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Development of Contextual Based Electronic Global Warming Modules using Flipbook Applications as Physics Learning Media in High Schools

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A B S T R A C T

This study aims to produce physics learning media in high schools in the form of the development of contextual based electronic global warming modules using a valid, practical and effective flipbook application. This type of research is research and development using the ADDIE model (Analysis, Design, Development, Implementation and Evaluate). The field trial design used was One Group Pretest-Posttest Design. The development of contextual based electronic global warming modules using the flipbook application has passed the validation test stage with an average percentage of material experts at 88.42% with a very valid category and an average percentage of media experts at 85.63% with a very valid category. Practicality test by the teacher obtained an average percentage score of 85.56% with very practical criteria and by students obtained an average percentage score of 91.33% with a very practical category. Improved learning outcomes using e-modules and without e-modules (the results of last year's tests) are included in the increased category. It can be concluded that the use of contextual-based electronic modules using the flipbook application in learning can improve student physics learning outcomes.

1. Introduction

The use of media in the learning process is very necessary because it can arouse new desires and interests, generate motivation and stimulation of learning activities, and even bring psychological influences on students. In accordance with the results of research Miftahul (2019) states that the use of learning media can improve students' creative thinking abilities. Besides that Maulida et al. (2019) also stated the use of interactive multimedia can increase students' learning

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motivation. An educator must be able to design learning media so that students are motivated to learn. One of these learning media can be done by developing teaching materials. According to Widyaningrum et al. (2013) that in improving the quality of the learning process in schools can be done, one of which is the development of teaching materials.

While in the field it is often found that educators in learning only use teaching materials (printed books) that are widely available in the market and students rely solely on printed books provided by schools. That, too, the book is not sufficient because many are damaged and missing, the presentation of material that is not contextual, and the evaluation is not in accordance with the learning objectives to be achieved. As stated by Sang Putu Sri Jaya (2012), that educators only use a book as the only teaching material (printed book) whose presentation content is not well-structured, packaging is less attractive, abstract, and complicated for students to understand.

Widyaningrum et al (2013), educators still use many learning resources available in the market that are not in accordance with the conditions and potential of the school and the characteristics of students. Tri Anita Nur Hasanah (2017), said 61% of students relied on textbooks and 71% of students said the books were less interesting and difficult to understand. It was found in schools that there was no match between learning material between books provided by the school and basic competencies, the book was more cognitive, less contextual, and was no longer suitable for use because it had been damaged (Reni Marlina et al, 2015). The textbook used by educators in learning that does not provide examples of the application of material in a real-world context and the language is difficult to understand (Gigih Adrian Said et al, 2015)

Yuliana, et al (2017) found that the content of the material contained in the existing textbooks was general or not in accordance with the students' environmental conditions, and did not provide examples (pictures / explanations) that were appropriate to the environment around the students, the textbooks were less attractive, not easy to understand and the examples presented in the book are not relevant in the lives of students, do not involve students interacting directly, and direct exercises / practices are not well planned so as to make students feel difficult in associating new knowledge with old knowledge that is they have got it. Rai Sujanem et al (2009) revealed that the packaging of Physics teaching materials has so far been linear in nature, that is, teaching material that only presents concepts and principles, examples of problems and solutions, and practice questions. Teaching materials are less associated with real problems that exist around students such as energy crisis problems, the greenhouse effect, problems caused by lightning, problems of building fires due to zippers, problems of high voltage power lines (sutet), and so on.

One of the teaching materials that is designed systematically, interestingly and contextually so that it is easy to learn independently is a module. Teaching materials are all forms of materials used to assist educators in carrying out

teaching and learning activities one of which is a module (Tri Anita Nur Hasanah, 2017).
The module is a teaching material that contains relatively short and specific contents that are arranged to achieve the learning objectives with the principle of independent learning (Lasmiyati and Idris Harta, 2014). Modules are a set of teaching materials that are presented systematically so that users can learn with or without a facilitator / teacher (Septian Ari Kususa et al, 2017). Modules are learning tools or tools that contain material, methods, limitations, and ways of evaluating that are designed systematically and attractively to achieve the competencies expected according to their level of complexity (MONE, 2008).

