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Optimizing Critical Thinking Skills Through Wizer.Me-Based E-Module Development Using Discovery Learning Model in Basic Physics

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ABSTRACT
In recent years, fostering critical thinking skills in students has become a priority in higher education, particularly in physics courses where analytical thinking is essential. This research aimed to develop an e-module based on the discovery learning model using Wizer.me to optimize students' critical thinking skills in basic physics courses with valid and practical criteria. This research uses research and development (R&D) methods with McKenney's development model. The data in this research are needs analysis data, validation data, and practicality data. The research instrument consisted of analysis sheets, validity, and practicality questionnaires. The data analysis technique uses descriptive percentages. Based on the research results, the e-module based on the discovery learning model using Wizer.me has been proven valid and practical in optimizing students' critical thinking skills in basic physics courses. This e-module can be implemented as an effective learning tool to enhance students' critical thinking abilities.

INTRODUCTION

The 21st-century learning paradigm emphasizes students' ability to think critically, connect knowledge with the real world, master information technology, and collaborate effectively. Critical thinking, as a central aspect of higher-order thinking, involves skills such as analysis, evaluation, and inference that enable individuals to reach logical conclusions or solve problems effectively [1]. It is a reflective and deliberate thought process focused on making decisions or forming beliefs [2]. Critical thinking is essential in education as it equips students with cognitive skills such as interpretation, analysis, evaluation, and self-regulation [3] [4]. Moreover, critical thinkers can explain their reasoning, improve their perspectives, and make accountable decisions [5].

Despite its importance, developing students' critical thinking skills remains a challenge. Indicators of critical thinking, such as elementary clarification, basic support, inference, advanced clarification, and strategies/tactics [6] often need to be developed more in students. Thus, innovative teaching methods

and media are required to address this issue. To improve students' critical thinking skills, as a facilitator, teachers must choose an effective learning model because an effective learning model can create a complete, interactive, and creative learning atmosphere that can make it easier for students to master learning materials [7]. During the learning process, students can think more critically when responding to problems to optimize learning outcomes.

One approach to fostering critical thinking is through integrating information technology into learning. The rapid development of information technology has transformed learning processes, encouraging efforts to improve their quality [8]. Technology integration in education has shifted traditional lecture-based teaching methods toward using interactive and engaging learning media, such as e-modules. Technology-based learning media, such as e-modules, have proven effective in enhancing student engagement, understanding and critical thinking skills. Research shows that the personal and interactive characteristics of e-modules can foster independent learning, enable students to participate in the learning process actively, improve student understanding, and support the application of critical thinking in various contexts [9] [10].

Electronic modules are digital learning media that provide interactive content such as text, images, videos, and animations. This interactive content helps students process information more effectively because it involves various sensory modalities. The more senses used to receive information, the more likely the information will be remembered and understood [11]. Electronic modules also support independent learning, allowing students to explore and understand the material at their own pace [12]. Research has shown that electronic modules encourage critical thinking by promoting active learning, creativity, and problem-solving skills [13]. In addition, electronic modules offer features such as automatic feedback, dare access, and multimedia integration, which make them superior to traditional printed modules.

E-modules can be developed using specific learning models, such as Discovery Learning, to improve their effectiveness in learning. Discovery Learning stresses the active involvement of students in constructing knowledge through exploration and investigation [14] [15]. This model aligns with constructivist principles, which allow students to process, analyze, and integrate new information with prior knowledge [16]. This model also encourages students to relate learning materials to real-life contexts, enhancing their critical thinking and problem-solving skills [17].

One platform that facilitates the creation of e-modules is Wizer.me, a user-friendly tool for designing interactive learning materials. Wizer.me provides a variety of features, including customizable templates, interactive question types (e.g., multiple choice, matching, sorting), and multimedia integration (videos, animations, and images) [18]. Wizer.me saves time by automatically checking and grading or reviewing individually to give more personal feedback. These features support the development of Discovery Learning-based e-modules that are engaging and practical for students. The initial appearance of the Wizer.me template can be seen in Figure 1 [19]. These features support the development of Discovery Learning-based e-modules that are engaging and practical for students. The initial appearance of the Wizer.me template can be seen in Figure 1.

