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DEVELOPMENT OF E-MODULES BASED PjBL USING THE FLIPBOOK APPLICATION FOR CLASS XI STUDENTS OF SMA MATERIALS STATIC FLUID

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ABSTRACT

This Study aims to produce the product in the form of the teaching materials in the form of Project Based Learning (PjBL) based E-Modules using the Flibook application on the cognitve learning outcomes of the students in grade XI at SMA Negeri 1 Tanjung Morawa. This Research and Development (R&D) method. The development model used is a 4-D model (Define, Design, Development, and Disseminate). The data analysis technique used is the validity and the effectiveness. Based on the results of the research that has been done, it can be concluded that the E-Module is included in the valid and effective criteria. This is shown from the results of the expert validation that giving an average percentage of 3,67% in the valid and good category and the results of students' daily test scores obtained by an average percentage of 88% in the effective and very good category. Therefore, the Project Based Learning (PjBL) based E-Module is proper to be used as the teaching materials at school

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1. INTRODUCTION

Natural Sciences (IPA) is the study of the entire universe and its contents. Physics is a branch of science that studies objects in nature physically and written down mathematically so that they can be understood by humans and used for the welfare of human (Sujanem, 2012). Based on this, learning Physics cannot be separated from mastering concepts, applying them in solving Physics problems, and working scientifically. However, learning Physics in today's classrooms tends to emphasize mastery of the material in the book and overrides students' physics problem solving abilities, so that students' ability to solve problems is still relatively low (Hudha, Aji, & Rismawati, 2017). Physics is a process of discoveries which is also known as real science. Physics subjects explain all phenomena that occur in the natural universe, so that Physics problems are often encountered in everyday life. The role of Physics learning is to train students' abilities in mastering the knowledge, concepts, and principles of Physics, having scientific abilities and science process skills. In addition to relating to natural phenomena, physics is also closely related to technological developments that continue to develop (Rosdianto, 2017).

Advances in technology have a very positive impact on the world of education, by providing many conveniences in the field of teaching and learning and can create innovations that are very useful in the world of education. Learning Physics using electronic-based modules (E-Modules) can help the online learning process

caused by the Covid-19 pandemic. Where with the E-Modul students can learn independently individually and have the goal of developing mastery of the concept of physics in high school students. this is very much needed because as research conducted by Prikustini et al. (2021), concluded that the learning process during the pandemic changed by using a remote network. This has an impact on teachers because they are less than optimal in providing learning materials and disrupting the learning process which causes the expected learning objectives to not be achieved.

E-Modules are independent teaching materials that contain videos, animations, and audio, presented in electronic form and connected with a link so that they can support learning to be more interactive (Kementerian Pendidikan dan Kebudayaan RI, 2017), foster creativity, productive thinking habits, create conditions for learning. active, effective, innovative and fun (Budiarti, Nuswowati, & Cahyono, 2016). E-Modul is also defined as a learning media using a computer that displays text, images, graphics, audio, animation and video in the learning process (Nugraha, Agung; Subarkah, 2015). E-Modules can be developed with various applications, one of which is the Flipbook application. The Flipbook application is an application for creating e-books, E-Modules, e-papers, and e-magazines (Hidayatullah & Rakhmawati, 2016). This application can also be used as a learning media that will help in the learning process because this application is not only glued to writings but can include motion animation, video and audio that can be used as an interactive and interesting learning media so that the learning process is not easy. boring.

Based on the results of a preliminary study conducted in class XI SMA N-1 Tanjung Morawa, it was found that there were 77.8% of students who stated that they had difficulty understanding the material and working on questions, 83.3% that the school still did not take advantage of advances in information & communication technology. in the learning process, 94.4% of students said they agreed to apply learning media based on Information and Communication Technology, 61% of students stated that the modules used in schools were less attractive, 77% of students stated that they liked learning physics by using practicum, and 88.9% of students stated that the method used in class was a lecture method, so students felt bored and did not play an active role in the learning process. From the results of the questionnaire analysis of student needs, the researchers conducted research in accordance with the problems that occurred in schools.

One of the efforts to overcome the problems above is with Project Based Learning (PjBL)-based learning E-Modules. Bases that emphasize projects will maximize student activities in learning, can increase learning creativity, critical thinking skills and improve student learning skills in the long term (Sampurno, 2009). In addition, PjBL-based learning can also have a good influence on physics learning outcomes, both affective, cognitive and psycho-motor (Yance, Ramli, & Mufit, 2013).

