

[Research Article]

**WEBTOON-BASED PHYSICS E-MODULE AS ALTERNATIVE MEDIA TO IMPROVE STUDENT'S CRITICAL THINKING ABILITY ON OPTICAL EQUIPMENT MATERIALS**

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**ABSTRACT**

This research focuses on developing and analyzing the qualifications, effectiveness, and reactions of e-module users on optical devices to improve critical thinking skills. The advantage of this e-module is that it contains material descriptions, videos, webtoons, and evaluation questions that can be accessed online. The research method uses research and development of the ADDIE model, with five stages: investigating student needs, designing learning media using pixton.com, canva.com, and the Flip PDF Professional application, and developing e-modules that are validated by media expert validators and material, amounting to two people. , product implementation to users, and evaluation of e-modules by teachers and students. Indicators of critical thinking skills tested include interpreting, analyzing, evaluating, and inferring skills. The feasibility of the e-module turned out to be valid by experts in the media and material obtained from the validation questionnaire. The results of the effectiveness of the e-module in improving critical thinking skills showed that the effectiveness was tested on 26 class X SMK students and user responses, namely teachers and students, were very positive.

Keywords: Critical Thinking Skills, E-modules, Optical Instruments, Webtoon

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## 1. INTRODUCTION

The 21st century has begun to change the educational paradigm that shifts from focusing on educators to focusing on students. Information and communication technology's role is very influential (EROL, 2021). Education is one of the fundamental things in determining the quality of life of a nation so that every individual is consciously able to be useful for himself and others (Andriani et al., 2018).

Education will be better if students possess the skills. Critical thinking skills are one of the skills in accordance with the 21st century and the objectives of the 2013 curriculum that students must possess (Zulmi et al., 2020). Achieve critical thinking skills. Of course, it is supported by the learning media used during learning (EROL, 2021). To achieve critical thinking skills, it is necessary to have exciting learning media that serves to achieve learning objectives, channel messages, and stimulate students' thoughts, feelings, concerns, and desires (Berlian et al., 2021).

Interesting learning resources currently are e-modules, designed as digital teaching for students' independent learning purposes, which are arranged systematically to stimulate students to solve problems independently with a complete sense of responsibility (Irwansyah et al., 2021). It is effortless to use and presents images, clips, and graphics. Besides, it is presented with evaluation questions to get feedback quickly, a feature of electronic modules compared to commonly used modules. (Triwahyuningtyas et al., 2020). In addition to these features, the designed e-module is combined with a webtoon that can stimulate students to be actively involved in the learning process. Webtoon developed into a digital form containing images and words that are easy to understand, published online, and accessed via gadgets (Berlian et al., 2021). The advantages of using webtoons can increase student motivation triggered by color image content, easy-to-understand words, accessible online. However, the current drawback is that webtoons have not been fully implemented in education (Rossana et al., 2019). In previous studies, the use of electronic modules in physics

lessons already existed, such as dynamic fluid material. However, in electronic modules, there has been no addition of video, audio or evaluation questions and no combination of comics (Nikita et al., 2018). In line with previous thoughts, the results of previous studies show that electronic modules are only limited to modules that are not added with pictures, videos, audio, animations, and normative quizzes that stimulate students' critical thinking skills (Ramadayanty et al., 2021).

The results of previous literature studies using electronic modules have been applied to optical instrument materials. However, not all optical instrument materials have been presented, the use of electronic modules for students' critical thinking skills has not been shown, and there is also no combination of comics, other videos, and evaluation questions that can be accessed online. (Judge et al., 2020). There are three focuses of problem formulation: how the feasibility of a webtoon combination digital module is applied to optical instrument materials, how practical a webtoon-based digital module is on critical thinking skills, and how users respond after using a webtoon-based e-module. This study aimed to determine the feasibility, effectiveness, and user response to webtoon-based e-modules.

