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Validity and Practicality of Discovery Learning E-Modules on environmental change material to Empower Critical Thinking Skills

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Abstract: Critical thinking ability is a way of thinking to determine the right decision or action by logically considering things related to information. Therefore, it is necessary to update what supports learning activities, such as updating the suitable media by utilizing technological sophistication. This study aims to determine the validity and practicality of the discover learning e-module on environmental changes to empower critical thinking skills. This research type uses the ADDIE model development (Analysis, Design, Development Implementation, Evaluation). This study is limited to testing the validity and practicality of the e-module. The instrument used is a validity and practicality questionnaire. Assessment of the results of the validity and practicality of the questionnaire was interpreted with a Likert scale. Based on data analysis, the results of the validity test by material experts, and media experts, obtained an average score of 89% and 92%, respectively, in the very good category. And on the test of education, practitioners by teachers and students obtained an average value of 91% and 88%, which fall into the very good category. Based on the validity test and practicality test, it can be concluded that the e-module developed is valid and practical for use in further research.

Keywords: E-Modules; Discovery Learning; Critical thinking skills;

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Introduction

Education is the primary key for the nation to advance and improve the condition of society. Education is a driving wheel that makes culture and habits change because education creates in every era of development. Technological developments in the digital era now occur in all lifelines, marking the start of the 21st century. Today, everyone can connect and share information with others worldwide without the limitations of space and time. Various changes in habits in the 21st century require human resources to have adequate abilities and competencies. More specifically, there is something new for students in education that is much more complex than in the previous era. Students are expected to study harder and be proactive in responding to global challenges (Diah Rusmala Dewi, 2019). Among the abilities that students must possess, critical thinking and being able to communicate with others effectively must be based on academic knowledge. Discussing the world of education, it is essential that students are expected to master specific skills or abilities according to the fields of interest to be successful in their lives, such as critical thinking, problem-solving, communication, and collaboration skills (Battelle for Kids, 2019).

The ability to think, which is the basis of other thinking skills, is the ability to think critically. (Kartimi, 2016). A directed and straightforward process is used in mental activities such as solving problems, making decisions, persuading, analyzing assumptions and conducting scientific research. So that students' critical

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thinking skills become the initial capital to explore more the knowledge gained and built by their thinking (Johnson, 2002). Critical thinking is a thinking activity by utilizing intellectual abilities to conduct investigations, make appropriate judgments and decisions, and implement them appropriately (Setiawan & Susilo, 2015)

Critical thinking is an essential ability that can be used to measure learning success in achieving competency standards (York et al., 2015) The importance of measuring critical thinking skills in Biology lessons is also a form of training in dealing with and solving problems in real life (Palm, 2008). In line with the concept of science learning which always puts forward critical thinking to understand every lesson that is very close to the real object. Biology is one of the sciences intended to prepare future students who are critical, creative, competitive, and able to make decisions and problem solve (Sudarmini et al., 2015)Based on the initial research that the researchers conducted at SMAN 15 Bandar Lampung, students' critical thinking skills in biology subjects on environmental change material were low, with a logit person score of -1.8 which was below the logit item 0.0, so further research was needed.

Lack of support for learning resources, the method used does not support student activity, and the media does not help learning activities, so students have difficulty understanding the material provided. Students need innovative learning materials or resources that can be used anywhere and anytime (Zhang et al., 2017)E-modules are one of the learning media that can be used in today's technological developments, where there are only differences in how to read them compared to print modules (Ummah et al., 2017). The characteristics of the E-module are the same as the print module because the aspects of the print module can be applied to the manufacture of the E-module (Priatna et al., 2019). The difference between the print module and the E-module is only physically visible, while the components contained in it are the same as the print module in general (Suantara et al., 2019). Smartphones are the impact of technological developments that are equipped with the Android operating system. Android is a system that bridges between E-Modules and users so that users can run available applications (Wiranda & Adri, 2020). Android can be used as learning support for students as the use of technology in education (Haka et al., 2021). Learning using the Android E-module is an effort so that learning can take place effectively and efficiently and has high appeal, especially in biology (Yunara Megadani et al., 2018). Therefore, the Android E-module should be developed with various approaches. Metacognition is needed to help students become someone who can think critically, especially at the high school level.