According to Alfi Anafidah et al (2017), the use of modules in contextual-based physics learning can improve students' critical thinking skills. Gigih Adrian Said et al (2015), Sang Putu Sri Jaya (2012), Septian Ari Kususa et al (2017) stated that the use of contextual-based modules can improve students' physics learning outcomes. Rai Sujanem et al (2009) the use of interactive, contextual physics based web modules is very effective in learning.

Besides having several advantages, the module also has several disadvantages. One of the weaknesses of the module is that it is monotonous and boring (Lasmiyati and Idris Harta, 2014). To overcome this problem is to utilize the development of information and communication technology in learning. Technology is used as an innovative learning media that is believed to be able to keep up with the times (Isma Ramadhani Lubis, Jaslin Ikhsan, 2015). With advances in technology and communication, education that was conventional in nature has shifted towards information technology-based education (Lilik Sufiyah et al, 2015). Tools or modules for independent learning in the era of technological advances are needed in the learning process (Adhin Setyo Winarko et al, 2013). The 2013 curriculum for high schools also requires learning that utilizes technology. In modern education lecturers / educators are required to be able to integrate ICT in the learning process (I M Suarsana, G.A. Mahayukti, 2013). To reduce students' boredom in learning with modules, the modules need to be combined with electronic media known as E-Modules (Edi Wibowo et al, 2018).

The electronic module known as E-Module is made based on the printed module format in the form of Microsoft Word files and then converted in PDF form then using the desired application with the help of laptops and computers. According to Yeni Prasetiyowati et al (2015), electronic modules are independent teaching materials that are arranged systematically into the smallest learning to achieve certain learning objectives that are presented in electronic form that is self instruction, self contained, stand alone, and user friendly containing one material learning. Electronic module is a form of presentation of independent learning materials that are arranged systematically into a particular learning unit, which is presented in an electronic format, where each learning activity in it is linked by a link as a navigation that makes students more interactive with the program, equipped with presentation of video tutorials, animations and audio to enrich learning experiences (DG of Primary and Secondary Education, 2017).

The application of the use of electronic modules can condition learning activities that are better planned, independent, complete, and the results (outputs) are clear and the teacher will be easier to carry out learning and students are easy to learn (Purwaningtyas et al, 2017). Technology-based learning can save time and students are also more independent and actively involved so as to create more interesting learning in the classroom (Lilik Sufiyah, 2015). Electronic modules can save the use of paper that continues to be produced to print learning books (Siti Ghaliyah et al, 2015). This is in accordance with the learning objectives of the 2013 XI high school physics class global warming material that students can analyze the solution to the effects of global warming, one of which saves the use of paper so that logging is not rampant by unscrupulous individuals. The material for global warming is on the basic competencies (KD in class XI namely KD 3.12 and 4.12.

Based on a questionnaire given to 7 physics educators (teachers) in class XI high school in the Kampar regency, it was found that 57% of educators / teachers stated that students were less active in learning about global warming. 71.4% of teachers / educators rarely use electronic media in presenting global warming materials. 85.71% of teachers / educators use books as their only source of learning. 57% of teachers stated that students were less interested in reading textbooks / print especially on global warming material. 57% of educators state that the text / print books used are incomplete, providing examples of the application of material in the real-world context of students. 57% of educators stated that the text / print books used in the presentation of the material were not understood by students. 85.71% of educators stated that media or electronic books in revolution 4.0 were urgently needed which suggested minimizing the use of paper. 100% of the test results obtained by students on the subject of global warming achieve completeness below 75%.

Global warming material is one of the abstract and complex learning materials and is a worldwide problem so that in learning requires media. While the syllabus demands learning activities for BC 3.12 and 4.12 so that students observe shows through articles / photos / videos about the effects of global warming supported by information from various sources, human activities that cause various impacts of global warming, the greenhouse effect, and climate change.

Based on the description above, the researcher conducted a research by developing a physics learning module with the research title: "Development of Contextual Based Electronic Global Warming Module using the flipbook application as a Physics Learning Media in High School."