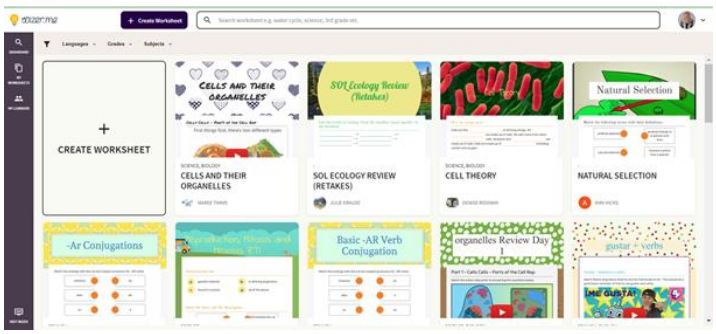


Fig 1. *Wizer.me Template*

Wizer.me also has various activities that can support the creation of e-modules. These activities are open questions, multiple choice, blanks, filling on an image, matching, table, sorting, drawing, text, image, video, link, embed, importing a Canva design, import worksheet, word search puzzle and reflection. Apart from that, tools are fast and easy to understand, making it easy to insert various kinds of videos, animations, images, simulations, quizzes, automatic corrections, and grade feedback not found in printed modules in general. The activities contained in Wizer.me can be seen in Figure 2.

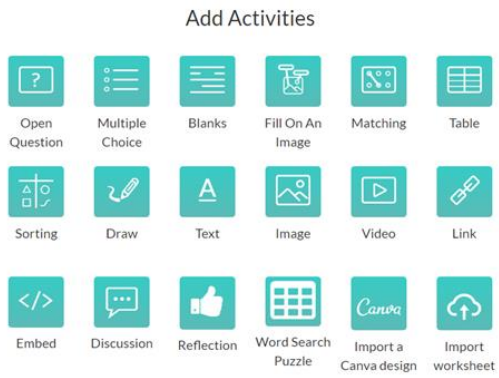


Fig 2. *Activites on Wizer.me*

Based on the features offered by Wizer.me, the advantages of using it in creating e-modules include (1) attractive theme and background designs; (2) a wide variety of question types; (3) integration of audio, images, and videos; (4) ease of access for users; (5) online worksheet submission; and (6) automatic grading, which facilitates the evaluation process. These advantages provide positive support in developing Discovery Learning-based e-modules. Based on these considerations, this study aims to create an e-module using Wizer.me based on the Discovery Learning model. The e-module will be evaluated for its validity and practicality to ensure its effectiveness in improving students' critical thinking skills.

METHOD

This development research uses Mckenney development model, commonly used in educational research, consists of several iterative phases and three stages: Needs and Context Analysis, Design, Development, Formative Evaluation, and Semi Summative Evaluation [20]. However, this research is focused on testing the validity and practicality of e-modules based on the discovery learning model using Wizer.me, so the development model used is limited to the Design, Development, and Formative Evaluation stages. The research and development procedures are carried out as follows. The detailed steps carried out in this research are described below.

Needs and Context Analysis

This phase aims to obtain information about existing problems and possible needs for improvement and innovation and to obtain temporary characteristics of the developed product. Needs analysis includes media analysis and student analysis. Specifically, this phase involves identifying the gaps in existing learning resources and the challenges students face in learning basic physics concepts, collecting information through observation and distributing a structured questionnaire with an instrument questionnaire for students who contract the basic Physics 1 course. The questionnaire was designed using a Likert scale with four categories to measure the level of need for the e-module. The needs analysis technique uses a Likert scale with four assessment categories using the formula:

$$P = \frac{f}{N} x100\% \quad 1)$$

Where P represents the percentage value, f is the obtained score and N is the maximum possible score.

Design, Development, and Formative Evaluation
The activities carried out at this stage are designing the e-module framework and developing the e-module content based on the needs analysis results by paying attention to the suitability of the content, language, construct, and graphics. The design and development process includes preparing a framework for the e-module that incorporates discovery learning principles and is compatible with the Wizer.me platform. The design results at this stage produced prototype I. Then, a self-evaluation was carried out by the researcher and two peers. During self-evaluation, feedback was sought to refine the initial version of the e-module. After the results of the self-evaluation are analyzed, revisions are carried out. Next, a validity test was carried out on prototype I. The validity test involved three lecturers from a university in Tasikmalaya who are experts in educational content and instructional media. They provided ratings using a validity questionnaire. Criticism, input, and suggestions from the validators were used as material for revising prototype I. Based on this feedback, a revised version called Prototype II was developed. The validity test used a questionnaire with analysis techniques using Aiken's V equation, namely.

$$V = \frac{\sum s}{[n(c-1)]} \quad 2)$$

Information:
s = $r - lo$
lo = The lowest validity assessment number
c = The highest validity assessment number
r = Number given by the validator

The validity categories of the e-module developed are ≥ 0,6 Valid and < 0,6 invalid [21].

