



## DEVELOPMENT OF PROBLEM-BASED LEARNING-BASED E-MODULES WITH FLIP PDF PRO APPLICATION IN PHYSICS COURSES

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### ABSTRACT

*This paper is based on the lack of students' learning interest in physics courses, which is indicated by the teaching materials used by educators during the learning process. The research in this paper aims to develop problem-based learning of e-glasses modules on momentum and impulse material as well as to determine the validity and practicality of e-modules for students of class X at SMA Negeri 1 Tapung. The type of research is the research and development (R&D) method. The method used is an R&D panel with the ADDIE model. To achieve the goal, several stages of development are analyzing, designing, developing, implementing, and evaluating. In addition, the research result is an electronic module on momentum and impulse material. The validation results of material and media experts on the electronic module achieve a proportion of 81.86%, which is in the very valid category. The practicality of a product seen from the practicality test that was obtained from the results of the practicality sheet for the electronic module is 95.70% and categorized in the very practical category.*

**Keywords:** *electronic module, flip pdf pro application, problem-based learning, momentum and impulse*

## PENGEMBANGAN E-MODUL BERBASIS PEMBELAJARAN BERBASIS MASALAH DENGAN APLIKASI FLIP PDF PRO PADA MATA KULIAH FISIKA

### ABSTRAK

Tulisan ini dilatarbelakangi oleh kurangnya minat belajar siswa terhadap mata pelajaran fisika yang disebabkan oleh bahan ajar yang digunakan oleh pendidik selama proses pembelajaran. Penelitian pada tulisan ini bertujuan untuk mengembangkan pembelajaran berbasis masalah modul kaca mata elektronik pada materi momentum dan impuls serta untuk mengetahui validitas dan kepraktisan e-modul pada siswa kelas X SMA Negeri 1 Tapung. Jenis penelitian adalah penelitian pengembangan dengan menggunakan metode *research and development* (R&D). Metode yang digunakan adalah panel R&D dengan model ADDIE. Untuk mencapai tujuan tersebut digunakan beberapa tahapan pengembangan yaitu menganalisis, merancang, mengembangkan, menerapkan, dan mengevaluasi. Sedangkan hasil dari penelitian berupa modul elektronik pada materi momentum dan impuls. Hasil validasi ahli materi dan media pada modul elektronik mendapatkan proporsi sebesar 81,86% yang termasuk dalam kategori sangat valid. Kepraktisan suatu produk dilihat dari uji kepraktisan yang diperoleh dari hasil lembar kepraktisan modul elektronik sebesar 95,70% dan termasuk dalam kategori sangat praktis.

**Kata Kunci:** *modul elektronik, aplikasi flip pdf pro, pembelajaran berbasis masalah, momentum dan impuls*

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### INTRODUCTION

This research is based on the lack of interest in learning students during the learning process takes place, students do not play an active role during the learning process because the media and teaching materials used by educators do not attract the attention of students. So the researchers took the development of PBL-based e-modules during the learning process as a

solution that could attract the interest and attention of students to learn.

Education is an important aspect in facing the globalization era which is full of challenges and changes. Through education it is expected to form characters that are innovative, skilled and creative. Law No. 20 of 2003 concerning the National Education System Article 40 has stated clearly that educators must

have professional competence to improve the quality of education in Indonesia.

According to (Trisna et al., 2016) Education is part of culture in the process of human life. On the one hand, education is a way or vehicle to pass on cultural values from the previous generation to the next generation. On the other hand, culture is a manifestation of the spirit of human life which animates the educational process in the dynamics of people's lives. Various efforts have been made by various parties or circles, both government and private in order to improve education, both in quantity (quantity) and quality (quality).

According to (Komikesari et al., 2020) In the process of learning physics requires student activity in the process of thinking and seeking understanding of objects, analyzing and constructing this knowledge so that new knowledge is formed within the individual. In physics subjects, students are more required to play an active role during learning, namely by finding solutions to problems that exist in the learning it self. In essence physics includes aspects of processes, products and attitudes.