## 2. METHOD

Development research is research that can produce a new product. Research and development are known as research and development and go through several stages, namely analyzing, designing, developing, implementing, and evaluating (Triwahyuningtyas et al., 2020). The stages that must be passed in producing a product in research and development are as follow:

### 2.1 Analysis

This stage is used to analyze students' needs in terms of material, the need for learning media and study cases according to the focused research. The need for analysis of students is obtained by distributing questionnaires about their perceptions of the media used in learning and the use of online media.

## 2.2 Design

The design stage is the stage of designing everything needed following the results of the needs analysis, which includes material design, indicators using Microsoft office word, and media development design through several stages, namely webtoon design using pixton.com, cover design using canva.com, and evaluation question design. Via google forms. Furthermore, after all the material designs are finished, the format is changed to PDF, which is then imported into the Flip PDF Professional application and continued with the addition of videos, images, webtoons, and links to evaluation questions.

## 2.3 Development

Furthermore, the development stage, the product stage that has been designed, will be validated by several experts who are used as a reference to whether a product is feasible or not to be used by students in learning.

## 2.4 Implementation

The implementation stage is the product stage that has been validated and revised as experts recommended to be implemented to students. This stage is needed to determine how implementing e-modules improves students' critical thinking skills.

## 2.5 Evaluation

The stage, which is the final part of the research process, is needed to find out the responses of students and educators to the e-module developed through the questionnaire sheet that the researcher has provided.

The subject of the study involved two experts consisting of media experts and material experts, physics instructors, and 26 students of class X MM SMK PGRI 2 Malang. An expert in the field of media and materials is a physics education tutor at the University of PGRI Kanjuruhan Malang. The study stage is where the investigator describes the e-module, how it is used, and its features contained in the e-module. Furthermore, students are allowed to use mobile phones so that they can access e-modules online.

The feasibility of the product is obtained from the validation process by the validator, namely media experts and material experts who are lecturers of physics education at the University of PGRI Kanjuruhan Malang. Assessments by experts in the field of media and materials are material feasibility, e-module quality, display quality, instructional quality, and language service aspects. Aspects of presenting the material's content, aspects of critical thinking contained in the e-module, and aspects of language feasibility are part of the aspects assessed by material experts.

In determining the effectiveness of the e-module in improving critical thinking, it is obtained through the test results of students by analyzing the normal pretest and post-test gains in the implementation phase. Meanwhile, in determining the user's response, it can be known through the evaluation phase, namely assessing the response questionnaire by the user. The teacher's response questionnaire includes assessing the problems presented, effectiveness in learning, and aspects of the feasibility of the language used. The categories that students evaluate are our content and appearance feasibility.

The information needed in the investigation is quantitative and qualitative. Quantitative information is obtained from the acquisition of scores with a scale range of 1: not good, 2: not good, 3: quite good, and 4: very good, which then the data will be processed into information for research. Meanwhile, the data obtained from suggestions, inputs, and comments were then analyzed into descriptive data.

The instruments needed in the research are observations which are part of the needs analysis phase, a questionnaire consisting of a questionnaire for media experts, material experts, educators, and students, as well as pretest and post-test questions, which are then analyzed to determine the improvement of students' critical thinking skills.

Formulas can know data analysis techniques according to the focus needed in the study. The e-module validation analysis can be obtained using the following ideal percentage formula:

$$\% \text{ feasibility} = \frac{\text{score}}{\text{max score}} \times 100\%$$

The e-module product reaches the minimum validity standard. It is considered to have good validity, achieved within the minimum validity range. The criteria for determining validation can be seen in table one.

**Table 1** Percentage of Ideal E-module

%	Criteria
80%-100%	Good
60%-79%	Enough
50%-59%	Less
0%-49%	Bad

The level of students' critical thinking skills can be known using the normalized gain (n-gain) formula (Paputungan & Mursalin, 2018).

$$\text{gain} = \frac{S_f - S_i}{100 - S_i}$$

Description:  $g$  is normalized gain (N-gain),  $S_f$  is post-test, and  $S_i$  is pretest.