After prototype II was declared valid, a practical test was conducted to see the practicality of the e-module. The evaluation of the e-module consisted of two stages: small group evaluation and field test. In the small group evaluation stage, 5-10 students used the e-module in a guided situation. The purpose of the small group evaluation was to identify the shortcomings of prototype II. The instrument used was a questionnaire that covered several aspects, such as ease of use, content suitability, and graphic display. Based on this feedback, revisions were made to prototype II to produce prototype III.

The next stage was the field test involving 75 students in a classroom setting. The e-module was used as part of regular learning activities at this stage. The field test aimed to determine the extent to which the e-module was practical in terms of ease of use, attractiveness, and time efficiency. Practicality data were obtained through questionnaires and direct observation of students' use of the e-module.

The data were analysed based on the field test results to identify the module's strengths and weaknesses. These trial and revision stages can be repeated until an e-module prototype meets the criteria for optimal practicality. The e-module practicality analysis technique uses a Likert scale using equations (1).

The practicality category of the e-module being developed can be seen in Table 1.

Table 1. Practicality Categories [22]

No	Value	Criteria
1	80% < x ≤ 100%	Very practical
2	60% < x ≤ 80 %	Practical
3	40% < x ≤ 60 %	Quite practical
4	20% < x ≤ 40 %	Less practical
5	0% < x ≤ 20 %	Not practical

Based on Table 1, the e-module developed is practically in the 60% and above category.

RESULTS AND DISCUSSIONS

Needs and Context Analysis

At this stage, student needs are analyzed by distributing a questionnaire using a Likert scale with four assessment categories consisting of 14 statements to students majoring in physics education who are contracting for the Basic Physics 1 course. The needs analysis aims to determine students' needs. The questionnaire results are used as a basis for researchers to prepare the e-module that will be developed. The results of the needs analysis can be seen in Figure 3.

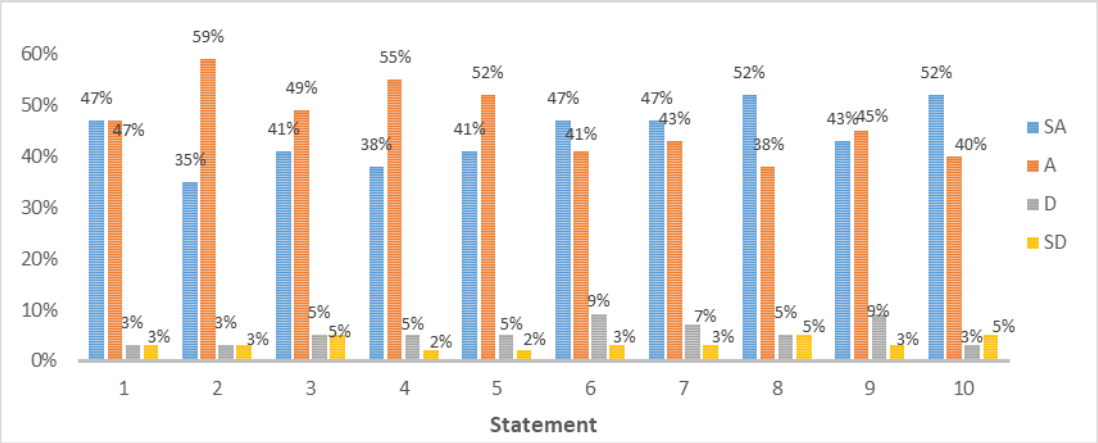


***Fig 3**. Needs and Context Analysis Results*

Table 1 summarizes the responses to various statements regarding learning physics. The responses are categorized into four levels: strongly agree, strongly Agree, Strongly Disagree, and Strongly Disagree. Statement 1 shows that most respondents (94%) enjoy learning physics through real-life applications, with only a tiny percentage (6%) disagreeing. Similarly, Statement 2 shows strong enthusiasm (94%) for learning that involves everyday life scenarios, which increases the desire to express opinions. This finding aligns with research by Telaumbanua [23], which suggests that students feel motivated to learn when they encounter examples of lessons in real-life contexts.

