table 1. Instruments for the needs analysis stage.

Method of data collection	Data collection instrument	Aim
Questionnaire	Questionnaire	Knowing: 1) students' difficulties in solving problems, 2) the availability of learning media, 3) students' interest in using technology in the learning process, 4) student activity in the learning process, 5) materials that are considered difficult in learning physics

The results of the needs analysis are used as the basis for formulating recommendations for the development of problem-solving-based e-modules.

3 Results and Discussion

Based on the needs analysis data obtained through distributing questionnaires to students, problems that cause the learning process to not be optimal can be identified.

Table 2. Identification of Learning Problems.

No	Analysis Question
1.	63.7% of students only use printed books provided by the school as learning materials
2.	61.8% of students experience problems in presenting <i>problem-solving-based learning</i> (Problem-Solving).
3.	59.8% of students don't learn independently—students are very dependent on the role of the teacher
4.	53.9% of students are very enthusiastic about learning using technology
5.	66.7% of students find projectile motion material difficult

Table 2 shows that students only use printed books in learning physics. In addition, students experience problems in presenting problem-solving-based learning. Printed books are learning media that are commonly used in schools that contain learning materials, descriptions, examples, and exercises. Some drawbacks of printed books include 1) Printed books cannot present movement. Its material presentation is linear, and it cannot present events sequentially; 2) Printed books can hardly provide guidance for readers who have difficulty understanding certain parts of the book; 3) Printed books can hardly provide guidance and feedback for questions asked, 4) Printed books cannot accommodate students with limited reading ability because printed books are written at a certain reading level [5]. Learning resources that are systematically arranged to be independently understood are teaching materials in the form of electronic modules (e-modules). They can contain text, images, and learning videos and are different from print modules. Hence, the students are required to learn about solving their problems using their own way. [6].

As many as 59.8 % of the students need to be more independent in learning. Students are very dependent on the role of the teacher, meaning that the learning process experienced so far is teacher-centered. Some learning activities that are like this are already quite good, but this paradigm is no longer appropriate when used to deal with students who have a variety of different characters. The learning process that occurs should lead the students to play an active role in building their own knowledge [7][7]. If the learning process is still teacher-centered, it will have an impact on students' conceptual understanding; the students need to be trained in solving problems in learning.

The other results of the survey show that 53.9 % of the students are very enthusiastic about learning by utilizing technology. Therefore, it is necessary to develop problem-solving-based e-module learning media. This e-module integrates multimedia. It includes elements of text, images, audio, animation, and video, which make the learning process interactive. The use of e-modules in learning is in accordance with the demands of the times, where the integration of technology into the world of education has a major influence on improving the quality of education [4].

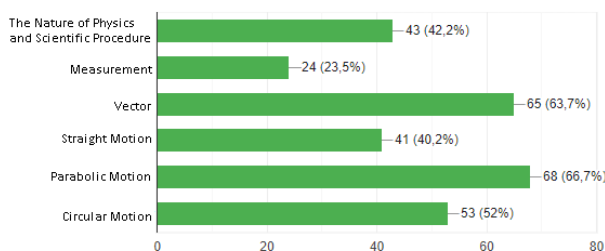


Fig. 1. Materials Considered Difficult

Based on **Fig. 1**, as many as 66.7% of the students think that *Projectile motion* material is difficult in class X semester 1. In understanding projectile motion material, the difficulties that are often experienced by the students are: (1) describing vector component in the x (horizontal) and y (vertical) direction; (2) distinguishing velocity vector, velocity vector component, velocity vector component in the x and y directions; (3) focusing on memorizing the formula for the time taken by the bullet for half a projectile trajectory, maximum height, maximum farthest distance; (4) always assuming that the final velocity of a projectile moving object when it hits the ground is always zero; (5) assuming the object's velocity is zero at the top (whereas only the velocity in the vertical direction is zero); (6) assuming objects in the x and y directions have acceleration; (7) using the sine cosine rule of triangles in determining the distance or height and vice versa and determining the distance or height based on information on speed [8].

4 Conclusion

The results obtained indicate that students need a learning resource that can improve their conceptual understanding of projectile motion material. In addition, they also require learning resources that can be understood independently by using technology. The appropriate learning media to be used in the implementation of the learning is a problem-solving-based e-module. This e-module can contain text, images, and videos. Through problem-solving-based e-modules, students can learn independently, anywhere and anytime.

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