2. Methodology

Development procedures are systematic steps taken by researchers when making products. The development procedure in this study uses the ADDIE model (Analize, Design, Development, Implementation, Evaluation). The selection of the ADDIE model is well suited to the types of research and development that

produce products in the form of modules. As stated by I Made Tegeh et al (2014) that this model has five steps or stages that are easily understood and implemented to develop development products such as textbooks, learning modules, instructional videos, multimedia and so on. The stages of the ADDIE model can be seen in Figure 1

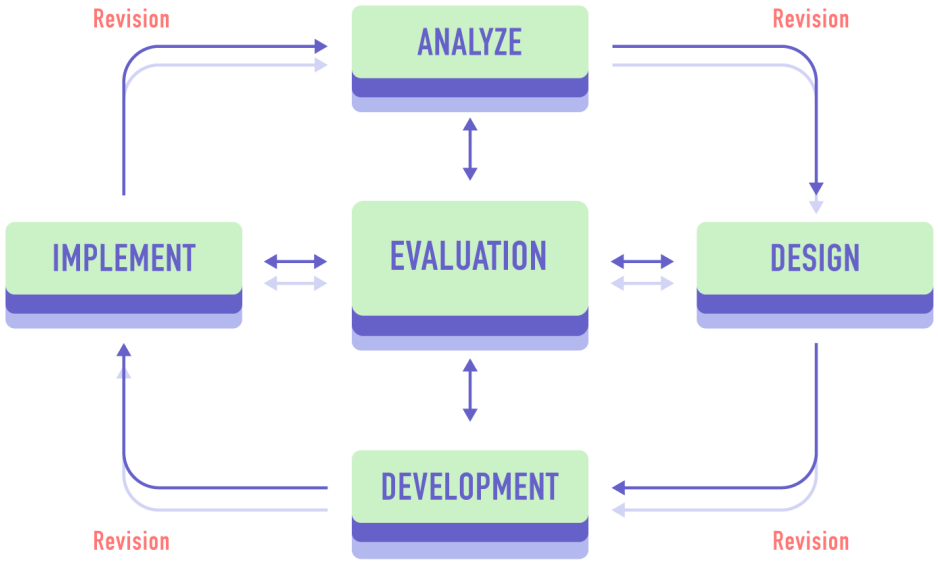

Figure 1. Stages of the ADDIE model (I Made Tegeh, 2014)

Based on the sequence of steps or stages of research and development of the ADDIE model, a development plan can be prepared in this study. The research steps that have been carried out can be described as follows;

a. Analysis

This stage of analysis includes the following activities; 1). distributing e-module needs questionnaires to class XI physics teachers in Kampar Regency High School, material analysis, and Syllabus analysis. Then an evaluation of the analysis of the three activities was carried out and it was found that one of the appropriate types of teaching materials was an electronic module using a contextual approach. So that the electronic module display is more attractive or not monotonous, use flipbook applications (back and forth) such as flipping through books / modules. The results of this evaluation are the basis for the development of contextual electronic module-based global warming using the flipbook application.

b. Design

The design phase is based on things obtained from the analysis phase. Activities undertaken in the design phase include;

a. Electronic module design

1). Determine the electronic module title
2). Identifying basic competency, learning material, GPA and assessment (RPP)
3). Drafting the module.
b. Designing research instruments for media experts, material experts, and the response of educators and students as module users.

In making research instruments based on the instrument grille. Instrument lattice is a guide or guide in formulating instrument questions derived from evaluation variables to be observed. The description of the instrument lattice for material experts, media, and students can be seen in tables 1, 2 and 3 below

1) Lattice Questionnaire Instrument Validation By Material Expert

Table 1. Lattice Questionnaire Instrument Validation by Material Expert

No	Assessment Components	Indicator	No Item Statement
1	Material Substance	Truth	1
		Depth	2
		Present	3
		Legibility	4
2	Learning Design	Title	5
		CC and KD	6
		Indicator	7
		Theory	8
		Exercise / evaluation	9
		Composer	10
		Reference	11
3	Contextual Aspects	Contextual Nature	12
		Contextual Components	13-19

(Adapted from the Ministry of National Education, 2008)

Based on Table 1, it can be explained that the material expert validation instrument consists of three assessment components, namely the substance of the material, learning design and contextual aspects. Component assessment of material substance consists of 4 indicators namely truth, depth, present and readability, each of which has one statement. Learning design assessment component consists of 7 indicators namely title, IC and BC, GPA, material, training / evaluation, compiler and reference, each of which has one statement. While the component of the contextual assessment component consists of 2 indicators, namely the nature of the contextual (1 statement) and the contextual component (7 statements). The total number of statements is 19 items.

