JPPIPA 10(11) (2024)

Jurnal Penelitian Pendidikan IPA

*Journal of Research in Science Education*

http://jppipa.unram.ac.id/index.php/jppipa/index

# Development of The *CinQASE* E-Module with a Professional Flip PDF Application on Electromagnetic Induction Material To Improve The Critical Thinking Skills of Class XII Students

Hunaidah[1*], Amiruddin Takda[1] , Erniwati[1], [1]

[1] Department of Physics Education, Universitas Halu Oleo, Kendari, Indonesia

Received: June 27, 2024
Revised: August 14, 2024
Accepted: November 25, 2024
Published: November 30, 2024

Corresponding Author:
Hunaidah M
hunaidah@uho.ac.id

DOI: 10.29303/jppipa.v10i11.8286



**Abstract:** This research aims to create a CinQASE model e-module with Flip PDF Professional's assistance that satisfies reliable, practical, and efficient criteria. This research uses the R&D (Research and Development) method with the 4D development model (Define, Design, Develop, and Disseminate). The research subjects were 25 SMA Negeri 2 Parigi Class XII MIA A students. The instruments used are validation sheet instruments, teacher response questionnaire instruments, student responses, and critical thinking ability tests. The research shows that the CinQASE model e-module is possible with the help of the developed Flip PDF Professional app, earning a validity score of 0.83 in the very valid category. The results of the practicality of the e-module from the average teacher response were 3.84 in the very good category, and the average student response was 3.75 in the very good category. The effectiveness of students' critical thinking skills obtained an average score of 81.88 with an average n-gain of 0.78, which is included in the high category.

**Keywords:** Critical thinking; E-Module CinQASE model; Flip PDF professional application; Learning outcomes.

## Introduction

The instantaneous development of information technology in today's era of globalization has significantly impacted education. In a global era, the education sector is required to continuously adapt to the advances in information and communication technology to enhance the quality of education, particularly through the use of technology in teaching and learning (Budiman, 2017). A curriculum that integrates visual technology into learning processes makes it easier for students to grasp concepts compared to traditional reading and oral communication methods (Setianingrum et al., 2022). Today, technology is utilized in education both as a learning resource and an alternative tool to meet students' learning needs. The use of technology aims to increase the effectiveness and efficiency of teaching and learning processes, broaden access to information and knowledge, and support diverse learning styles. With technology, students can learn independently, access more interactive materials, and reach a broader range of educational resources, thus enhancing their skills and knowledge more optimally. The rapid advancement of digital technology has affected all academic disciplines, economic sectors, and industries (Cynthia et al., 2023). The use of specific instructional media supports the implementation of a particular learning model (Aqib, 2013). Initially, learning resources were merely considered tools to assist teachers in teaching activities. Learning resources can provide more concrete experiences, motivate, and enhance students' retention and understanding during the

**How to Cite:**
Hunaidah, Takda, A., & Erniwati. (2024). Development of The CinQASE E-Module with a Professional Flip PDF Application on Electromagnetic Induction Material To Improve The Critical Thinking Skills of Class XII Students. *Jurnal Penelitian Pendidikan IPA*, *10*(11). https://doi.org/10.29303/jppipa.v10i11.8286

learning process. One of the learning resources that can be used is a module.

One of the objectives of teaching physics is to develop analytical thinking skills through reasoning, using physics concepts and principles to explain various natural phenomena and solve problems, both qualitatively and quantitatively. One of the crucial thinking skills to develop is critical thinking. *Critical thinking* can be defined as logical and reflective thinking or the use of tentative hypotheses or assumptions in decision-making to solve problems (Prabasari et al., 2021). Critical thinking is the active and skillful process of formulating orderly reasoning from conceptualizing, applying, analyzing, synthesizing, or evaluating information collected through observation, experience, reflection, reasoning, or communication as a basis for determining action (Nafiah & Suyanto, 2014). Critical thinking involves various essential skills, such as conceptualization, application, analysis, synthesis, and information evaluation, in a structured and systematic manner. This process requires active engagement in gathering and interpreting information obtained through observation, experience, or communication, which is then used as a basis for decision-making and action. The importance of critical thinking lies in its ability to help individuals make better judgements, solve problems, and make decisions based on valid and objective reasoning. As a continuously developing process, critical thinking also involves reflecting on one's thoughts, ensuring that every argument or conclusion is based on precise data and logic, free from subjective bias (Abduqodirovich, 2023; Al-Mubaid, 2014). In an educational context, critical thinking not only aids in understanding academic content but also in developing independent thinking and sound judgment in everyday life. Various teaching methods designed to enhance critical thinking skills have proven effective in enriching the learning process and fostering a more analytical and reflective mindset.

One of the ways to cultivate critical thinking skills is by supporting them with appropriate learning media. Suitable learning media can facilitate the critical thinking process by presenting interactive information that stimulates students to analyze, evaluate, and logically conclude information (Febliza et al., 2023; Sumawati et al., 2021). Interactive learning media play a crucial role in facilitating the development of student's critical thinking skills. By presenting content that encourages students to interact and actively participate, this media motivates students to analyze, evaluate, and logically conclude information. The use of interactive media in learning has been proven to increase student engagement and optimize learning outcomes, especially in critical thinking skills (Winarni et al., 2021).

Additionally, virtual interactive media, such as in online learning environments, can also facilitate critical thinking processes through interactive mechanisms involving reflection and group discussions (Saadé et al., 2012). One of the learning media that can be used to support critical thinking skills is an e-module, which offers an interactive and flexible approach to teaching and learning (Kurniati et al., 2021; Seruni et al., 2019). E-modules allow students to access learning materials independently, according to their learning pace, while providing opportunities for analytical and reflective thinking (Hadianto & Festiyed, 2020; Mv et al., 2021). Furthermore, e-modules are often equipped with various features, such as practice questions, instructional videos, and interactive simulations, that can stimulate students' critical thinking abilities (Kurniati et al., 2021; Syahfitri & Muntahanah, 2024). Supported by multimedia, students can more easily understand abstract concepts, develop problem-solving skills, and evaluate information critically.