Statement 3 reveals that 89% of respondents find it easier to relate physics learning to facts, suggesting that starting from concrete examples is beneficial. Statement 4 and Statement 5 indicate that respondents have a positive attitude towards conceptual learning, with 93% agreeing that it is enjoyable and simplifies learning.

In terms of experimental learning, statements 6 and 7 show that 88% and 90% of respondents favor learning through experiments and find it easier to understand and apply. Statement 8 supports this finding, with 89.6% expressing excitement about participating in practical activities.

Finally, Statement 9 and Statement 10 indicate that a significant majority (88% and 92%, respectively) believe that conceptual learning and everyday life contexts are valuable for training critical thinking skills and enhancing engagement in learning.

Overall, the results demonstrate a strong preference for learning methods that incorporate real-life examples, conceptual understanding, and hands-on experiments. These approaches are perceived to significantly benefit student engagement and critical thinking development. This is consistent with the research by Kabalisa [24] which states that real-life application-based approaches enable students to

understand concepts more deeply by connecting them to real-life situations. Such approaches also encourage students to think critically and apply their knowledge practically.

The results of the analysis show that learning resources such as e-modules with discovery learning models are needed to help students learn physics materials and develop their thinking skills. E-modules can increase the efficiency of students' time to understand learning materials [25], which aligns with students' preferences for more interactive and time-saving learning methods, as shown by their enthusiasm for real-life applications in physics learning. The discovery learning model encourages students to relate learning materials to real-life contexts, which can improve their critical thinking skills. It is in line with the findings from Perdana et al [17], which showed that discovery-based learning can strengthen students' understanding through independent exploration and application of concepts in everyday life situations.

Design, Development, and Formative Evaluation

a. Design Stage

The design stage is the e-module planning stage, developed by compiling a framework as a flowchart and storyboard. The flowchart design aims to describe the workflow or work process of e-modules based on the Discovery learning model assisted by the Wizer.me platform. The flowchart design is presented in Figure 3.

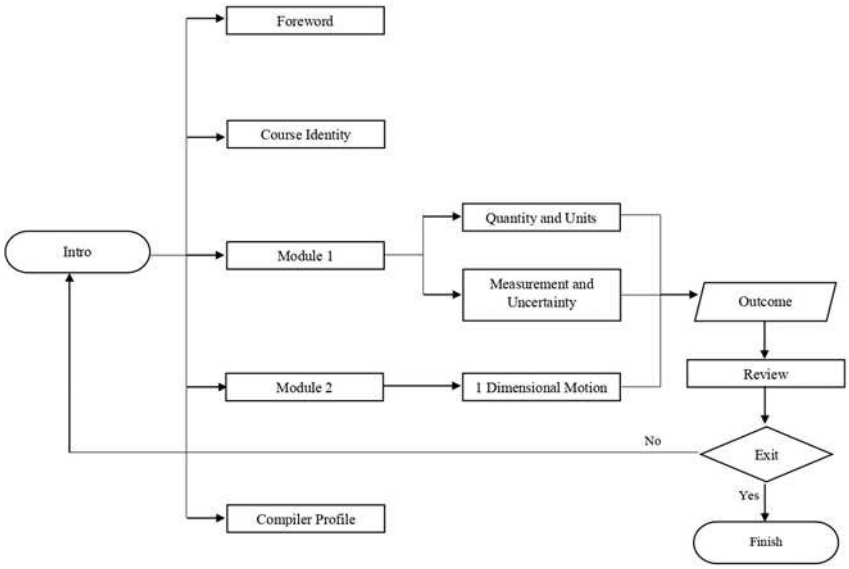


Fig 4. *Flowchart E-Module*

After creating a flowchart, the next step was to design a storyboard. The storyboard design describes the design of the e-module product description. Making a storyboard provides a detailed description of the e-module that will be developed. As suggested by Rizal et al [26], creating a storyboard involves designing information scenarios to depict object representations and task actions, helping users understand and interpret the proposed functionality.

b. Development Stage

After the design stage is complete, the e-module components are prepared. The following describes the elements of the designed e-module.

1) Cover

The e-module Cover was designed using Canva with a white background. The display can be seen in Figure 5.

