The validity of e-module based on guided inquiry integrated ethnoscience in high school physics learning to improve students’ critical thinking

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Abstract. Currently, the role of technology is very much felt, especially during the Covid-19 pandemic conditions. Education is no exception, everything must be done online. However, the problem in online learning, there are still many learning materials such as modules that do not support the online learning process that guides students to think critically to investigate and find concepts of learning materials that are close and follow the conditions of students. Guided inquiry-based e-module integration of ethnoscience is needed to enhance students' critical thinking skills. It is hoped students can study online independently with problems around them. Data analysis techniques have been carried out using the Aiken V formula. Based on the validation that has been done, the integrated inquiry-based e-module ethnoscience was valid and can be used.

1. Introduction

Education around the world has changed completely because of the coronavirus pandemic. Education around the world that runs normally in schools face to face. However, due to the coronavirus pandemic, the system in the world of education has changed completely, so it must be done online. However, the problem is that to support online learning has not been able to run optimally and effectively because there are no many media or teaching materials that support the online learning process. It is the same as the demands of the 2013 curriculum which must use technology in the learning process to increase the efficiency and effectiveness of this learning [1]. One format of media or teaching materials that utilize technology is e-modules. Therefore, schools need e-modules that are unusual and contain not only learning material. The e-module needed by schools is an e-module that can guide students to investigate problems in the learning process so that students can think critically because of it [2].

E-module is a learning process that uses teaching materials that display audio-visual, sound, film, and easy to use [3]. E-Module can function as teaching material and learning media, this depends on the use of it by educators in the learning process. E-module is a display of information in a book format that is presented electronically with a hard disk, floppy disk, CD, flash disk, and can be operated on a computer or smartphone [4]. Based on these two expert opinions, it can be concluded that e-modules are teaching materials and learning media in the form of book formats containing audiovisuals, sounds, films that are easy to use and can be run on computers or smartphones.
A good e-module must contain learning material that can guide students to investigate problems contained in the e-module. To support the inquiry learning process, e-modules can be developed by incorporating a learning model into it. One of the suitable learning models is guided inquiry. Learning that uses the guided inquiry model can develop students' self-confidence and improve their thinking ability to find alternative answers to problems to improve students' understanding of concepts and creativity [5]. So that by adding elements of the guided inquiry learning model to the e-module can make students carry out investigations to solve problems contained in the e-module so that it can improve students' understanding of concepts.

Teaching materials based on the guided inquiry model can improve knowledge competencies [6]. In line with the above statement, the addition of a guided inquiry model to the e-module makes the learning material contained in the e-module has various obstacles that need to be solved. The problem here can be in the form of problems around students. Problems close to students can be in the form of socio-cultural problems. Ethnoscience is a social-cultural form that is always around students. Ethnoscience is a science that is owned by a society or a group of people using certain methods or procedures and is part of the traditions of that society [7].

The e-module contains elements of the guided inquiry model in it and the problems contained in the e-module are integrated with ethnoscience which aims to improve student's critical thinking skills. Based on two variables included in the e-module, there is an increase in students' critical thinking skills. The e-module requires students to think deeply about problem-solving from material that is integrated with ethnoscience. The learning process that integrates a variable in learning will be able to increase the goals to be achieved [8]. Learning by using teaching materials which can be in the form of modules or textbooks that are integrated with certain themes can make the learning process run effectively [9]. Integrated science learning can make students explore and connect science learning and real student life [10]. The ethnoscience variable contained in the e-module is a tradition that is close to students so that it can create effective learning. Learning that contains problems in daily life and packaged in digital form can make learning run effectively [11].

However, does the e-module have the validity to be said as a teaching material that can make students think critically? Validating a teaching material is very important to do before the teaching material is given to students as target users of e-modules. There are four validity variables, namely material substance, presentation feasibility, appearance feasibility, and language [12]. The validity of teaching materials is said to be good if the four variables are good. So that we need teaching materials in the form of e-modules that use a guided inquiry learning model integrated with ethnoscience to improve students' critical thinking skills and well-validated e-modules.

2. Research Method

Based on the above problems, the e-module development model has been carried out using the ADDIE development model. There are five obstacles, namely analysis, design, development, implementation, and evaluation. The validity analysis was carried out based on a questionnaire given to the validator. The validation data analysis was tested using Aiken's V formula. The steps for evaluating the validity of the e-module were carried out using a Likert scale. First, give a score for each item. Second, add up the total score for each indicator. Third, give validity value using Aiken's V equation [13]. the aiken V equation and its validity categories are as follows.

$$V = \frac{\sum s}{n(c-1)} \text{ with } s = r - lo$$

Where:

- $l_o$: number rating validity lows
- $c$: number rating validity highest
- $r$: figures are given validator
The validity category of the e-module being developed can see in Table 1.

| Score | Category   |
|-------|------------|
| ≥ 0.6 | Valid      |
| <0.6  | Not valid  |

3. Results and Discussion

ADDIE development model, at the analysis stage, a preliminary analysis is carried out to find problems in the field. Then at this design stage, the researcher makes designs and components of the developed e-module. Then at the development stage, namely starting to create and compile teaching materials that are developed into good and validated e-modules. The following is an overview of the e-modules that have been developed which can be seen in the image below.

![Figure 1. Cover and introduction](image.png)

The cover on the e-module is designed with an attractive color combination. On this cover, there is a title, an agency logo, and a 2013 curriculum logo, an image that matches the contents of the e-module, and the identity of the author. A good cover can make people have an interest in seeing and reading the contents of the cover and a good cover of teaching materials must also be able to represent what is contained in it. This introductory part is the developed e-module structure. In this section, there are basic content and competencies, namely competencies for achieving expected student learning outcomes after using this e-module.
Figure 2. Parts of learning activities.