Biology as a subject has different characteristics; biological objects in the form of living things are a unique attraction that can attract students' attention and interest in studying it. Discovery learning is a learning model that can encourage student activity and independence to find their concepts and principles in learning. Discovery learning learning model is a learning model that facilitate students to experienced in finding the concept of a problem faced through discovery information with a series scientific activities facilitated by teachers (Suphi & Yaratan, 2016). E-Modul is a collaboration between print modules and technology that is very suitable for discovery learning because e-modules are suitable for active learning and are learning resources that match your needs. E-Module is a learning media designed to help students learn independently. Teaching media in the form of E-Module an expected to attract students' attention and interest so that they are motivated to learn; thus E-Modules are thought to be able to improve competence

Based on the background of the problem and the results of initial observations, the researchers developed an e-module on environmental change based on discovery learning to empower critical thinking skills.

Method

The type of research used is research and development (R&D) by applying the ADDIE development model. The selection of the ADDIE development model is by the procedure for developing the e-module teaching materials to be developed, simple and easy to understand, then provides the opportunity to evaluate and revise continuously in every stage it goes through. This is in line with the reasons (Cahyadi, 2019) that the ADDIE model development procedure is structured in a detailed and straightforward manner, suitable for developing teaching materials, and has specific objectives to be achieved by the learning products set. The ADDIE model consists of five stages: analysis, design, development, implementation, and evaluation.

Four validators carried out the e-module Feasibility Test Process in media validation with details, namely two material experts and two media experts, for practicality testing by one biology teacher and 35 students. This research is limited to testing the validity and practicality of the e-modul. The instrument used is a validity and practicality questionnaire. Categories of the validity and practicality questionnaire based on the Likert scale are shown in Table 1.

Table 1. Likert scale

Answer Options	Score
Not very good	1
Not good	2
Pretty good	3
Good	4
Very good	5

(Riduwan, 2010)

Data obtained from the results of validity and practicality questionnaires are then analyzed using the following Formula 1:

$$P = \frac{\sum x_i}{\sum x} \times 100\% \quad (1)$$

Information:
P = Percentage rating
$\sum x_i$ = Score given by expert validators
$\sum x$ = Maximum score
The obtaining percentage results are interpreted into several categories shown in Table 2.

Table 2. Likert scale interpretation

Precentage	Category
86 – 100	Very Good
72 – 85	Good
58 – 71	Pretty Good
44 – 57	Not Good
< 44	Not very good

(Riduwan, 2010)

In the development process, guided inquiry-based e-modules with virtual laboratories is valid and practical if they obtain a value with a minimum category of "Good".

Result and Discussion

The development of e-modules in this study is presented based on the analysis results of a preliminary study where educators are still confused about the Covid-19 pandemic. Educators only use textbooks at school and do not add interactive learning resources so that students are less active in the learning process. This, of course, relates to the ability to think critically of students. Based on the analysis of student needs, it is revealed that students need additional interactive learning resources to empower critical thinking. One of the learning media that can be developed is *E-module*.
The e-module developed is based on discovery learning models on environmental change materials arranged in an attractive design. Each topic has a different colour theme, and pictures support the material. The display of the developed e-module can be seen based on the viewed as folows:

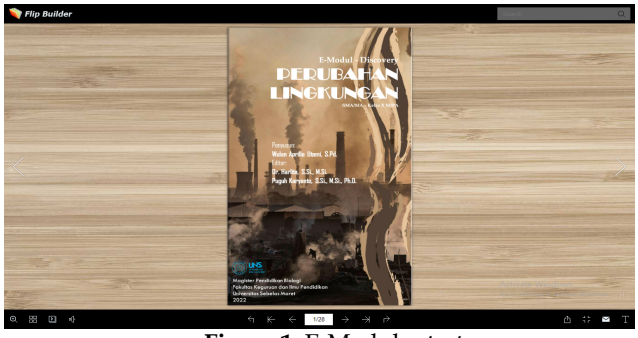
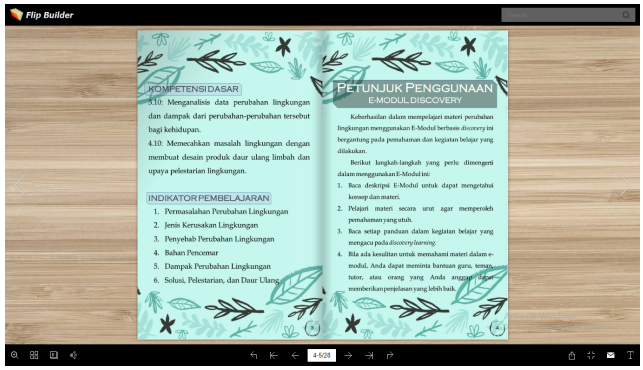


Figure 1. E-Module start

Figure 1 is the front page of the e-module that was developed, containing information on the author, editor, and title of the e-module.



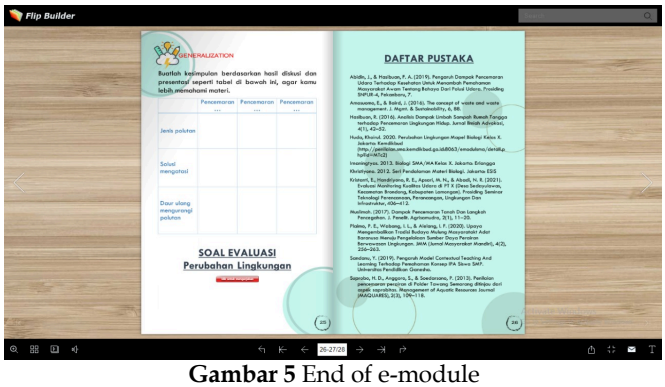
Gambar 2. Introduction to E-module

Gambar 3. Introduction to E-module

Figures 2 and 3 contain additional information from the developed e-module in the form of the essential competencies used, instructions for using e-modules and learning steps from discovery learning.

Gambar 4. Example of E-Module material

Figure 4 is the core part of the e-module, which was developed using discovery learning syntax and provides Student Worksheets. Then at the end of the e-module, an evaluation question is offered to students, and a bibliography for further information for students is presented in Figure 5



Gambar 5 End of e-module

In the development of e-modules pay attention to the feasibility of the e-module itself. The feasibility of the discovery learning-based environmental change E-module based on the results of the validation and practicality test seen from the assessment of the validator consisting of 4 people, namely media experts and material experts. In the practicality test 1 educator (Biology) and student responses. This is in accordance with (Nieveen, 1999) statement that the validity of a product is based on the assessment of experts. The validation results from material experts can be seen in Table 3.

Table 3. Validation of material expert

Aspect	Score	Material expert 1	Material Expert 2
Aspect of Material Truth	∑X	22	25
	∑Xi	25	25
	Percentage (%)	88	100
Average			94 (%)
Aspect	Score	Material expert 1	Material Expert 2
Language Aspect	∑X	21	24
	∑Xi	25	25
	Percentage (%)	84	96
Average			90 (%)
Overall average			92 (%)

Based on the results of the material expert validation that has been carried out, the results on material truth show that the average score of material experts is 94%, and the linguistic aspect gets a score of 90%. So that the overall average results are 92% and fall into the very good category. The results of the validity of the e-module developed based on Table 2 show that the e-module made according to the standard rules should be so that the e-module can meet the criteria for good teaching materials. This is by (Sudjana, 2009) statement that the instrument developed must be in accordance with its objectives. This means that the instrument is said to be good for supporting the content of learning. These results also indicate that the components are complete to facilitate student involvement in the learning process. The developed e-module is based on the discovery learning syntax, namely discovery learning. Then when viewed from the aspect of the language used in the preparation of the e-module, it is straightforward and easy to understand. The use of good sentences can increase students' interest in learning (M et al., 2012)). The material packaged in this e-module is valid with several revisions based on data analysis. At the same time, the results of media expert validation are presented in Table 4.