According to (Malina et al., 2021) Physics is a subject that relies on good arithmetic, reasoning and logic skills. Therefore, students are required to understand the concepts of physics in a directed manner. By doing this, students are expected to have the ability to reason, communicate, solve problems and use physics in everyday life.

According to (Hidayaturrohman, 2017) Physics as a product, namely physics as a result of empirical knowledge and experience arranged systematically in the form of facts, concepts, laws, and theories. Physics as a process that shows how knowledge or concepts are obtained through observation, research, analysis, thinking and others. Physics as an attitude is a picture of a scientific attitude in conducting research and discovering a knowledge or concept. (Komikesari et al., 2020) One important thing that needs to be considered in supporting physics learning is that the delivery of concepts can be better, namely the availability of learning support, one of which is teaching materials.

According to (Kimianti & Prasetyo, 2019) Learning resources in the form of teaching materials is one of the important elements in the formation of a learning. The existence of teaching materials will help teachers design learning, while for students, teaching materials will help them master learning competencies. The government has made efforts to meet the needs for teaching materials for the 2013 Curriculum by providing teacher books and student books. The availability of teacher's books is intended as a minimum guide for teachers in carrying out the learning process based on the 2013 Curriculum, while student books are books that are provided to help students in the learning process and master the expected competencies.

Teaching materials that can make it easier for students to observe physical phenomena are by observing pictures, animations, simulations, and learning videos. One of the teaching materials that meet these criteria is an electronic module (e-module).

Based on observations in class X MIA 1 SMA Negeri 1 Tapung in July 2022, information was obtained that physics learning at school was still teacher-centered, while students only received the information conveyed. Educators who fully convey material have not involved students directly in learning, this causes students to be less interested in learning so that it has an impact on their activeness during the learning process. One way to attract students' attention and interest in learning is to use interesting and interactive teaching materials such as e-modules accompanied by problem based learning (PBL) models.

Electronic modules are expected to be able to facilitate students in the learning process, e-modules can be accessed via gadgets to help the physics learning process at this time. According to (Wijayanto & Zuhri, 2014) E-module is information that is displayed in a book format whose presentation model is carried out electronically using storage media in the form of a hard disk or flash drive and can be read using a computer or other electronic device. According to (Komikesari et al., 2020) E-module is a form of independent teaching material that is systematically arranged in language that is easy

to understand into the smallest learning units, presented in an electronic format which includes animation, audio, video which makes the user more interactive with the programme.

According to (Laili, 2019) Electronic modules have advantages including: (1) Being able to foster motivation for students; (2) There is an evaluation that allows educators and students in which section which have not been completed or have been completed; (3) Study materials can be broken down so that they are more evenly distributed in one semester; (4) learning materials are arranged according to academic level; (5) Can make modules more interactive and dynamic than printed modules which are more static; (6) Can use video, audio, and animation to reduce high verbal elements of print modules.

Besides that, the lack of interest in students to learn is also due to the lack of activity of students during the learning process. According to (Sari et al., 2020) the learning model used in the learning process in the classroom must be right on target and able to be applied by the teacher properly. A good learning model is a learning model that is selected and developed by the teacher to encourage students to learn by utilizing their potential optimally. The expected learning is not just hearing, obtaining or absorbing the information conveyed by the teacher. The learning model that is suitable to be applied in involving students' activeness is a problem-based learning model, namely problem-based learning.

According to (Fatimah, 2012) Problem Based Learning (PBL) as a learning model has distinctive characteristics, namely always starting and centering on problems. In PBL students can work in small groups and must identify what they know and what they do not know and must learn to solve a problem. From the explanation above, it can be concluded that PBL is a problem-centered learning process, with this learning process students can play an active role during the learning process. According to (Sulistiyani, 2019) PBL (Problem-based learning) is a learning approach designed to help students develop thinking skills, problem solving skills problems, and intellectual skills.