The e-module consists of several learning activities. In learning activities there are indicators of success and learning objectives, subject matter, material descriptions, practice questions, summaries, evaluations, answer keys, and bibliography. The development carried out in this e-module is the inclusion of learning model syntax and indicators of critical thinking in learning activities. In the material section, the author includes the guided inquiry model syntax, namely the orientation and indicators of critical thinking, namely information. This main material provides stimulation to students about the material to be studied. The stimulus in this section has also been integrated with ethnoscience. The material description contains an exploratory section containing videos of ethnoscience science and conceptual formulas containing questions related to ethnoscience videos. The exercises, summaries, and evaluations contained in the e-module aim to reinforce new concepts that students find. The next part, namely the answer key and bibliography is made so that students can learn independently.
Figure 3. Glossary, Author's Biodata, Back Cover

The glossary contained in this e-module aims to provide an explanation of physics terms and an explanation of the Minangkabau language contained in the e-module. The author's biography contains an introduction to the author's biography. This back cover contains a brief explanation of the advantages of the e-module being developed and also contains a moral message.

The validity of the e-module is one of the important indicators of validity to get a validated e-module with the appropriate indicators. The validation indicators are material substance, presentation feasibility, appearance feasibility, and language. The material feasibility component consists of three indicators, namely material accuracy, guided inquiry model syntax, and supporting material. The accuracy of the material will see whether the physics material contained in the e-module is correct. Guided inquiry model syntax, in the e-module, includes elements of the learning model, but whether the syntax of the model is correct both in terms of the correctness of the syntax used and in terms of syntax placement. In the third indicator, there is supporting material that can support the goals of making e-modules.

In the accuracy of the material, there are sub-indicators such as whether the material is based on facts, is it following the correct facts, principles, and concepts, does it increase students' ethnoscience knowledge, whether students carry out investigations to find similarities. The inquiry model syntax contained in the e-module starts from exploration activities which can contain videos, photos, or discourses that must be researched. The concept of formulation, from the investigations, carried out, students are directed to find their solutions to the problems contained in the e-module. Finally, some exercises and conclusions can reinforce new concepts that students find. The supporting material contained in the e-module can be in the form of illustrations, pictures, videos, and statements related to ethnoscience.

The presentation feasibility indicator consists of the suitability of the e-module title, the suitability of the material with the core competencies and basic competencies made, and whether the e-module design has been made well and clearly. The rules for making titles must be following the material, not more than 22 words, not using various types of fonts, using good and proportional font size, and having a color that contrasts with the background. The suitability of the core competencies and basic competencies includes learning objectives and learning achievement indicators. In the supporting section of the presentation, some questions are integrated with ethnoscience, training is also integrated with ethnoscience, author identity, bibliography, every media listed in the e-module always includes a bibliography. Completeness of presentation contains instructions for use, table of contents, page numbers, and glossary.
Display validity is discussed in the cover design and e-module design. This e-module design pays attention to the letters used, layout, color combinations, video, and image selection. The validity of language is an indicator of the correct use of language rules, the use of terms and symbols, the integration of the flow of thought, and the development of students.

Guided Inquiry Integrated Ethnoscience based on e-modules to improve students' critical thinking skills is validated by three validators who are experts in their fields. The three validators are AS, RM, and TS, they are lecturers from Universitas Negeri Padang. The validity component includes the validity of the material substance, presentation, appearance, and language. The results of the validator's assessment for each component of the e-module validity can see in Table 2.

Table 2. E-Module Validity Results.

| No  | Component             | Expert validator | Total | Category |
|-----|-----------------------|------------------|-------|----------|
|     |                       | AS | RM | TS |       |
| 1   | Material eligibility  | 0.87 | 0.69 | 0.96 | 0.84 | Valid |
| 2   | Serving eligibility   | 0.93 | 0.73 | 0.98 | 0.88 | Valid |
| 3   | Appearance eligibility| 0.86 | 0.77 | 1 | 0.88 | Valid |
| 4   | Language eligibility  | 0.86 | 0.66 | 0.93 | 0.82 | Valid |
|     | Average               | 0.85 |       |       |       | Valid |

Based on Table 2, it can see that the e-module validity average value of the validator is 0.85. The validation value of the material feasibility is 0.84 in the valid category, meaning that the material contained in the e-module is made by good and correct facts, principles, and concepts of physics. Presentation feasibility is assessed as 0.88 with the valid category, the order of presentation in the developed e-module starts with something light, such as starting with discussing culture that is related to the material, then entering physical concepts. The feasibility display is also valid with a value of 0.88, which means that the e-module display that is made is under the discussion in it and is also by the development of students as e-module users. The feasibility of language 0.82 is valid, the language used in the e-module is made in Indonesian which is good and correct, there is a glossary to explain the Minangkabau language, which not all students understand the meaning and terms of physics. Overall, this means that Guided Inquiry-based e-modules are integrated with Ethnoscience to enhance students' critical thinking invalid and well-used categories. Applicable in terms of material feasibility, presentation feasibility, appearance feasibility, and language eligibility.

4. Conclusion
This study uses the ADDIE model, the analysis stage is to find and get problems in the field. The next stage designs, at this stage the researcher compiles the appropriate learning material, namely Newton's law material about motion, work, and energy, as well as momentum and impulse. This development stage is carried out with e-module validation. The questionnaire analysis of the validators was carried out using the Aiken's V formula. The validity of the e-module by three validators can be concluded that the Guided Inquiry-based e-module integrated with Ethnoscience can fix students' critical thinking skills which are valid and can be used by students.

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