The following is a table display of the N-gain acquisition criteria to find out the criteria based on the analysis results.

**Table 2** N-gain Criteria

Score	Criteria
$g \geq 0.7$	High
$0.3 < g < 0.7$	Moderate
$0.0 \leq g < 0.3$	Low

The following equations can be used to determine the results of student and teacher responses.

$$P = \frac{f}{n} \times 100\%$$

Description  $P$  is the percentage of user responses,  $f$  is the number of responses to each aspect by the user, and  $n$  is the total number of respondents.

The following is a table display of the criteria used as a reference to determine the criteria for obtaining user responses (Anggraini et al., 2020).

**Table 3** Responses Criteria

%	Criteria
$75\% \leq R \leq 100\%$	Good
$50\% \leq R < 75\%$	Enough
$25\% \leq R < 50\%$	Less
$0\% < R < 25\%$	Bad

### 3. RESULT AND DISCUSSION

#### 3.1 Results

Alternative learning media in the form of e-modules using the ADDIE model, which includes the analysis stage, the design stage, the development stage, the implementation stage, and the assessment stage.

##### 3.1.1 Analysis

In this phase, a study or analysis of the needs of students is carried out both in terms of material, learning media, and learning objectives achieved. Through the results of the questionnaire analysis distributed at two Vocational schools in Malang, information was obtained that the need for alternative learning media in the form of e-modules was very high, with a percentage of 90%, and the use of online media was very high with a percentage of 98% gain. An analyzing the optical instrument material for class X Vocational High School was carried out by conducting a literature study and obtained information that the optical instrument material was used as an e-module material that needed to be developed because the optical instrument material was related to the lives of students and previous research showed that the use of e-modules in optical instrument learning had been developed. However, the material discussion is incomplete and has not been combined with a webtoon (Hakim et al., 2020).

##### 3.1.2 Design

The first stage in designing e-modules is setting learning objectives following the applicable

curriculum and designing essential competencies and indicators of optical instrument material. After the first design is completed, it is continued with the second stage, which includes:

1. Designing comics

This is the stage for designing the characters and conversations needed in comics through the Pixton (link: <https://www.pixton.com/>)



Figure 1 Designing comics

2. Design the module cover

Furthermore, designing the cover of the module which includes the title, author's name, and an image of the application of the optical instrument through the Canva (link: <https://www.canva.com/>)

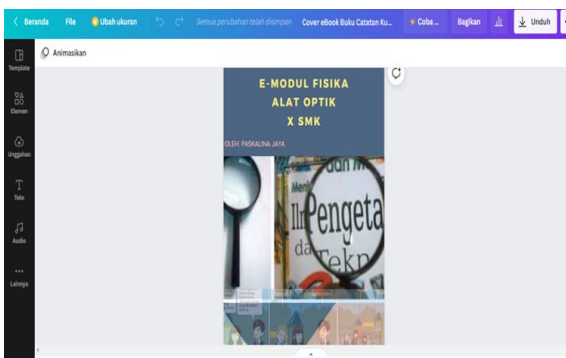


Figure 2 Cover design

3. Designing materials

After the first design is completed, the next step is to make optical instrument materials, including material reviews, optical equations, optical instrument pictures, and other necessary materials, which are then converted into PDF files.