An e-module is a learning tool that fosters creativity and productive, interactive thinking, which facilitates exploration, contains images, audio, video, and animations, and includes tests aimed at enabling students to learn independently in an electronic format (Budiarti et al., 2016; Maryam et al., 2019; Nurdyansyah, 2018; Suarsana & Mahayukti, 2013). The strategy of organizing learning materials involves sequencing, which refers to the arrangement of the presentation order of learning materials, and synthesizing, which refers to efforts to show the interrelation between facts, concepts, procedures, and principles contained in the learning materials (Parmin & Peniati, 2012). Thus, it can be said that electronic modules are easier to update than printed modules. If there are changes or additions to the material, the digital version can be adjusted quickly and redistributed easily.

Based on the results of observations and interviews with several high school physics teachers in Kendari City, Southeast Sulawesi, it was found that there is a lack of learning resources, teaching materials, and interactive physics learning media available for teaching students. One of the deficiencies is the lack of interactive physics modules on the topic of electromagnetic induction. By developing the CinQASE e-module based on Flip PDF Professional, it is expected that students will learn independently, review materials according to their needs, and explore topics that interest them in a relaxed atmosphere without waiting for the teacher's explanation. Students will experience a new, highly positive learning environment, as a conducive learning atmosphere reduces barriers to student competence achievement through the learning process (Asma et al., 2020).

One aspect of thinking skills is critical thinking ability. Critical thinking is one of the many essential thinking skills that students need to possess, as it enables individuals to process and use information easily to find solutions to problems. One of the physics topics that is difficult for students to understand is electromagnetic induction (Yustiandi, 2017). Therefore, this topic requires critical thinking skills to comprehend the concepts involved. Effective teaching is teaching that has a good system, which enhances the success of the learning process by creating an active environment where students can develop all their learning abilities (Suwardi, 2012). One learning model that can enhance critical thinking skills is the CinQASE learning model.

The CinQASE learning model (Collaborative in Questioning, Analyzing, Synthesizing, and Evaluating) is specifically designed to enhance students' collaborative critical thinking skills (Hunaidah et al., 2019). Husnah (2017) states that critical thinking skills are crucial for students in learning, especially in solving problems that require deeper alternative solutions, which are often not far from the problems encountered in daily life. According to her research, critical thinking skills can improve students' learning outcomes; the higher the level of critical thinking, the more significant the functional relationship with learning outcomes. This CinQASE learning model is implemented in an e-module designed with the aid of the Flip PDF Professional application.

The development of electronic teaching materials supported by Flip PDF Professional is considered adequate because this application is not limited to text but also allows the inclusion of animations, videos, and audio, making it an attractive and interactive learning medium, thereby preventing monotonous learning (Widiastuti, 2021). A flipbook is a type of classic animation created from a stack of paper resembling a thick book, where each page illustrates a process that appears to move or animate. Several studies have been conducted, including research by Sriwahyuni et al. (2019) on the development of electronic teaching materials supported by Flip PDF Professional on the topic of optical instruments in high school. Based on their development research and the discussions presented, it was stated that the validation results by expert judgment and practitioners regarding the developed teaching materials fall into the very good category, with an average percentage of 79.45%. Another study conducted by Lestari et al. (2022) on the development of e-modules supported by Flip PDF Professional on the theme of global warming as an independent learning resource for Grade VII students showed that the validity test results of the e-module received a material validation percentage of 76%, categorized as valid, a media expert validation percentage of 85%, categorized as valid, and a science teacher validation percentage of 100%, categorized as very valid. Another study by Rama et al. (2022) on the "Development of E-Modules Assisted by Flip PDF Professional Application in the Course of Basic Education Curriculum Analysis" showed that the practicality questionnaire results by the instructor received an average score of 98.95%, with the product quality aspect at 96.85%, material presentation aspect at 100%, and benefit aspect at 100%. The practicality questionnaire results by students obtained an average score of 87.76%, with the product quality aspect at 87.75%, the material presentation aspect at 87.21%, and the benefit aspect at 88.33%. At the effectiveness analysis stage, the instructional module developed by the researchers met the criteria for effectiveness. The analysis used the gain score formula. The effectiveness test analysis results based on students' cognitive test results, seen from the pre-test and

## Method

The method used in this research is Research and Development (R&D). The development research design uses the 4D development model proposed by Thiagarajan (1974) which includes the processes of define, design, develop, disseminate . 4D model research model chart according to Thiagarajan (1974).

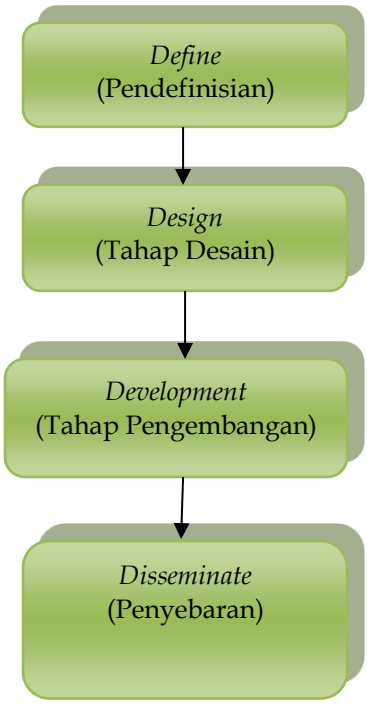


**Figure 1**. Development Research Flow Chart E -module CinQASE

*Data analysis technique*
*E-module Validation Data Sheet*

Evaluation of validation results by the validator, in the form of validation questionnaire scores on a scale of 1 to 4, for each criterion. The scale includes; 1= Very Unsuitable (STS), 2= Not Suitable (TS), 3= Suitable (S), and 4= Very Suitable (SS). The results of the assessment were analyzed using SBI (ideal standard standard). Data analysis of the validation sheet uses quantitative descriptive analysis with the following steps: Find the average score for the e-module assessment, using the formula:

$$\bar{X} = \frac{\Sigma x}{n} \quad (1)$$

With $\bar{X}$ is the average score, n is the number of items, and Σ $x$ is the number of item scores. The total average score for each aspect obtained is then converted into qualitative data in the form of *e-module feasibility level* . Conversion guidelines can be seen in Table 1.