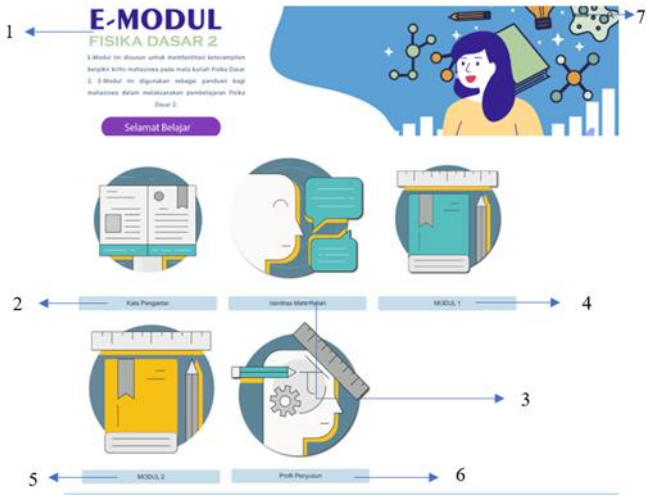


***Fig 5**. E-Module Cover*

The information displayed on the cover includes the following elements:
(1) The e-module title is the primary element on the cover, making it easily identifiable.
(2) Foreword button allowing users to access the introduction or preface of the module.
(3) Course identity button contains essential details such as the course code, course name, and the number of credits associated with the course.
(4) Module 1 button providing direct access to the content of Module 1.
(5) Module 2 button leading to the content of Module 2.
(6) Compiler profile button where users can view the identity and background of the e-module developer.
(7) Home menu, which contains navigation buttons that guide users to different sections of the e-module, such as the foreword, course identity, Module 1, Module 2, and the compiler profile, ensuring smooth and intuitive access to all parts of the module.

Each numbered element corresponds to specific features on the cover, making the layout user-friendly and easy to navigate.

2) Foreword
The Foreword contains information about the role of e-modules in the learning process, an explanation of the e-module development model, parts of e-modules, and the role of e-modules.

3) Module
In this section, there is an introduction, namely a brief explanation of the name and scope of the module content. In the first module, there is an introduction and learning activity buttons. In the introductory section, there is an introduction to the material that will be studied. Apart from that, this introduction also explains how the learning activities will be carried out and the competency achievements after studying the e-module.

4) Learning Activities
a) Material Description
Contains a description of knowledge or concepts about the competency being studied.