The following are the steps of the Project Based Learning (PjBL) learning model according to the Kemendikbud (2014), including:

1. Step 1: Start with essential questions
2. Step 2: Design Project
3. Step 3: Create Schedule
4. Step 4: Monitoring the students and progress of project
5. Step 5: Assess the Outcome
6. Step 6: Evaluation of the Experience

There are several expert opinions about the PjBL steps, but in this study the steps used according to the Ministry of Education and Culture, because each of these steps are regular and students can more easily understand these stages and the completion of the project can be in accordance with the steps that have been determined.

Making PjBL-based E-Modules discusses Static Fluid material, Selection of Static Fluid material because Static Fluid material is considered difficult to understand if it is only explained in percentages. This material needs to require the discovery of concepts, understanding, and real applications in everyday life. Making PjBL-based E-Modules displays material objects that seem real and easier for students to understand than print media modules. Susilana & Cepi (2008) stated that learning provided with direct and conceptual experience is the most concrete level of learning, because students are faced directly with the surrounding environment. By using PjBL-based E-Modul teaching materials, it is expected to be able to overcome students' learning difficulties in the Physics subject of Static Fluids. The main objective of the PjBL learning model is to develop students' intellectual skills through projects and be able to study in groups.

Based on the background described above, it can be formulated the problem that will be studied is how is the validity and effectiveness of E-Modul teaching materials using the PjBL-based Flipbook application in

class XI SMA students with Static Fluids? Meanwhile, the purpose of this study was to determine the validity and effectiveness of the product in the form of E-Module teaching materials for PjBL-based Static Fluids using the Flipbook application for class XI high school students.

2. RESEARCH METHOD

This type of research is research and development (Research and Development). The research and development used is the 4D model proposed by Thiagarajan which stands for Define, Design, Development, and Dissemination. However, this research is limited only to the Development stage. At the Define stage, an analysis of student needs and material selection is carried out. In the Design phase, the selection of media and learning device formats is carried out according to the needs of students related to the material of Static Fluids. The Development Phase produces teaching material products in the form of PjBL-based E-Modules with the Flipbook application which produces output in the form of links and `html`. After the E-Module was completed, the E-Modul was validated by four validators, namely two material experts, one media expert, and one linguist through a validation questionnaire aimed at determining the feasibility of the product obtained so that it could be tested on students.

The research instrument used is the instrument of validity to obtain information about the quality of the E-Module, and the instrument of effectiveness in the form of a test to students, namely a test to determine the level of ability of students after being given the E-Module in learning activities.

The types of data collected in the making of this E-Module are quantitative data and qualitative data. Quantitative data was obtained from the results of filling out a validation questionnaire conducted by four validators and a student response questionnaire to see the feasibility of the Static Fluid E-Module. Qualitative data was obtained based on criticism, input and suggestions related to the E-Module material for Static Fluids. Guidelines for scoring the results of the assessment using a Likert Scale 1 to 4 used for the validity and effectiveness test instruments are in Table 1 (Widyoko & Eko, 2009).

Table 1. Scoring Guidelines

Number	Criteria	Score
1	Very Good	4
2	Good	3
3	Not Enough	2
4	Very Less	1

The ideal maximum score is 4 and the ideal minimum score is 1, then the E-Module assessment classification is shown in Table 2 (Widyoko & Eko, 2009).

Table 2. Guidelines for E-Module Validity Criteria

No	Interval Score	Criteria
1	$\overline{x} > 4.2$	Very Good
2	$3.4 < \overline{x} \leq 4.2$	Good
3	$1.8 < \overline{x} \leq 2.6$	Not Enough
4	$\overline{x} \leq 1.8$	Very Less

The category of the percentage of completeness of the criteria for the completeness of the student learning outcomes test results is shown in Table 4 (Widyoko & Eko, 2009).

Table 3. Criteria for Completeness of Student Learning Test Results

Percentage of Execution	Category
$x \geq 80\%$	Very good
$60\% \leq x \leq 80\%$	Good
$20\% \leq x \leq 40\%$	Not Enough
$x \leq 20\%$	Very Less

Based on the effectiveness analysis above, the resulting E-Module is said to be effective if the student learning outcomes test completeness meets the minimum criteria of good.

3. RESULT AND DISCUSSION

This research is a development research, so the product of this research is an E-Modul based on Project Based Learning (PjBL) which meets the valid and effective criteria. The E-Module development stage uses the Thiagarajan 4-D (Define, Design, Development, Disseminate) model. However, in this study the author only reached the development stage.

In the Define stage, based on the analysis of student needs, it was found that students still use printed books and are less attractive so that students experience a lack of interest in learning so that students have difficulty learning Physics subjects.