**Table 1.** Converting Scores to Scale 4 (Mardapi, 2004)

| Score Intervals | Category |
|---|---|
| $\bar{X} \geq \left( \bar{X}i + 1.SBi \right)$ | Very good |
| $\bar{X} \geq \left( \bar{X}i + 1.SBi \right)$ | Good |
| $\bar{X}i \geq \bar{X} \geq \left( \bar{X}i + 1.SBi \right)$ | Not good |
| $\bar{X} \leq \left( \bar{X}i + 1.SBi \right)$ | Very Not Good |

Category: $\bar{X}$ = Average, $\bar{Xi}$ = Average Ideal Score, = ½ (ideal maximum score + ideal minimum score), SB $i$ = Ideal Standard Deviation = 1/6 (ideal maximum score-ideal minimum score).

Based on Table 1, guidelines for converting quantitative values 1 to 4 into qualitative categories can be obtained to conclude the level of feasibility of the e-module being developed. If the *Xi* and *SBi values* are substituted in the formula in Table 1, you will obtain conversion guidelines as presented in Table 2.

**Table 2.** Conversion of Actual Scores into Qualitative Categories for Intervals 1 to 4 (V)

| Intervals | Category |
|---|---|
| $\bar{X} > 3$ | Very good |
| $3 \geq \bar{X} > 2{,}5$ | Good/Fair |
| $2{,}5 \geq \bar{X} > 2$ | Not good |
| $\bar{X} \leq 2$ | Very Not Good |

Description: $\bar{X}$ = Average Score

*Practicality Analysis*

Practicality analysis was obtained based on analysis of teacher response questionnaire data and student responses. Analysis of teacher response questionnaire data and student responses uses quantitative descriptive analysis with steps. Change the statement scale to a scale value of 1 to 4, namely 1=Strongly Disagree (STS), 2=Disagree (TS), 3=Agree (S), and 4=Strongly Agree (SS). Look for the average score of lecturer response statement items and student responses. The total average score for each aspect obtained is converted into qualitative data in the form of product feasibility criteria. Conversion guidelines are shown in Table 3.

**Table 3.** Converting Scores to Scale 4 (Mardapi, 2004)

| Score Intervals | Category |
|---|---|
| $\bar{X} \geq \left( \bar{X}i + 1.SBi \right)$ | Very good |
| $\bar{X} \geq \left( \bar{X}i + 1.SBi \right)$ | Good |
| $\bar{X}i \geq \bar{X} \geq \left( \bar{X}i + 1.SBi \right)$ | Not good |
| $\bar{X} \leq \left( \bar{X}i + 1.SBi \right)$ | Very Not Good |

Category: $\bar{X}$ = Average, $\bar{Xi}$ = Average Ideal score = 1/2 (ideal maximum score + ideal minimum score, SB $i$ = Ideal Standard Deviation = 1/6 (ideal maximum score-ideal minimum score).

Based on Table 3, guidelines for converting quantitative values 1 to 4 into qualitative categories can be obtained to conclude the level of feasibility of the e-module being developed. If the *Xi* and *Sbi values* are substituted in the formula in Table 4, you will obtain conversion guidelines as presented in Table 4.

**Table 4.** Conversion of Actual Scores into Qualitative Categories for Intervals 1 to 4 (Sukarjo et al., 2006)

| Intervals | Category |
|---|---|
| $\bar{X} > 3$ | Very good |
| $3 \geq \bar{X} > 2.5$ | Good/Fair |
| $2{,}5 \geq \bar{X} > 2$ | Not good |
| $\bar{X} \leq 2$ | Very Not Good |

Description: $\bar{X}$ = Average Score

*Effectiveness Analysis*

Analysis of Improving Students' Critical Thinking Skills Critical thinking skills in this research are seen from increasing grades. The increase in value can be seen from the comparison of scores between *posttest* and

*pretest* which are analyzed using the normalized *gain score* with Formula 2.

$$(g) = \frac{S_f - S_i}{100 - S_i} \quad (2)$$

Note: ( $g$ ) = *gain* value ; S = *pretest score* ; $S_f$ = *posttest* score

The value of 100 in the formula is the maximum *pretest* or *posttest value* . The *gain* value of each student is classified based on the *gain value* to determine the quality of improving critical thinking skills as shown in Table 5.

**Table 5.** *Gain* Interpretation

| Gain Value (g) | Interpretation |
|---|---|
| (g) ≤0.7 | Tall |
| 0.7 < (g) ≤ 0.3 | Currently |
| (g) < 0.3 | Low |

## Results and Discussion

Development of the CinQASE model e-module with the Flip PDF Professional application to improve the critical thinking skills of class XII high school students. The e-module format developed is based on the e-module standards developed by the Ministry of Education and Culture, Directorate of SMA, Directorate General of PAUD, DIKDAS and DIKMEN in 2020 with the help of Flip PDF Professional. The learning model used in the e-module is the CinQASE model. to make it easier for students to understand Electromagnetic Induction material. The Electromagnetic Induction E-module consists of three meetings with each meeting consisting of 2 lesson hours. The average validity results for the construct aspect and content aspect are at the "Very valid" criteria with a final validator agreement index of 0.88 and 0.85 respectively. This value is included in the feasible category. Details of the validation results of the Electromagnetic Induction learning e-module can be seen in Table 6.