2) Lattice Questionnaire Instruments Validation By Media Experts

Table 2. Lattice Questionnaire Instrument Validation by Media Experts

No	Assessment Components	Indicator	No Item Statement
1	Visual Communication	Navigation	1

	Display	Typography	2
		Media	3,4,5
		Color	6
		Animation	7
		Layout	8
2	Software Utilization	Interactive	9
		Supporting Software	10
		Authenticity	11
3	The substance of the contents of e-modules	Characteristics of e-modules	12, 13,14,15
		The e-module component	16

(Adapted from the Ministry of National Education, 2008)

Based on Table 2 above, it can be described that the assessment component for media expert instruments consists of three namely visual communication display, software utilization, and e-module substance. Components of visual communication display assessment consists of 6 indicators, namely navigation (1 statement), typography (1 statement), Media (3 statements: picture, sound, video), color (1 statement), animation (1 statement), layout (1 statement). The component of software utilization assessment consists of 3 indicators, namely interactive (1 statement), supporting software (1 statement) and authenticity (1 statement). The substance of the contents of the e-module module consists of 2 indicators namely e-module characteristics (4 statements) and e-module components (1 statement). The total number of statements is 16 items.

3) Lattice Instrument Questionnaire Response Students

Table 3. Lattice Instrument Questionnaire Responses of Students

No	Assessment Components	Indicator	Sub Indicator	No Item Statement
1	Cognitive Response	Perception	Students' perception of the sentence structure in the e-module	1
			Students' perception on the selection of type and size of letters, color composition	2,3
			Students' perceptions of the material presented	4
			Students' perceptions of the questions presented	5
			Students' perception of the use of e-modules in the classroom	6
2	Affective	Attitude	Student interest in the images	7,8

	response		/ animations and videos that are presented	
			Student interest in the overall appearance of the e-module	9,10
3	Conative response	Actions related to the object of attitude	The tendency of students towards the use of e-modules	11,12

(adapted from Desti Puspita Sari et al, 2018)

Based on Table 3 there are three components of assessment for students' responses, namely cognitive response, affective response and conative response. The component of cognitive response assessment consists of one indicator, namely perception (6 statements). The affective response assessment component consists of one indicator, attitude (4 statements). And the component of conative response assessment consists of one indicator, namely actions related to the attitude object (2 statements). The total number of statements for students' responses was 12 points. While the number of statements for the teacher / teacher response questionnaire to the electronic module was 18 statements adapted from Sri Indra Wahyuni et al (2018).

c. Development

The development phase includes the manufacturing of electronic modules consisting of;

1). Editing by drafting a module in the form of a microsoft publisher file is converted to pdf and continued to import the pdf file into the kvisoft flipbook maker application to produce an electronic module. To make the e-module look more attractive enter images, animations, music and videos using the kvisoft flipbook maker application.

2). Validate electronic modules to media experts and material experts. The validator consisted of four material experts and four media experts from the Postgraduate Physics Education lecturer at Riau State University.

After being validated by experts, researchers measure the results of the feasibility assessment or the validity of electronic modules in terms of material and media. The validation sheet assessment is in the form of a Likert scale with a score of 1-5. The following categories of Likert scale assessments by validators are shown in Table 4

Table 4. Categories of Media and Material Validation Assessments

Rating Score	Rating Score
5	SS: Very agree
4	S: Agree
3	KS: Not agree
2	TS: Disagree

1	STS: Strongly Disagree

(Sugiyono, 2013)

From Table 4 the Likert scale rating categories above will be calculated the average percentage of each component using the following formula:

$$P = \frac{\sum \chi}{\sum \chi i} \times 100\%$$

Information:
P = Percentage score (rounded)
$\sum \chi$ = Number of respondents' answers in one item
$\sum \chi_i$ = The ideal number of scores in one item

Giving meaning and decision making about the quality of e-module products will use a conversion rate of achievement with a scale of 5 as in Table 5 below:

Table 5. Validity criteria questionnaire data assessment of media and material validators

Persentase	Criteria
$80 < P \leq 100$	Very feasible / very valid / does not need to be revised
$60 < P \leq 80$	Eligible / valid / no revision needed
$40 < P \leq 60$	Inadequate / less valid / needs to be revised
$20 < P \leq 40$	Ineligible / invalid / needs revision
$P \leq 20$	Very improper / very invalid / needs revision

(Modified from Suharsimi Arikunto, 2010)

Next the researchers made improvements to the electronic module according to the advice of the material experts and media experts. Contextual-based electronic global warming module that has been repaired according to the advice of material and media experts, the e-module is revalidated so that it is declared valid or suitable for use in the field without any revisions.

d. Implementation

After the electronic module has been made and is declared feasible by experts, the electronic module is implemented or implemented in a small scale trial. Then the researcher distributes the questionnaire responses of educators and students to the practicality of the electronic modules that have been used.