According to (Nadeak et al., 2021) Problem Based Learning (PBL) is learning that uses real, unstructured and open-ended problems as a context for students to develop problem-solving and critical thinking skills as well as build new knowledge. Problem-based learning is the use of various kinds of intelligence needed to confront real-world challenges.

According to (Sriwiyata, 2022) The problem-based learning approach (Problem-Based Learning) is a learning approach that uses real world problems as a context for students to learn about critical thinking and problem solving skills. According to (Armis & Zuhriurwaty, 2021) PBL emphasizes the process of seeking or constructing knowledge independently. Students are actively involved in learning so that meaningful learning can be created. It can be said that PBL is a student-centered learning model. In the activities of guiding individual and group investigations, and developing and presenting work results, a learning resource is needed that can help carry out PBL properly.

According to (Wulandari & Surjono, 2013) Problem based learning has advantages including: (1) Problem solving is good enough to be applied; (2) problem solving can challenge students' abilities; (3) Helping students to understand problems in everyday life; (4) Help students develop their knowledge and be responsible for their own learning; (5) Helping students understand the nature of learning as a way of thinking; (6) Creating a fun learning environment, allowing application in the real world; (7) Stimulating students to learn continuously.

According to (Syarif, 2017) The steps in problem based learning are divided into five stages namely student orientation to problems, organizing students to learn, guiding investigations, presenting work, and evaluation. One of the media that can be used in making problem-based learning-based teaching materials is Flip PDF Pro, Flip PDF Pro is presented in the form of computer-based software. According to (Seruni et al., 2020) the flip pdf pro application is easier to use because it can be operated for beginners, flip pdf pro is a flipbook maker application that has a page edit function and can

create interactive book pages by inserting images, videos from YouTube, MP4, audio video, hyperlinks, quizzes, flash, etc.

According to (Khairinal et al., 2021) Flip pdf pro allows us to make flipbooks with various features and a page editor from the pdf files we have. Flip pdf pro allows everyone to be creative with interactive effects such as adding multimedia in the form of videos, animations, images, hyperlinks, YouTube, and so on so that everyone can make good and easy books. This application is very easy to use, with a publish display in the form of flip (back and forth) like a real book. In this application there are components that support such as combining text, images, audio, video and so on.

According to (Khairinal et al., 2021) The advantages of this flip pdf pro are: (1) Interactive publishing, with an attractive appearance, by adding videos, images, links, and others, making the flipbook interactive with users; (2) There are various templates, scene themes, backgrounds, and plugins to customize our e-modules; (3) E-Modules can be supported with text and audio; and (4) Flexible output formats, such as html, EXE, zip, Mac App, mobile version and burn to CD. Thus, the researcher intends to conduct

research by developing problem based learning (PBL) e-modules with the flip pdf pro application in physics subjects.

Based on the problems described above, the researcher provided a solution in collaboration with the physics teacher at SMA Negeri 1 Tapung to apply teaching materials in the form of e-modules with problem-based learning models to attract the interest and attention of students during the learning process.

## REASERCH METHOD

### 1. Research And Development (R&D) Research

The type of research used in this research is research and development or development. The model used is the development of the ADDIE model. According to (Sugiyono, 2019) The ADDIE development model is a model that involves five development phases, namely Analyze, Design, Develop, Implement, and Evaluate. This development model was chosen because it aims to produce products in the form of e-modules. The products developed are then tested for feasibility with product validity and trials.