**Table 6.** Results of *CinQASE E-Module* Validation Assessment Assisted by the Professional Flip PDF Application.

| Item | Aspect | Sub-Aspect | V | Category |
|---|---|---|---|---|
| I | Construct | Graphic feasibility | 0.87 | Very valid |
| | | Feasibility of electronic media | 0.88 | Very valid |
| Average of Construct Aspects | | | 0.88 | Very valid |
| II | Contents | Content eligibility | 0.84 | Very valid |
| | | Feasibility of presentation | 0.82 | Very valid |
| | | Language eligibility | 0.82 | Very valid |
| Content Aspect Average | | | 0.83 | Very valid |
| Average of All Aspects | | | 0.85 | Very valid |

The results of the CinQASE E-Module Validation Assessment Assisted by the Professional Flip PDF Application can be seen graphically in Figure 2.

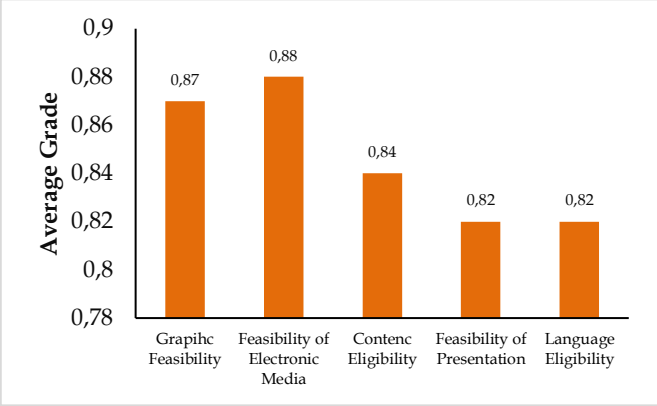


**Figure 2**. Graph of CinQASE model E-module validation results

The practicality of the limited test of the CinQASE e-module model assisted by Flip PDF Professional was measured by teacher and student response questionnaires. class XII MIA A SMA Negeri 2 Parigi t is presented in Table 7

**Table 7.** Response from the Physics Teacher for class XII MIA SMA Negeri 2 Parigi for Limited Test

| Aspect | X | Category |
|---|---|---|
| Content Eligibility | 3.87 | Very good |
| Linguistic Feasibility | 4.00 | Very good |
| Feasibility of benefits | 3.87 | Very good |
| Graphic feasibility | 3.61 | Very good |
| Average of all aspects | 3.84 | Very good |

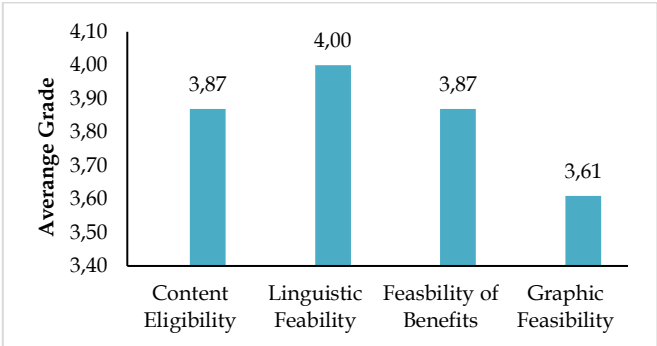


**Figure 3**. Graphic of Teacher Response Results to the CinQASE model e-module with the Flip PDF Professional application.

Based on SBI analysis, the results of teacher responses to the CinQASE model e-module assisted by

Flip PDF Professional based on Figure 3 show that the content aspect has an average response value of 3.84 which is in the very good category. Thus, the CinQASE model e-module assisted by Flip PDF Professional that has been developed has had a very good practical response from teachers, so it is suitable for use. The results of the responses of 25 class XII MIA B students at SMA Negeri 2 Parigi to the CinQASE model e-module assisted by Flip PDF Professional can be seen in Table 8.

**Table 8.** Responses of 25 students in class XII MIA B SMA Negeri 2 Parigi

| Aspect | X | Category |
|---|---|---|
| Content Eligibility | 3.77 | Very good |
| Linguistic Feasibility | 3.74 | Very good |
| Feasibility of benefits | 3.76 | Very good |
| Graphic feasibility | 3.75 | Very good |
| Average of all aspects | 3.75 | Very good |

Table 8 contains the responses of 25 students in class Based on these results, it can be seen that the students' response to the CinQASE model e-module assisted by Flip PDF Professional was classified as very good. The level of effectiveness of the CinQASE learning e-module was obtained based on the results of increasing students' physics learning outcomes and increasing critical thinking skills. Student learning outcomes in electromagnetic induction material are measured using pretest and posttest. The pretest and posttest questions are given in the form of a multiple-choice test consisting of 20 question numbers which are divided into 10 pretest question numbers and 10 posttest question numbers. The results of the pretest and posttest analysis of the CinQASE e-module model assisted by Flip PDF Professional can be seen in Table 9.

**Table 9.** Results of Pretest and Posttest Analysis of Students

| Name | Pretest | | Posttest | | | Increased |
|---|---|---|---|---|---|---|
| | Score | Criteria | Score | Criteria | Gain | Category |
| WOA | 10 | Incomplete | 70 | Incomplete | 0.77 | High |
| SSD | 20 | Incomplete | 80 | Complete | 0.75 | High |
| AS | 10 | Incomplete | 80 | Complete | 0.77 | High |
| SRA | 30 | Incomplete | 80 | Complete | 0.71 | High |
| ASR | 50 | Incomplete | 100 | Complete | 1 | High |
| MAL | 30 | Incomplete | 90 | Complete | 0.85 | High |
| MAS | 20 | Incomplete | 70 | Incomplete | 0.80 | High |
| WOC | 10 | Incomplete | 70 | Incomplete | 0.77 | High |
| AM | 10 | Incomplete | 70 | Incomplete | 0.88 | High |
| WM | 10 | Incomplete | 90 | Complete | 0.88 | High |
| WOF | 30 | Incomplete | 90 | Complete | 0.85 | High |
| WS | 40 | Incomplete | 80 | Complete | 0.66 | Medium |
| AR | 10 | Incomplete | 70 | Incomplete | 0.66 | Medium |
| NNQ | 10 | Incomplete | 80 | Complete | 0.88 | High |
| KFG | 10 | Incomplete | 80 | Complete | 0.77 | High |
| SW | 20 | Incomplete | 90 | Complete | 0.87 | High |
| WFL | 10 | Incomplete | 80 | Complete | 0.77 | High |
| WNR | 30 | Incomplete | 90 | Complete | 0.85 | High |
| Average | 20.55 | Incomplete | 80.55 | Complete | 0.81 | High |