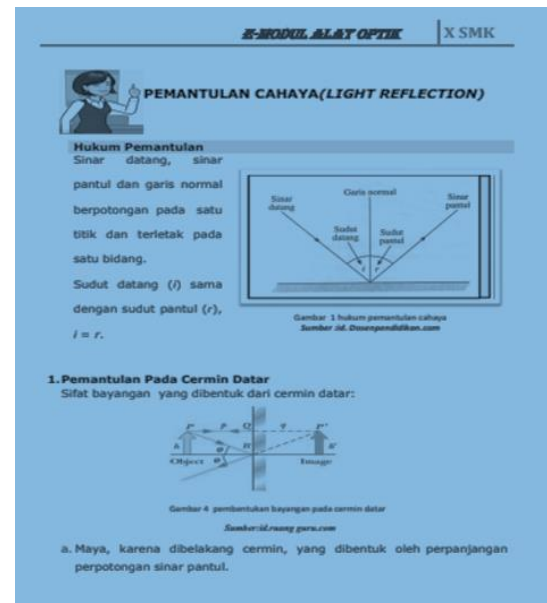


Figure 3 Design Subjects

4. Designing evaluation questions

This stage is a stage that designs optical instrument questions in the form of essay questions via a google form and then copies the imported question link on Flip PDF Professional.

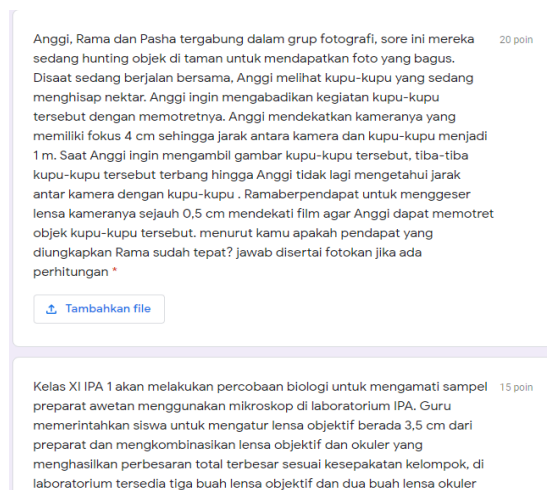


Figure 4 Test design

5. Import file

After the material design, evaluation questions, covers, and comics have been designed, then open Flip PDF Professional and import the files that have been designed.

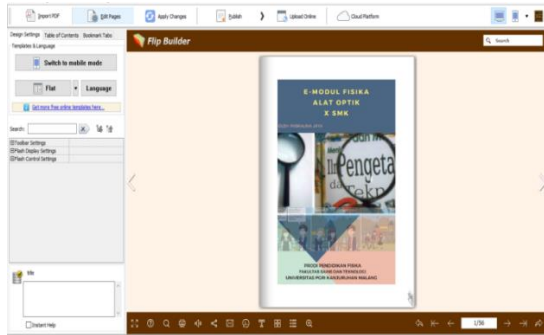


Figure 5 Import File

6. Import video and test link

Next, add learning videos and links about optical instruments, as presented in the following picture.



Figure 6 Video Preview

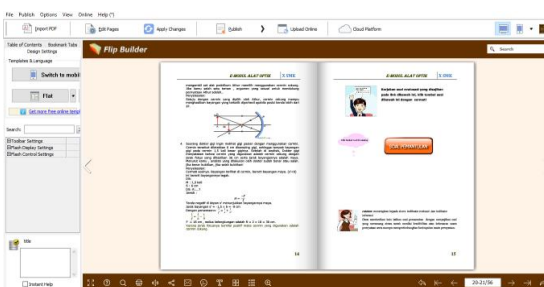


Figure 7 Test Preview

7. Publish e-module

The finished e-module is presented online as a mobile link that is easily accessible online anywhere and anytime.