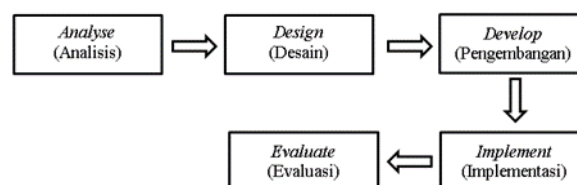


Figure 1. The ADDIE Development Model Steps

In the analyze stage, it is the initial stage in identifying existing problems in the field. At this stage, data collection is carried out in the form of initial analysis, including curriculum analysis, concept analysis, and student analysis. The results of the initial analysis are then processed to follow up by designing the development of teaching materials that are suitable for application in learning.

The design stage, namely the product design stage, this stage is carried out in several steps, namely (1) Preparing materials according to

needs; (2) Preparing learning objectives; (3) Designing e-module products; (4) E-modules that are designed not only contain instructions for use but also contain steps for the learning model used.

The develop stage, namely the design realization stage which will later be assessed by experts, the output at this stage is in the form of problem based learning e-modules that are valid to use.

The implement stage, namely the product trial stage that will be developed as well as see the practicality of using the developed media, trial use

for educators and students is carried out to find out the practicality of problem based learning e-modules.

And the evaluate stage, which is the final stage to measure the achievement of product objectives. This stage is carried out to provide feedback to product users, so that revisions are made in accordance with the evaluation results that have not been fulfilled by the product.

## 2. Place, time, and research subjects

This research was conducted in class X MIA 1 SMA Negeri 1 Tapung in the even semester of the 2021/2022 academic year. The subjects of the study were 36 students and 1 educator who taught the class.

## 3. Research instruments

The instruments used in this study were (1) learning devices consisting of syllabus, learning implementation plans (RPP), and electronic modules; (2) the data collection instrument consists of student validity data sheets

and practicality data sheets for educators and students.

## 4. Data Collection Techniques

In accordance with the research objectives, there are two techniques used to collect the required data as follows:

- a. Observation techniques are used to collect data on (1) learning management, (2) learning processes, (3) student behavior in learning.
- b. Questionnaire technique, used to collect data on student responses to learning.

## 5. Data analysis techniques

The data that has been collected uses descriptive quantitative data analysis techniques. Data on the validity of students and the practicality of students and educators were analyzed using a Likert scale analysis. In table 1, the data validity questionnaire rating scale is presented. Furthermore, in table 2, the practicality sheet rating scale is presented.

**Table 1. Validation Questionnaire Scale**

Instrument Item Answers	Score
Strongly Agree	4
Agree	3
less Agree	2
Disagree	1

**Table 2. Practicality Questionnaire Scale**

Instrument Item Answers	Score
Strongly Agree	4
Agree	3
less Agree	2
Disagree	1

## RESULTS AND DISCUSSION

### 1. Research results

The first stage in this research is analysis, namely analyzing the curriculum, concepts, and students, which aims to collect reports and problems that exist during the learning process as an initial step in the development of e-modules. Based on the results of curriculum analysis, it was found that the curriculum used in research schools was the 2013 curriculum. In concept analysis, it was found that the material concepts developed

were in accordance with the demands of the 2013 curriculum and were related to KI and KD.

In the analysis of students, it was found that during the learning process students were more interested in learning using learning videos that were not boring during the learning process, the abilities of students were classified as varied in understanding the understanding of the material, this was due to the limitations of the textbooks used so that the learning process ineffective learning.

Furthermore, the design of e-module teaching materials is made in Microsoft Publisher by adjusting the results in the previous stage. According to (Rasyidan et al., 2016) Microsoft Publisher is one of the Microsoft Office applications used for desktop publishing activities. Results from desktop publishing include newspapers, catalogs, brochures, magazines, greeting cards, posters, bulletin boards, calendars and others. One of the advantages of using Microsoft Publisher is that you can make desktop publishing works easily and there are various templates available and

various effects available for editing images of works that can be printed and saved in various formats and can be sent via e-mail or converted to HTML which can be directly saved in online storage and can be accessed anytime anywhere. In making teaching materials using a publisher, several components are produced including: preface, table of contents, KD along with indicators, instructions for use, concept maps, material equipped with problem-based learning syntax, homework, summaries, glossaries, and bibliography.