Students' critical thinking abilities in electromagnetic induction material are measured using a pretest and posttest. The pretest and posttest questions are given in the form of an essay test which consists of 8 question numbers which are divided into 4 pretest question numbers and 4 posttest question numbers. The results of the pretest and posttest analysis of the CinQASE emodule model assisted by Flip PDF Professional can be seen in Table 10.

The research being developed is the development of the *CinQASE* model *e-module* with the help of *Flip PDF Professional* to improve the learning outcomes of class XII high school students. The *e-module* format developed is based on the *e-module standards* developed by the Ministry of Education and Culture, Directorate of SMA, Directorate General of PAUD, DIKDAS and DIKMEN in 2020. The *CinQASE* model *e-module* assisted by *Flip PDF Professional* on Electromagnetic Induction material consists of three meetings with each meeting consisting of 2 lesson hours. The learning model used in *the e-module* developed is the *CinQASE model* as a characteristic of *the e-module* to make it easier for students to understand Electromagnetic Induction material.

The validity of *the E-module* being developed will be validated by three validators. The assessment of the validity of this *e-module* is reviewed in terms of construct and in terms of content, each of which consists of several aspects. Construct assessment was carried out to assess the validity of *the e-module* from the aspects of feasibility,

graphics and appropriateness of electronic media. Meanwhile, the content assessment is to assess the validity of *the e-module* from the aspects of appropriateness of content, appropriateness of presentation, and appropriateness of the language in *the emodule* that has been developed.

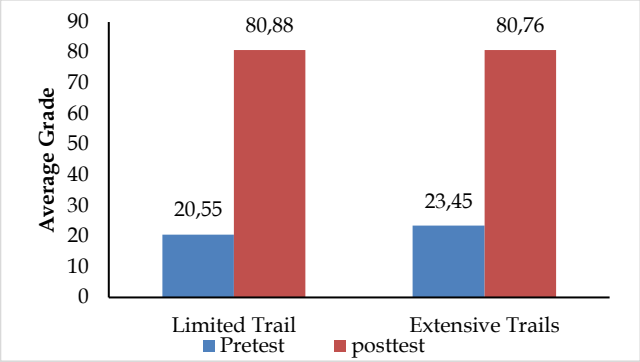


**Figure 4.** Comparison graph of pretest and posttest scores for limited trials and extensive trials

Based on the assessment results from the three validators presented in Table 6, the average validity results for the construct aspect and content aspect were in the "Very valid" criteria with the final agreement index from the three validators respectively being 0.88 and 0.85. This value is included in the feasible category, according to the theory that *e-module media* is said to be appropriate if it meets a minimum score of 0.61 (Arikunto, 2010). These results are relevant to Seruni et al. (2020) research entitled "Development of BiokiIPA Electronic Modules (*E-Modules)* on Lipid Metabolism Material with the help of *Flip Pdf Professional* " which obtained validation results with good criteria so that *the e-modules* developed can be used for classroom learning. . The next stage in this research and development is testing the practicality of *the emodule* that has been developed. Practicality of the *CinQASE* model *emodule* assisted by *Flip PDF Professional* is measured by questionnaire responses to students and teachers.

**Table 10.** Results of Student Pretest and Posttest Analysis

| Name | Pretest | | Posttest | | | Increased |
|---|---|---|---|---|---|---|
| | Score | Criteria | Score | Criteria | Gain | Category |
| HD | 30 | Incomplete | 80 | Incomplete | 0.71 | High |
| AF | 10 | Incomplete | 80 | Complete | 0.77 | High |
| MA | 20 | Incomplete | 90 | Complete | 0.87 | High |
| SATI | 30 | Incomplete | 80 | Complete | 0.71 | High |
| SM | 30 | Incomplete | 80 | Complete | 0.71 | High |
| LMR | 40 | Incomplete | 90 | Complete | 0.66 | Medium |
| RA | 20 | Incomplete | 80 | Incomplete | 0.75 | High |
| LFE | 20 | Incomplete | 70 | Incomplete | 0.62 | Medium |
| SS | 30 | Incomplete | 90 | Incomplete | 0.85 | High |
| TH | 30 | Incomplete | 80 | Complete | 0.71 | Medium |
| WFO | 0 | Incomplete | 70 | Complete | 0.62 | Medium |
| WOS | 40 | Incomplete | 80 | Complete | 0.66 | Medium |
| MSM | 20 | Incomplete | 80 | Incomplete | 0.75 | High |
| AL | 20 | Incomplete | 90 | Complete | 0.87 | High |
| MR | 10 | Incomplete | 80 | Complete | 0.77 | High |
| WZN | 20 | Incomplete | 70 | Complete | 0.62 | Medium |
| WSO | 30 | Incomplete | 80 | Complete | 0.85 | High |
| MLK | 20 | Incomplete | 80 | Complete | 0.75 | High |
| SH | 20 | Incomplete | 90 | Complete | 0.87 | High |
| RS | 40 | Incomplete | 100 | Complete | 1 | High |
| WL | 10 | Incomplete | 70 | Complete | 0.66 | Medium |
| ROS | 20 | Incomplete | 80 | Complete | 0.75 | High |
| ASR | 40 | Incomplete | 80 | Complete | 0.66 | Medium |
| FR | 30 | Incomplete | 80 | Complete | 0.71 | Medium |
| SJ | 10 | Incomplete | 70 | Complete | 0.66 | Medium |
| MY | 40 | Incomplete | 80 | Complete | 0.66 | Medium |
| Average | 20.55 | Incomplete | 80.76 | Complete | 0.74 | High |