Based on the results of the analysis of material selection based on the syllabus, it is obtained that KD.3.3 Applying the laws of static fluid in everyday life, and KD 4.4 Designing and conducting experiments that utilize the properties of static fluids, along with presentation of experimental results and their use.

After carrying out the Define stage, then the Design stage is carried out which aims to prepare the design of learning devices with two main steps, namely: (1) media selection, which has been adapted to the analysis of student needs. The media selected in this study were electronic-based module teaching materials (E-Module); (2) the selection of formats, indicated to design or design learning content as teaching materials. The format used in this study is the Flip-book application in making electronic-based modules (E-Modules).

The next stage is Development to make teaching material products in the form of E-Modules which are shown in Figure 1, Figure 2 and Figure 3.

Figure 1. E-module cover display,
(a) Before Revision, (b) After Revision

This page is the cover page for PjBL-based E-Modules. On this page there is an E-Module title, material title, author name, and class. This E-Module consists of 2 (two) Learning Activities including: KP 1: Hydrostatic Pressure, Pascal's Law, and Archimedes' Law; KP 2: Surface Tension, Capillarity, and Viscosity.

After the E-Modul has been created, the E-Modul is validated by material experts, media experts, and linguists through questionnaires and questionnaires.

The tests of material experts, media experts, and linguists are carried out by validators who are experts in their fields including two experts, namely Physics Education lecturers and Physics subject teachers as material expert validators, Informatics Engineering lecturers as media expert validators, and Indonesian Language and Literature Education lecturers as validators. language expert validator.

(a) (b)

Figure 2. Display of e-module contents,
(a) Before Revision, (b) After Revision

3.1. E-Module Validation Results

From the results of the validation analysis of material, media and language experts, the results of the assessment are shown in Table 4.

Table 4. Criteria for Completeness of Student Learning Test Results

Validator	Validation Result					
	Feasibility Content	Feasibility of Presentation	Contextual Feasibility	Validation Results	Validation Results	Rating Average (%)
SY	3.6	3.6	3.6	-	-	3.7
AH	3.9	3.7	3.9	-	-	
KN	-	-	-	3.8	-	3.8
RK	-	-	-	-	3.5	3.5
Average						**3.67**
Category						**Good and Valid**

Based on the assessment made by the validator both in terms of material, language, and media that the average score of material experts is 3.7, the average score of linguists is 3.8, the score of media experts is 3.5. So the percentage of the average value of each aspect of the assessment is 3.67% which is in good and valid criteria. All material, language and media validators say that the E-Module can be used with some suggestions or feedback.

3.2. E-Module Effectiveness Results

The results of the students' daily test scores obtained by the authors through the learning that has been done. The author provides E-Modules to students through physics teachers and distributes them to students. Based on the test work contained in the E-Modul, it can be seen from the 18 students who answered, there were 16 students who had met the minimum (KKM) of 75 which means there were 88.9% of students who had completed and there were 2 students who did not meet (KKM). which means 11.1%. Therefore, it can be concluded that the making of the E-Module can be said to be effective.

Based on the results of the learning test given to students and obtained a score of 88% and is in the Very Good category, the PjBL-based E-Module produced is said to be Effective. This is in line with research conducted by Izati et al. (2018), which stated that student learning outcomes increased from 67.65% before being given the PjBL learning strategy to 85.29% after being given the PjBL learning strategy. The increase in learning outcomes occurs due to an increase in teacher and student activities during the learning process through project work. Trianto, (Trianto, 2012) also states that the results of the score in the criteria are good if the results of students' scores reach classical completeness or at least 85% of the number of students in the class reach the KKM. Minimum Completeness Criteria (KKM) for Physics Subjects is 75.

The final result of making an E-Modul is software in the form of a link https://s.id/E-ModulFluidaStatis_KlsXISMA. The E-Module is provided free of charge so that students can get it easily.

4. CONCLUSION

Based on the results of research and discussion in this study, it can be concluded that the making of PjBL-based E-Modules is valid based on the results of validation that has been carried out by 4 validators consisting of 2 (two) material experts, 1 (one) linguist and 1 (one) media expert with an average score percentage of 3.67% with good and valid categories and some suggestions or improvements. The making of PjBL-based E-Modules is effective based on the results of the practice test questions that have been carried out by the physics subject teacher with 18 students, where it is stated that 16 students have passed the KKM, and 2 students have not passed the KKM. The percentage of the average value generated is 88% in the Very Good category. The E-Module is suitable for use as teaching materials in schools.

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