Figure 2. E-module design

Through teaching materials in the form of e-modules, educators and students can use them as supporting materials for learning physics.

Educators can also follow the steps of the problem-based learning method during the learning process.



**Figure 3. Problem Based Learning Syntax**

Based on Figure 3, the e-module is created using the problem based learning syntax. In this section the e-module presents learning videos that are equipped with simple questions.

If the design of the e-module design has been completed, then the next stage is development. E-module teaching materials are made with the help of Flip PDF Pro to add learning videos. At the development stage, it is carried out by perfecting the e-module with flip pdf pro which has been developed by researchers and has been improved based on validity tests and suggestions from validators. To get a decent product, a validation process is needed before conducting field trials. The validity test was

carried out to the validation of material experts and media experts. The PBL-based e-module validation assessment according to material and media experts includes four aspects, namely: content feasibility, presentation feasibility, language feasibility, and graphic feasibility.

The results of this study can be seen from the suggestions given by the validator, namely, vary each sample question, and add a list of references to the e-module. Based on the analysis of data obtained from 3 validators, the designed e-module is categorized as very valid with a score percentage of 81.86%. The validity results can be seen in table 3.

**Table 3. Validity Calculation Results**

No	Assessment aspect	Validators			Validation percentage average	validation category
		MS	RZ	HN		
1	Content feasibility aspect	89,58%	75,00%	79,17%	81,25%	Very Valid
2.	Aspects of language and image feasibility	74,29%	75,00%	78,57%	75,95%	Valid
3.	Aspects of presentation feasibility	96,43%	75,00%	89,29%	86,90%	Very Valid
4.	Aspects of graphic feasibility	90,00%	75,00%	85,00%	83,33%	Very Valid
<b>Average</b>					<b>81,86%</b>	<b>Very Valid</b>

From the data obtained, the feasibility aspect of the content is categorized as very valid with a percentage of 81.25%, this proves that the indicators, learning objectives, and description of the material in the e-module are in accordance with the requirements of KI and KD, the description of the material presented in a systematic manner is in accordance with the syntax of the learning model used, then on aspects of language and images are categorized valid with a percentage of 75.95%, in this aspect there are still deficiencies, namely the delivery of the language used is not communicative for students. In the feasibility aspect, the presentation is

categorized as very valid with a percentage of 86.90% research product. In this aspect, the e-module is arranged systematically and the concept presentation system in the e-module starts from easy to difficult. Next is the graphical aspect, in this aspect it is categorized as very valid with a percentage of 83.33%, results, these results indicate that the design and color of the e-module is clear and can attract students' attention to read it. As well as the pictures and videos on the e-module are in accordance with learning and have a clear resolution. The following is a graph of the validation calculation results

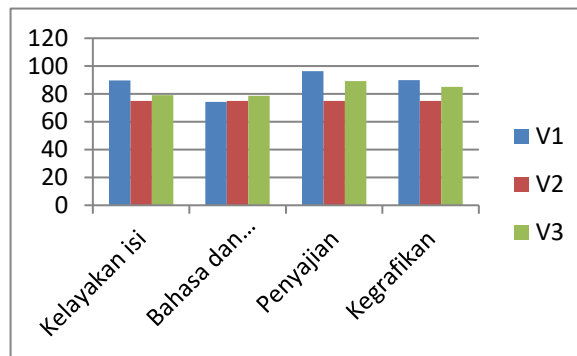


Figure 4. Validation calculation results

The development of e-modules is carried out on momentum and impulse materials based on problem-based learning models. This can increase the activity of students during the learning process. The next stage is implementation, at this

stage the products that have been declared feasible are then tested on educators and students in class X. The results of processing the practicality of the module can be seen in table 4.