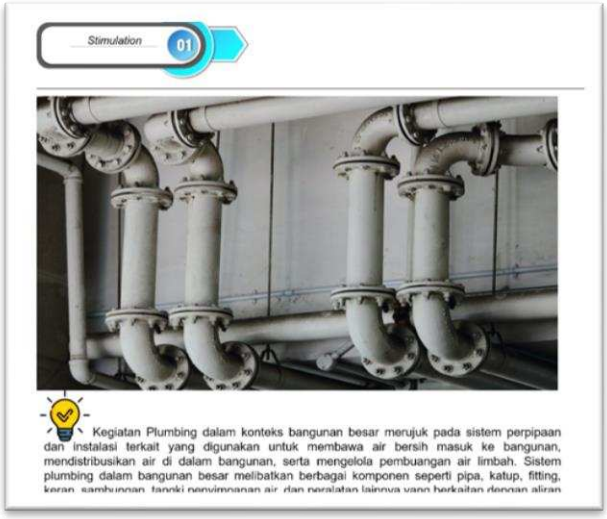
b) Exercise

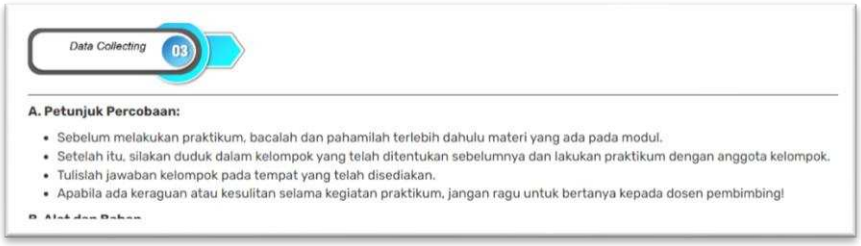
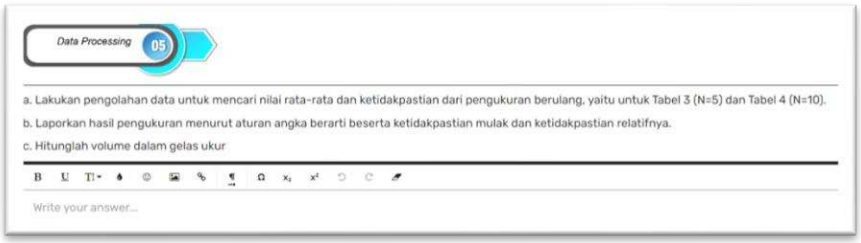
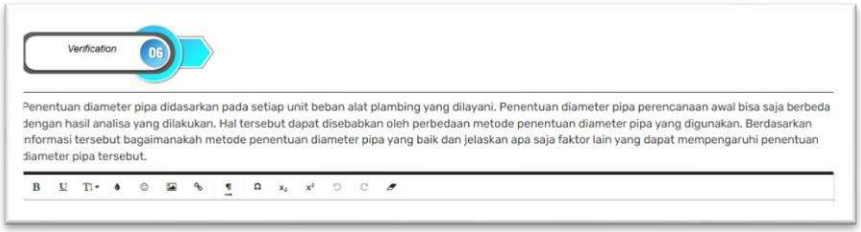
The training section of learning activities contains exercises to strengthen understanding of the concepts/knowledge/important principles being studied. This training activity uses the help of Wizer.me. Therefore, before doing the exercise, there is a guide to accessing the Wizer.me platform.

c) Skills Worksheets

The skills worksheet contains instructions for practical activities. This worksheet was prepared using the Wizer.me platform. The practicum activities are based on the Discovery Learning model, which aims to practice critical thinking skills from the specified material. The developed worksheet can be seen in Table 2.

Table 2. The Developed Worksheet

No	Module Section	Module Section Screnshoot and Discovery Learning Components on the Module
1	Stimulation	At stimulation stage, students are stimulated to begin thinking through certain questions or situations, which relates to elementary clarification in critical thinking. This includes analyzing questions, where students are encouraged to understand the core of the question, and focusing questions, where students are directed to concentrate on relevant and important questions 
2	Problem Statement	The problem statement stage involves students designing or posing problems to be solved. This activity involves critical thinking skills such as Asking and answering questions. Students not only identify problems but also respond with critical questions and answers 
3	Data Collecting	At the data collecting stage, students gather information relevant to the problems they are addressing. At the data collecting stage, students engage in strategies and tactics related to critical thinking, which include determining solutions to the problems. Here, students develop strategies to find potential solutions. They then document their proposed solutions or answers, recording their generated ideas

No	Module Section	Module Section Screnshoot and Discovery Learning Components on the Module
		
4	Data Processing	This stage involves critical thinking skills, namely basic support. Students analyze and assess the results of the information or data collected
		
5	Verification	Students verify or test the resulting solution. This activity is related to advanced clarification critical thinking skills. At this stage, students ensure that the terms and assumptions used are correct and seek and identify the assumptions underlying the arguments or solutions given.
		
6	Generalization	Students draw conclusions from the tested. This activity is related to critical thinking skills of inference. Students make valid conclusions based on data and verification at this stage and consider alternative solutions to the same problem
		

d) Discussion Forum

This discussion forum is provided to facilitate students who wish to have the opportunity to ask questions and provide opinions.

e) Summary

This section contains a summary of the knowledge contained in the material description.

f) Formative Test

The formative test aims to determine the development of a student's mastery of the material being studied. This formative test uses the help of Wizer.me.

g) Bibliography
The bibliography contains references used in e-module development.

The overall result of this development stage is called Prototype 1. For more details regarding the e-module being developed, you can access it at the following link https://sites.google. com/view/e-modulfisikadasar2/home?authuser=0.

c. Formative Evaluation
After completing the development stage, a formative evaluation of the e-module is then carried out to obtain a valid and practical e-module. The steps can be described as follows.
1) Self Evaluation
Self-evaluation is to double-check the completeness of the components in the developed e-module. The evaluation was also conducted by two peers to strengthen the self-evaluation results. The results of the self-evaluation can be seen in Table 3.

Table 3. The Results of the Self-Evaluation

E-module	Before Revision	After Revision
1. Stimulation Stage	At the stimulation stage, it is not equipped with pictures.	Added images related to the phenomena discussed
2. Verfication Stage	At the verification stage, you are only asked to prove the correctness of the experimental results with learning sources.	The verification stage is connected to phenomena that occur in everyday life, and students are asked to carefully examine data and information based on experiments.