The student and teacher response questionnaire sheets provided consist of 31 statement items for the student response questionnaire and the teacher response questionnaire contains 35 statement items. All of the statement items will be filled in by students and teachers by providing *a checklist* in one of the four assessment columns available on the questionnaire sheet. Results of student and teacher responses to the *CinQASE* model *e-module* developed with the help of *Flip Pdf Professional is used as a benchmark for the practicality of e-module* teaching

materials. Based on the practicality of *e-modules* that have been developed through student response questionnaires, the average scores for limited trials and extensive trials are 3.68 and 3.75 respectively, where both are included in the very good category. These results state that the *CinQASE* model *emodule* is assisted by *Flip PDF Professional* really helps students understand the material and hone their argumentative skills in presenting concepts, and is easy to use in learning. *Table 7 and Table* 8 regarding the response *questionnaire* for Class try to be broad. These results can be stated that the teacher's response to the *CinQASE* model *e-module* developed was with the help of *Flip PDF Professional* can be used in learning. The results of the practicality of *the e-module* are in accordance with research conducted by (Supriyadi et al., 2021) entitled " *E-Module* on Temperature, Expansion and Heat: Valid and Practical" which obtained an average score of 3.76 in the very practical category. Based on the results of the responses of students and physics subject teachers to the assessment of the *CinQASE* model *e-module* assisted by *Flip PDF Professional* which has been developed, it can be concluded that the *CinQASE* model *e-module* assisted by *Flip PDF Professional* on electromagnetic induction material is practical for use in learning at school.

The final stage in this research is the application of *the e-module* to assess the effectiveness of the *CinQASE* model *e-module* assisted by *Flip Pdf Professionals* that have been developed. This stage is carried out by measuring students' learning outcomes and critical thinking abilities on electromagnetic induction material before and after learning. The student material mastery test consists of 14 questions which are divided into 10 multiple choice questions to measure student learning outcomes and 4 essay questions to measure thinking abilities. This stage is divided into a broad test and a limited test, each consisting of 18 students for the limited test and 26 students for the wide test which is measured by giving *a pretest at the beginning before learning with CinQASE* model *e-module* learning assisted by *Flip PDF Professional* and *a posttest* when All learning activities during 3 meetings with *CinQASE* model *e-module learning* assisted by *Flip PDF Professional* were carried out.

Based on the limited test, it showed that of the 18 students given *the pretest*, none met the minimum completeness criteria (KKM). The KKM score for physics subjects is ≥ 75. The average *pretest score* achieved by students in the electromagnetic induction material is 22.5 which is included in the "Incomplete" category. After being given the use of teaching materials in the form of *CinQASE* model *e-modules* assisted by *Flip PDF Professional* in learning, *posttest results were obtained* with an increase in the students' average score to 80.85 which was included in the "Complete" category. The Ngain score obtained between *the pretest* and *posttest* for using *e-modules* was 0.83 in the "High" category. for the extensive test, the average score *achieved* was 23.45, which was included in the "Incomplete" category. After being given the use of teaching materials in the form of *CinQASE* model *e-modules* assisted by *Flip PDF Professional* in learning, *posttest results were obtained* with an increase in the students' average score to 80.76 which was included in the "Complete" category. The Ngain score obtained between *the pretest* and *posttest* using the *CinQASE e-module* model assisted by *Flip Pdf Professional* was 0.74 in the "High" category. Effectiveness of providing *CinQASE* model *e-modules* assisted by *Flip PDF Professional* in learning is analyzed using Ngain. Ngain will show the difference in *pretest* and *posttest* scores using *the CinQASE e-module* model assisted by *Flip PDF Professional*. The results obtained for the level of effectiveness of *e-modules* are in accordance with research conducted by Lestari & Parmiti (2020) entitled "Development of Science E-Modules Containing *Online Tests* to Improve Learning Outcomes" obtained results that based on the testing criteria, H0 was rejected and H1 was accepted, which means there are significant differences. significant (5%) learning outcomes before and after using the science *e-module containing online* tests for class VII D students at SMP Negeri 3 Singaraja. Based on these results, it shows that the *CinQASE* model *e-module* assisted by *Flip PDF Professional* on electromagnetic induction material is effective in improving student learning outcomes.

Table 9 and table 10 show the results of students' critical thinking abilities for limited trials. The average *pretest* and *posttest scores* were respectively 15 in the incomplete category and 81.33 in the completed category. So, the N-gain value obtained between *the pretest* and *posttest* for using *the e-module* was 0.75 in the "High" category. Table 9 and Table 10 show the results of *the pretest* and *posttest* for the extensive test, where the respective average scores were 15.96 for the *pretest* in the incomplete category and 80.46 for *the posttest* which was included in the completed category. The *pretest* and *posttest* scores were analyzed using Ngain analysis where an average score of 0.76 was obtained with high criteria. Based on these results, it shows that the *CinQASE* model *e-module* assisted by *Flip PDF Professional* on electromagnetic induction material is effective in improving students' critical thinking abilities. Based on research conducted by Latifah et al., (2020) on "Development of Physics *E-Modules* to Improve Students' Critical Thinking Abilities" shows an increase in students' critical thinking abilities seen from the *pretest scores* where *the pretest results* show a mean value of 33.19 and *the posttest* scores show the average

value 73.47 obtained the ngain criteria of 0.602 in the medium category because the gain value is included in the normalized gain criteria of $0.3 \geq g \geq 0.7$.