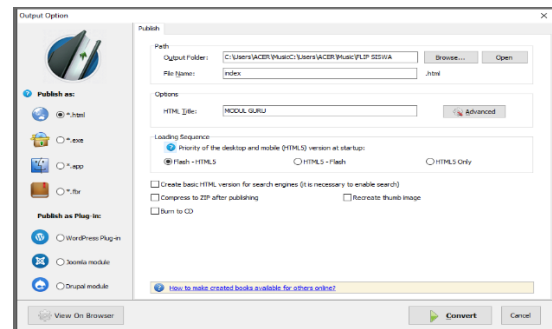


Figure 8 Preview Publish E-module

3.1.3 Development

The steps needed to determine the feasibility of the e-module are implemented for users, which are obtained from validation by validators of media experts and material experts. The instrument needed for validation is a questionnaire. The validator consists of two media and material experts. Media experts assess the feasibility of teacher e-modules and student e-modules. The aspects assessed by media experts are the practicality of the content, which includes the breadth of the content of the optical instrument material, the suitability of presenting the material using appropriate examples, the suitability of the content of the optical instrument material with the purpose, the ease of accessing the E-module, the quality of images and videos in the E-module, presentation text in E-modules, support for independent learning activities and practicality of language. The following is an analysis of data from media experts on e-module products.

The ideal percentage gain value by media experts is 95%. This identifies a digital module combined with an excellent webtoon to be used as an intermediary in the teaching and learning process on optical instrument material. This study follows previous research, that e-modules can be used as alternative learning media (Sriwahyuni et al., 2019).

Table 4 Media Expert Assessment Data

Aspects	Indicators	Score
Practicality of Presentation	The breadth of the content of the optical instrument	4
	The suitability of presenting the material using appropriate examples	4



Aspects	Indicators	Score
	Conformity of the content of the optical instrument with the purpose	4
	Ease of accessing	4
	Image and video quality	4
	Presentation of text	3
	E-module display design	4
	Support for independent learning activities	4
	It makes it easier to understand the material of optical instruments	4
Language Practical	Use of language	3

In addition to being validated by experts in the media field, e-modules also need to be validated by experts in the material field. The evaluated components are the practicality of the content, the critical thinking indicator presented in the e-module, and the practicality aspect of language. The ideal percentage of information obtained is 90%. Based on this information, it can be shown that e-modules can be used as learning media that can be applied in physics learning, especially optical instrument materials. Furthermore, this research aligns with previous research (Reynaldo, 2020).

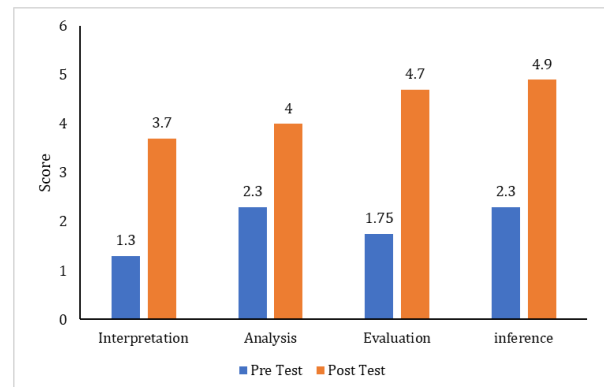
**Table 5** Material Expert Assessment Data

Aspects	Indicators	Score
Content practicality	The suitability of the material with critical thinking indicators	4
	Achieving learning goals	3
	Critical thinking indicator	The truth of the material structure
Improve critical thinking skills through illustrated images on E-modules		4
The discussion questions presented		4
Exercises		4
Practical language	Material presentation	3
	Language communicative	4
	Sentences used	3
	Notation truth	4

### 3.1.4 Implementation

This stage is the stage to find out how effective e-modules can help strengthen critical thinking skills. The first stage is to give a test before

learning in the form of an essay. Furthermore, the researchers gave directions to students to access e-modules online during learning. After all the learning activities are completed, the post-test is continued. The results of the post-test analysis were calculated using n-gain.



**Figure 9** Critical Thinking Indicator Improvement Chart

The graph above is a graph that shows the average acquisition of critical thinking skills in each indicator component. As seen in the graph, the indications of critical thinking focus on the questions being tested are interpretation, analysis, evaluation, and inference. Based on the graph in Figure 1, there is an increase in critical thinking on each indicator when implementing e-modules combined with webtoons. With this in mind, previous research has also shown that the use of e-modules in learning can increase critical thinking (Rossana et al., 2019; Gurcay & Ferah, 2018).