Table 4. The results of calculating the practicality of educators and students

Assessment Aspects	Practical Percentage		Average Percentage Score	Practicality Category
	Educator	Learners		
Ease of Use	100	95,14	97,57	Very Practical
time required	88	93,4	90,7	Very Practical
Easy to interpret	100	96,7	98,35	Very Practical
Have the same equivalent	100	92,36	96,18	Very Practical
<b>Average</b>	<b>97</b>	<b>94,40</b>		
<b>Practicality category</b>	<b>Very Practical</b>	<b>Very Practical</b>	<b>95,70</b>	<b>Very Practical</b>



The practicality test results on the aspect of ease of use get an average percentage of 97.57%, this proves that teaching materials in the form of e-modules are easy to use by educators and students during the learning process, this can be used as teaching materials to accompany educators and students in carrying out the learning process so that students have no difficulty in bringing teaching materials.

In the aspect of time required, a percentage of 90.7% is obtained, in this aspect the relationship between the time used in using the e-module during learning is the same as the time set

by the educator. In the easy-to-interpret aspect, a percentage of 98.35% is obtained, this proves that teaching materials in the form of e-modules are suitable for use in the physics learning process. In aspects that have the same equivalence, a percentage of 96.18% is obtained, this indicates that the learning model and the material used are less related, the solution given is to pay attention to what learning model is suitable in momentum and impulse material, or vice versa what material is suitable for use with problem-based learning models. The following is a graph of practicality calculations.

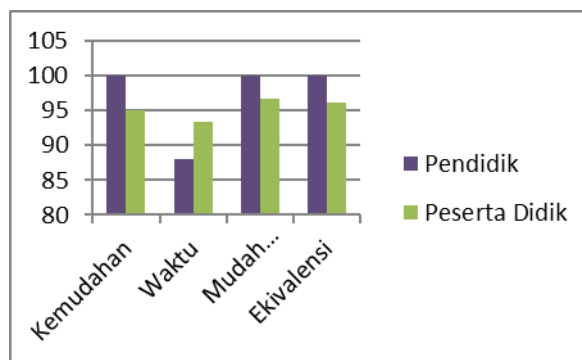


Figure 5. Practicality calculation results

It can be concluded that students like the appearance of e-module teaching materials and understand the contents of e-modules because they use language that is easy to understand and the existing learning videos make it easier for students to understand the material.

Relevant research results regarding the development of Problem Based Learning-based e-modules were carried out by (Wakiah et al., 2019). The results of the study obtained an average percentage of 89%, if converted into a conversion table, it is included in the very good category. This shows that the developed e-module can attract the attention of students during the learning process.

### Discussion

Based on the analysis of learning process data on students, it can be seen that the application of a problem-based learning model is in accordance with the plan. During the learning

process students play an active role and most of the students look enthusiastic and participate during the learning process carried out, students try to solve the questions given by the teacher well.

From the results of data analysis it was found that the teaching materials used could attract the interest and attention of students during the learning process and students did not feel bored while learning. Based on the results of the analysis obtained, it can be concluded that the application of e-modules using the PBL model can attract the attention of students and improve learning management and the physics learning process for class X MIA 1 SMA Negeri 1 Tapung in the even semester of 2022/2023.

### CONCLUSIONS AND RECOMMENDATION

Based on the results of the analysis that has been carried out, it can be concluded that the PBL-based Physics e-module that has been developed is categorized as very valid and very

practical. Based on the results of validity by experts obtained a percentage score of 81.86% and based on practical results obtained from educators and students obtained a percentage score of 95.70%. From the data obtained, the PBL-based physics e-module has been categorized as very practical with a score of 97% for educators, and a percentage of students' practicality of 94.40%. Based on the discussion above, it can be concluded that the development of PBL-based e-modules for class X MIA students at SMA Negeri 1 Tapung is in the valid and practical category with a validity score percentage of 81.86% and a practicality score percentage of 95.70%.

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