Based on self-evaluation, the purpose of presenting images at the stimulation stage is to help students visualize the phenomena they have to analyze, making it easier for them to understand the concept and encouraging critical thinking processes. In the verification stage, connecting to phenomena that occur in everyday life emphasizes the importance of the verification stage in connecting learning with phenomena that occur in everyday life. Asking students to examine data and information from experiments carefully helps them understand scientific concepts' relevance in authentic contexts and enhances critical thinking skills. After the self-evaluation, improvements were made. The results of these improvements were then consulted and discussed with experts.

2) Expert Validation
Validity is an assessment of the design of a product. Design validation assesses whether the product design is rationally more effective than the old one [27]. It is rational because validation here is still an assessment based on logical thinking, not yet facts in the field. Three validators carried out the validation of the e-module. The summary of validation scores from all validators for each validation component is presented in Table 4.

Table 4. The Summary of Validation Scores

No	Validation Indicator	Expert Validator			Value
		1	2	3	
1	Content	37	30	39	0,8
2	Construct	32	27	32	0,9
3	Language	32	32	32	1,0
4	Graphical	23	20	22	0,9

Based on Table 3 of the validation results that have been carried out, it can be concluded that the e-module developed is in the valid category. It is proven by the value of each aspect, assessed at a value of ≥0.6. The following is a discussion of each aspect:

Content Aspect. The content aspect obtained an average score of 0.8, indicating that the e-module has been based on the formulated competency achievements. This is in line with Kemendikbud [28],

which emphasizes that e-modules must be able to facilitate the achievement of learning competencies. The activities designed in this e-module contain the steps of the Discovery Learning model, such as stimulation, problem statement, data collecting, data processing, verification, and generalization, which have been proven to support students' critical thinking skills. Research by Chusni et al [29] shows that Discovery Learning can improve critical thinking skills, including interpretation, clarification of assumptions, and decision-making. In addition, a meta-analysis revealed that this learning model positively affects science learning [30], especially with the support of the Internet as a learning technology [31], such as e-modules. Thus, this e-module provides information and actively involves students in the learning process, thus holistically supporting the development of critical thinking skills.

Construction Aspect. The validation of the construction aspect obtained an average score of 0.9, indicating that the e-module features have met the specified design elements. The structure and components of the e-module are designed according to the e-module guidelines [28], such as a systematic structure, easy navigation, and an attractive appearance. These elements help students understand the material better and ensure the e-module has an optimal pedagogical function. Each chapter is arranged attractively so that it helps students follow the learning flow more easily. Well-designed navigation ensures that students can quickly access the information they need, supporting an effective and efficient learning process [32].

Language Aspect. Language obtained a perfect score of 1.0, indicating that the e-module uses good, correct, clear, and easy-to-understand language. The language used complies with effective and efficient Indonesian language rules. According to Islamiyah [33], language has a central role in students' intellectual, social, and emotional development. In this context, the language in the e-module is designed to be easy to understand, clear, concise, and motivating for students [32]. Using clear language in the e-module can support students' understanding of the material, thereby improving the quality of learning [34]. It supports the role of language as the primary medium in conveying information effectively and efficiently, ultimately improving student learning outcomes.

Graphic Aspect. The graphic aspect obtained an average score of 0.9, indicating that the type, font size, illustration layout, and colors used are proportional and well-designed. These elements are important in attracting students' attention and maintaining their interest in learning [35]. In this e-module, a combination of blue and white creates a neutral and visually comfortable atmosphere without giving an overly striking effect. This aligns with Kang et al [36], which states that colors such as blue can increase calmness and focus, thus supporting a more effective learning experience. In addition, Dzulkifli & Mustafar [37] emphasized that color plays an important role in the human cognitive system, including increasing motivation and working memory. Other studies also show that the use of color when studying helps students retain information more efficiently by making it part of implicit memory [38]. With an attractive graphic design, e-modules can motivate students to focus more on learning.

Based on the validation results, the developed e-module has met the validation criteria regarding content, construction, language, and graphics. A valid e-module has a match between each of its components [39]. Thus, this e-module is ready to be tested in learning. This validation provides a solid basis for implementing e-modules as effective learning aids.

3) E-Module Practicality Test in Small Group Evaluation

A small group evaluation was conducted by involving a group of students to assess the practicality of the prototype, which was still in the development stage. This evaluation was performed after an expert evaluation. The purpose was to review revisions based on input from the expert evaluation and provide additional suggestions for further improvement [40]. The practicality test of the e-module in small groups was conducted over two meetings. Small group evaluation was carried out by ten students. The results of the e-module practicality test for each statement are presented in Table 5.