### 3.1.5 Evaluation

This stage is the stage for obtaining the opinions of educators and students regarding digital modules. This stage is carried out after the e-module is applied to the user. The number of students who took part in this assessment was class in Malang, amounting to 26 people. The aspects assessed by students are the presentation of the material in the e-module, student worksheets, evaluation exercises, instructional quality, and the appearance and quality of the e-module.

**Table 6** Student Response Data

Aspects	Score	Average
Material Presentation	247	3.16

Aspects	Score	Average
Student Worksheet	325	3.13
Evaluation Exercise	174	3.35
Instructional Quality	425	3.30
E-module Appearance and Quality	716	3.44

Table 6 shows the data analysis of student responses to e-modules, with the percentage of research obtained being 85%. This categorizes students' opinions about e-modules as very positive.

In addition to knowing students' responses, teachers' responses are also needed, especially physics subject teachers. The components evaluated by the teacher are the content's practicality and language's practicality. The following is a table of data analysis of teacher responses to e-modules.

**Table 7** Teacher Response Data

Aspects	Indicators	Score
Content	Problems presented	19
Practicality	Scope of material	8
	Practical Activity Sheet	6
	Problems example	4
	Exercises	12
	Convenience	14
Language Practical	Effectiveness	12
	The language used to present the problem	6
	The language used in the material	8
	The language used in the question	3

In the teacher response analysis data in table 7, the percentage obtained is 92%. This informs that the teacher's response to the e-module is very positive.

### 3.2 Discussion

The learning media developed in this study is an e-module combined with a webtoon on optical instrument material with the method used, namely research and development, with the model applied, namely the ADDIE model, with five stages to go through, namely the analysis stage, the design stage, the development stage, implementation stage, and evaluation stage.

The first stage in learning media development is an analysis carried out on initial needs, including material analysis and learning media needs. The problems found, which were later resolved, required a product in the form of an e-module combined with a webtoon on optical instrument material. Of course, teaching and learning materials can attract students' desires, feelings, and interests, so they want to find out (Rahmawati, 2018).

The next step is to design learning media. The first stage is to determine and establish indicators, essential competencies, and objectives that need to be achieved in learning activities. Furthermore, designing e-modules starts with cover design through canva.com and designing comics through pixton.com. The last step is to import files to Fip PDF Professional and add links to evaluation questions and learning videos published online to be accessed anytime and anywhere.

The next step is development, which is the stage to assess the feasibility of the e-module. The feasibility of the e-module can be determined through a validation process by experts in the field of media and materials. The components evaluated by media experts are the practicality of presentation and the practicality of language. In comparison, the aspects assessed by the material expert are the content feasibility aspect, the critical thinking indicator contained in the e-module, and the language feasibility aspect. Based on the data obtained that e-modules are well applied in optical instrument learning, this is supported by the percentages achieved from the validation of media experts and material experts, respectively 92% and 90%. This study is in line with previous research that e-modules can be applied as an alternative learning media on optical instrument material (Andila et al., 2021; Triwahyuningtyas et al., 2020).

Of course, the development of e-modules has a goal that is achieved, one of which is the effectiveness of e-modules in increasing students' critical thinking. Through the pretest stage before using the e-module and the post-test stage after using the e-module, information was obtained that the effective e-module greatly



influences the improvement of critical thinking, which is known from the average of each critical thinking indicator that has increased before and after using the e-module (Himmah, 2019). With this in mind, previous research has also shown that using e-modules in learning can increase critical thinking (Rossana et al., 2019) and (Gurcay & Ferah, 2018). The advantage of this e-module is that it contains material reviews in videos, comic material, and evaluation questions that can be accessed online wherever and whenever the user needs it.

The next phase in the investigation is the assessment stage, where the stage is to determine the user's response to the e-module. The user's response to the e-module is optimistic based on the information obtained.

#### 4. CONCLUSION

The results showed that the e-physics module combined with a webtoon on optical instrument material improved critical thinking skills as an alternative learning medium.

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