## Conclusion

Based on the entire development research process carried out, it can be concluded that: the level of validity of the CinQASE model e-module assisted by the Flip PDF Professional software developed is valid for use to improve the critical thinking skills of class X1I MIA students at SMA Negeri 2 Parigi. Based on the validator results obtained, the average construct aspect was 0.88 and the content aspect was 0.83 in the "Very Valid" category. So that the CinQASE model e-module assisted by Flip PDF Professional software is valid or suitable for use in the learning process to improve student learning outcomes. Then, the level of practicality of the CinQASE model e-module assisted by Flip PDF Professional software can be determined by the value of learning implementation, the results of teacher and student responses. Where the final decision index results for each meeting, both limited trials and field trials, were obtained in the "Very High" category. The average results of student responses on limited trials and extensive trials were 3.68 and 3.75 in the "Very Good" category and the average results of teacher responses on limited trials and extensive trials were 3.84. and 3.87. Therefore , these results show that the use of the CinQASE model e-module assisted by Flip PDF Professional software in Electromagnetic Induction material is practical for use in learning. Furthermore, the effectiveness of the CinQASE model e-module assisted by the Flip PDF Professional software can be seen from the learning outcomes and improvement in students' critical thinking abilities after using the CinQASE model e-module assisted by the Flip PDF Professional application. 22.5 in the incomplete category and for the posttest it was 80.85 in the completed category.

**Acknowledgments**
Thank you to the Department of Physics Education at Halu Oleo University for all their support so that the research can be completed.

**Author Contributions**
Hunaidah (Conceptualization, Methodology, Formal analysis, Writing - Original Draft), Erniwati (Writing - Original Draft, Resources, Investigation), Amiruddin Takda (Formal analysis, Conceptualization, Formal analysis).

**Funding**
The reseach not recieve funding

**Conflicts of interest**
"No confict of interest"

## References

Abduqodirovich, M. A. (2023). Picularities And Importance of Critical Thinking. *International Scientific and Current Research Conferences*, 355–358. https://doi.org/10.37547/geo-67

Al-Mubaid, H. (2014). A New Method for Promoting Critical Thinking in Online Education. *International Journal of Advanced Corporate Learning (IJAC)*, *7*(4). https://doi.org/10.3991/ijac.v7i4.4048

Aqib, Z. (2013). *Model-Model, Media, dan Strategi Pembelajaran Kontektual (Inovatif)*. Bandung: Yrama Widya.

Arikunto, S. (2010). *Prosedur penelitian: Suatu pendekatan praktik*. Rineka Cipta.

Asma, R., Asrial., & Maison. (2020). Development of interactive electronic student worksheets on electromagnetic induction based on scientific approaches. *Jurnal Penelitian Pendidikan IPA (JPPIPA)*, *6*(2), 136–143. https://doi.org/10.29303/jppipa.v6i2.387.

Budiarti, S., Nuswowati, M., & Cahyono, E. (2016). Guided Inquiry Berbantuan E-Modul Untuk Meningkatkan Keterampilan Berpikir Kritis. *Journal Of Innovative Science Education*, *5*(2). Retrieved from https://journal.unnes.ac.id/sju/jise/article/view/14264

Budiman, H. (2017). Peran Teknologi Informasi dan Komunikasi Dalam Pendidikan. *Al-Tadzkiyyah: Jurnal Pendidikan Islam*, *8*(1). https://doi.org/10.24042/atjpi.v8i1.2095

Cynthia, C., Arafat, K., & Palloan, P. (2023). Development of Interactive Physics E-Module to Improve Critical Thinking Skills. *Journal of Science Education Research*, *9*(5), 3943–3952. https://doi.org/10.29303/jppipa.v9i5.2302

Febliza, A., Afdal, Z., & Copriady, J. (2023). Improving Students' Critical Thinking Skills: Is Interactive Video and Interactive Web Module Beneficial? *International Journal of Interactive Mobile Technologies (IJIM)*, *17*(03). https://doi.org/10.3991/ijim.v17i03.34699

Hadianto, A., & Festiyed. (2020). Meta analysis the use of e-modules based on research based learning models. *Journal of Physics: Conference Series*, *1481*(1), 12067. https://doi.org/10.1088/1742-6596/1481/1/012067

Hunaidah, S., E., P., B., & Mahdiannur. (2019). Improving collaborative critical thinking skills of physics education students through implementation of CinQASE learning model. *Journal of Physics: Conference Series*, *1*. https://doi.org/10.1088/1742-

6596/1108/1/012101

Husnah, M. (2017). Hubungan tingkat berpikir kritis terhadap hasil belajar fisika siswa dengan menerapkan model pembelajaran problem-based learning. *PASCAL (Journal of Physics and Science Learning)*, *1*(2), 10–17. https://doi.org/10.30743/pascal.v1i2.338

Kurniati, R. D., Andra, D., & Wayan Distrik, I. (2021). E-module development based on PBL integrated STEM assisted by social media to improve critical thinking skill: A preliminary study. *Journal of Physics: Conference Series*, *1796*(1), 12077. https://doi.org/10.1088/1742-6596/1796/1/012077

Latifah, N., Ashari, A., & Kurniawan, E. S. (2020). Pengembangan e-Modul Fisika Untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik. *Jurnal Inovasi Pendidikan Sains (JIPS)*, *1*(1). https://doi.org/10.37729/jips.v1i1.570

Lestari, E., Nulhakim, L., & Suryani, D. I. (2022). Pengembangan E-modul Berbasis Flip Pdf Professional"Tema Global Warming Sebagai Sumber Belajar Mandiri Siswa Kelas VII." *Journal of Science Education*, *6*(2). https://doi.org/10.33369/pendipa.6.2.338-345

Lestari, H. D., & Parmiti, D. P. (2020). Pengembangan E-Modul IPA Bermuatan Tes Online untuk Meningkatkan Hasil Belajar. *Journal of Education Technology*, *4*(1). https://doi.org/10.23887/jet.v4i1.24095

Mardapi, D. (2004). *Penyusunan Tes Hasil Belajar*. Yogyakarta: UNY Press.