Table 5. The Results of Small Group Evaluation

No	Statement	Value	Category
1	Easy To Understand	75,0	Practical
2	Interesting	80,0	Practical
3	Efficient	78,0	Practical

Based on Table 5, the level of practicality of the e-module from each aspect is in the practical category. The value of each statement is in the range 67 to 88. The lowest value is in the statement that the E-module can be operated easily. This aligns with Asfiya et al [25], which states that the ease of the e-module aspect is in the practical category because the e-module element can only be used when students are connected to the internet. The links accessed by students cannot be opened when students are offline. Then, students need help sending assignments in certain formats via cell phones. Meanwhile, the highest value is in the statement that the color composition of the e-module is interesting to read. This is because the combination of blue and white visually provides a neutral and comfortable atmosphere.

Furthermore, based on small group tests, revisions were made to the easy-to-understand aspect, namely providing a material download option that allows students to access content without an internet connection—in addition to providing various assignment submission formats that are compatible with mobile devices, such as photos, documents, or direct text—in addition, preparing a guide that helps students understand the assignment submission process. After the improvements were made, Prototype III was made. The resulting prototype was then continued with large-group testing.

4) E-Module Practicality Test in Large Group Evaluation

Prototype III trials were carried out over two meetings by 75 students. Large test using a questionnaire. The summary of Large Test Evaluation scores is presented in Table 6.

Table 6. The Results of Large Group Evaluation

No	Statement	Value	Category
1	Easy To Understand	82,7	Very practical
2	Interesting	86,2	Very practical
3	Efficient	85,2	Very practical

Table 6 shows that the practicality of e-modules from every aspect is in the very practical category with a score above 80. A product is declared practical if (1) the costs used are not too high; (2) easy to administer, easy to understand, and simple language; (3) easy to interpret; and (4) the time used is not too long [41]. In the field test, the e-module based on the Discovery Learning model showed positive results from various aspects.

The module's practicality of being easy to understand is reflected in the material presented clearly and easily understood by students. The learning activities in the e-module are also easy to understand, according to the principle of Discovery Learning, which emphasizes the active development of student understanding through exploring and discovering new concepts independently. This aligns with the findings from Saryadi & Sulisworo [42], which show that e-modules based on Discovery Learning require students to discover new things.

The exciting aspect of the e-module shows that the completeness of the material presented in the e-module is interesting to learn and can enrich students' insights and information. Discovery learning-based e-modules are effective in improving students' understanding of concepts, in addition to improving the ongoing learning process to be better [43]. This dramatically supports efforts to make learning more enjoyable and not monotonous.

In addition, the efficient element in the e-module shows that the time required to understand the material is relatively short. Discovery Learning-based e-modules allow students to learn at their own pace [34], facilitating deeper understanding without rushing. This e-module functions as an additional

resource to facilitate understanding of the material and develop students' critical thinking skills, which are very important in facing the challenges of 21st-century education.

The evaluation results show that the category of e-modules developed is "very practical" in every aspect. Thus, e-modules based on the Discovery Learning model not only positively impact mastery of the material but also develop critical thinking skills that are very much needed in facing challenges in the real world.

CONCLUSION AND SUGGESTION

The development of Wizer.me-based e-modules with the Discovery Learning model have proven valid and practical. The evaluation results show that the e-module meets the validity criteria, with each indicator scoring ≥ 0.6, indicating its suitability for learning. Practicality tests in small and large groups also show that this e-module is in the practical and very practical categories. These findings confirm that the developed e-module facilitates students' critical thinking skills in the Basic Physics 1 course. This e-module can be implemented as a learning resource to improve the quality of physics learning.

The study's implications are the importance of utilizing technology, such as e-modules, in creating interactive, meaningful, and relevant learning experiences for students' needs. Technology-based e-modules provide flexibility in time and place, allow students to learn independently, and support the development of 21st-century skills, such as critical thinking. Educators are expected to be able to integrate e-modules into learning to improve the quality of student learning outcomes. In addition, the results of this study can be a reference in the development of technology-based e-modules for various learning purposes. Further research is recommended to apply similar approaches to other subjects or levels of education to encourage innovation and effectiveness in teaching practices.

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