Table 4. Validation of media expert

Aspect	Score	Media expert 1	Media Expert 2
Eligibility Aspect	∑X	63	70
	∑Xi	75	75
	Percentage (%)	84	93
Average		89%	

The overall average result is 89% and falls into the very good category based on the data presented. The selection of objects, colours, and arrangement of places in the e-module was considered good by media experts. The feasibility of e-modules shows that students can use e-modules as teaching materials that provide a new and not dull learning experience because the presentation of material that is different from other teaching materials is more exciting and interactive. The assessment of teaching material is said to be valid according to (Wulansari et al., 2018) if it meets the criteria, namely: (1) the validator gives an assessment of being classified as good or very good, (2) the validator chooses an option suitable for use without revision or suitable for use with revision (3) indicators/descriptors contained in the validation sheet of teaching materials that have been developed by taking into account the aspects that must be observed in determining the validation of teaching materials, namely the material expert validation sheet and the media expert validation sheet. Based on the validation results from the four lecturers, it was said to be Valid and, of course, underwent several revisions until the results were obtained. Meanwhile, the results of the e-module practicality test conducted by educators are shown in Table 5.

Table 5. Validation of educational practitioners (Teacher)

Aspect	Scores	Practitioners
Material	∑X	22
	∑Xi	25
	Presentase (%)	88
Media	∑X	24
	∑Xi	25
	Percentage (%)	96
Compatibility Media with Material	∑X	22
	∑Xi	25
	Percentage (%)	88
Average		91%

Table 5 shows the average score by education practitioners at 91%. Aspects assessed by practitioners include the content of the material, the media, and the suitability of the media with the material. The values obtained fall into the very good category in line with these results. Furthermore, the practicality test of students is carried out by a group of students who use the e-module on environmental change. The results of the practicality test can be seen in Table 6.

Table 6. Validation of educational practitioners (Student)

Aspect	Scores	Practitioners
Display Aspect	∑X	1142
	∑Xi	1296
	Percentage (%)	88
Aspects of Material Presentation	∑X	2133
	∑Xi	2448
	Percentage (%)	87
Benefit Aspect	∑X	511
	∑Xi	576
	Percentage (%)	89
Average		88

Based on the student practicality test results above, the test response reached an overall average of 88%. In the display aspect, the percentage obtained is 88%, in the material presentation aspect 87%, and 84% in the e-module benefits aspect and falls into the very good category. The validity and practicality tests that have been carried out obtain an average category of very good. It is declared valid and practical to be used in further research.

The achievement of the e-module learning media's effectiveness is that the media also acts as a medium and as a learning resource. This media has advantages in terms of visual appeal and can present learning material in several forms of presentation, such as text, images, and videos. This makes it easier for students to understand learning material, increases student motivation to participate in learning and reduces boredom while studying (Wijayanti et al., 2016). In line with the research of (Nurhidayah et al., 2021), technology's ability to present information visually is essential in biology learning. Good pictures, animations, and an interactive environment can make it easier to understand the learning objectives. Students quickly understand the material presented in the E-module with the supporting features, so student learning outcomes have increased (Yulaika et al., 2020). Therefore, discovery learning-based e-modules are more attractive to students because they have an attractive appearance.

Conclusion

Based on the research that has been done, it can be said that the e-module on environmental change based on the discovery learning model is valid and practical. Suggestions obtained from expert validators, teachers, and students can improve the quality of the developed e-modules to be suitable for use in the learning process.

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