Maryam, M., Masykur, R., & Andriani, S. (2019). Pengembangan E-Modul Matematika Berbasis Open Ended Pada Materi Sistem Persamaan Linear Dua Valiabel Kelas VIII A. *Jurnal Matematika Dan Pendidikan Matematika*, *10*(1). https://doi.org/10.26877/aks.v10i1.3059

Mv, A., Tp, R., & J, A. J. (2021). Project Educate: A skill based e-learning for rural areas. *2021 4th International Conference on Computing and Communications Technologies (ICCCT)*, 219–222. https://doi.org/10.1109/ICCCT53315.2021.9711825

Nafiah, Y. N., & Suyanto, W. (2014). Penerapan Model Problem-Based Learning untuk Meningkatkan Keterampilan Berpikir Kritis dan Hasil Belajar Siswa. *Jurnal Pendidikan Vokasi*, *4*(1). https://doi.org/10.21831/jpv.v4i1.2540

Nurdyansyah, N. (2018). *Pengembangan Bahan Ajar Modul Ilmu Pengetahuan Alambagi Siswa Kelas IV Sekolah Dasar* [Universitas Muhammadiyah Sidoarjo]. Retrieved from http://eprints.umsida.ac.id/1607/

Parmin, & Peniati, E. (2012). Pengembangan Modul Mata Kuliah Strategi Belajar Mengajar IPA Berbasis Hasil Penelitian Pembelajaran. *JPII*, *1*(1), 8–15. https://doi.org/10.15294/jpii.v1i1.2006

Prabasari, J. S., Muzzazinah, M., & Wahyuningsih, D. (2021). Development of Electronic Modules (E-Modules) Based on Problem Based Learning on Additives and Addictive Substances to Improve Students' Critical Thinking Ability. *Jurnal Penelitian Pendidikan IPA*, *7*, 312–319. https://doi.org/10.29303/jppipa.v7iSpecialIssue.1233

Rama, A., Putra, R. R., Huda, Y., & Lapisa, R. (2022). Pengembangan E-Modul Menggunakan Aplikasi Flip Pdf Professional Pada Mata Kuliah Analisis Kurikulum Pendidikan Dasar. *Jurnal Riset Tindakan Indonesia*, *7*(1). https://doi.org/10.29210/30031473000

Saadé, R. G., Morin, D., & Thomas, J. D. E. (2012). Critical thinking in E-learning environments. *Computers in Human Behavior*, *28*(5), 1608–1617. https://doi.org/10.1016/j.chb.2012.03.025

Seruni, R., Munawaroh, S., Kurniadewi, F., & Nurjayadi, M. (2019). Pengembangan Modul Elektronik (E-Modul) Biokimia Pada Materi Metabolisme Lipid Menggunakan Flip PDF Professional. *Jurnal Tadris Kimiya*, *4*(1). https://doi.org/10.15575/jtk.v4i1.4672

Seruni, R., Munawaroh, S., Kurniadewi, F., & Nurjayadi, M. (2020). Implementation of e-module flip PDF professional to improve students' critical thinking skills through problem based learning. *Journal of Physics: Conference Series*, *1521*(4), 42085. https://doi.org/10.1088/1742-6596/1521/4/042085

Setianingrum, D. A., Pratiwi, S., & Jumadi, J. (2022). Development of science module based on flipbook about physics in the respiratory system to improve studentsâ€TM learning independence. *Jurnal Penelitian Pendidikan IPA*, *8*(6), 2621–2628. https://doi.org/10.29303/jppipa.v8i6.1923

Suarsana, I. M., & Mahayukti, G. A. (2013). Pengembangan E-Modul Berorientasi Pemecahan Masalah untuk Meningkatkan Keterampilan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan Indonesia*, *2*(2). https://doi.org/10.23887/jpi-undiksha.v2i2.2171

Sukarjo, Supardi, K. M. E. P. U. N. Y., U., L., Suhendri, H., & Rismurdiyati. (2006). Pengaruh Media Pembelajaran dan Minat Belajar Terhadap Hasil Belajar Fisika. *Jurnal Formatif*, *2*(1). https://doi.org/10.30998/formatif.v2i1.86

Sumawati, R. A., Pramita, M., Santanapurba, H., Wiranda, N., & Utami, B. (2021). STEM-Based

Interactive Learning Media to Improve Student's Critical Thinking Skills on Number System Materials. *International Conference on Education Technology (URICET)*, 425–430. https://doi.org/10.1109/URICET53378.2021.9865952

Supriyadi, U., Marlina, L., & Sriyanti, I. (2021). EModule Pada Materi Suhu, Pemuaian, dan Kalor: Valid dan Praktis. *Jurnal Ilmiah Pendidikan Fisika*, *5*(2). https://doi.org/10.20527/jipf.v5i2.3787

Suwardi, D. R. (2012). Faktor-Faktor Yang Mempengaruhi Hasil Belajar Siswa Kompetensi Dasar Ayat Jurnal Penyesuaian Mata PelaJaran Akuntansi Kelas XI IPS Di SMA Negeri 1 Bae Kudus. *Economic Education Analysis Journal*, *2*. Retrieved from https://journal.unnes.ac.id/sju/eeaj/article/view/667

Syahfitri, J., & Muntahanah, M. (2024). The effectiveness of local wisdom-based interactive digital module on students' critical thinking disposition. *International Journal of Evaluation and Research in Education (IJERE)*, *13*(4), 2170. https://doi.org/10.11591/ijere.v13i4.28256

Widiastuti, T. (2021). Pengembangan E-Modul Bahasa Indonesia Kelas XII dengan Flip PDF Profesional Sebagai Alternatif Pembelajaran Di Tengah Pandemi Covid 19. *Jurnal Diklat Keagamaan*, *15*(1). https://doi.org/10.52048/inovasi.v15i1.211

Winarni, S., Akhyar, M., & Sudiyanto, G. N. (2021). Needs analysis of mathematics digital media development to improve critical thinking skills in elementary school students. *Proceedings of the 5th International Conference on Learning Innovation and Quality Education*, 1–6. https://doi.org/10.1145/3516875.3516962