Evaluation questionnaire responses of educators and students based on the Likert scale 1-5 can be seen in Table 6 below:

Table 6. Categories of Evaluation of Student Responses

Rating Score	Information
5	SS: Very agree
4	S: Agree
3	KS: Not agree

2	TS: Disagree
1	STS: Strongly Disagree

(Sugiyono, 2013)

The results of the assessment of the responses of educators and students are calculated on average by the following formula:

$$P = \frac{\sum \chi}{\sum \chi i} \times 100\%$$

Information:
P = Percentage score (rounded)
$\sum \chi$ = Number of respondents' answers in one item
$\sum \chi_i$ = The ideal number of scores in one item

The results of the average percentage score from the questionnaire responses of educators and students that have been obtained are then converted into qualitative data to determine the practicality criteria for using e-modules which can be seen in Table 7 below.

Table 7. Percentage Criteria for Product Practicality

Persentase	**Information**
$80 < P \leq 100$	Very practical
$60 < P \leq 80$	Practical
$40 < P \leq 60$	Practical enough
$20 < P \leq 40$	Not Practical
$P \leq 20$	Very Not Practical

(Modified from Akbar, 2013)

Researchers evaluate the responses of educators and students as users of electronic modules. If the results are declared practical in learning, a large-scale test is carried out.

e. Evaluation

At this stage, the researcher makes a final revision of the e-module that is developed based on the input obtained from the student response questionnaire. It is intended that the e-module developed is truly appropriate and can be used by the wider school.

The study design was carried out using the One Group Pretest-Posttest Design as shown in Figure 2 below:

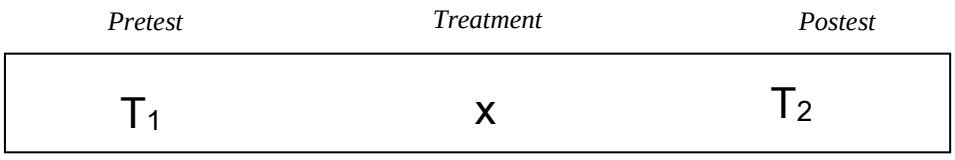

Figure 2. One Group Pretest-Posttest Design

Where: T1 = Test before treatment (Pretest)
X = Treatment using e-modules
T2 = Post-Test

Figure 2 explains that the pretest and posttest were carried out in the same class. Pretest is done before implementing contextual based electronic global warming module using flipbook application. Whereas the posttest was carried out after applying the contextual based electronic global warming module. The results of this pretest as a comparison of learning outcomes between before and after applying e-modules in learning, in this case using the N-gain test

Another way to see an increase in student learning outcomes is the result of reducing posttest or repetition of applying e-modules to posttest or repetition without applying e-modules (posttest data taken from previous year's student learning outcomes on global warming material) with the equation

$$\Delta X = X2 - X1$$

Information :
ΔX = improvement of cognitive learning outcomes
X2 = posttest or test by applying e-module
X1 = posttest or test without applying e-module

Cognitive learning outcomes of students are said to increase with the following criteria:

$\Delta X > 0$ = increase
$\Delta X = 0$ = does not increase
$\Delta X < 0$ = decreases

Contextual-based electronic global warming modules using the flipbook application can be said to be effective if obtained $\Delta X > 0$ and $g > 0.3$ Before pretest and posttest the questions are tested on students who have studied global warming material. Then the test results are processed using the Anates V4 application to determine the validity and reliability of the questions.

3. Results and Discussion

The results of this study are physics learning media products for high schools in the form of contextual-based electronic global warming modules using the flipbook application. The following is the final display of the global warming electronic module developed:

Figure 3. Display of the electronic module front cover

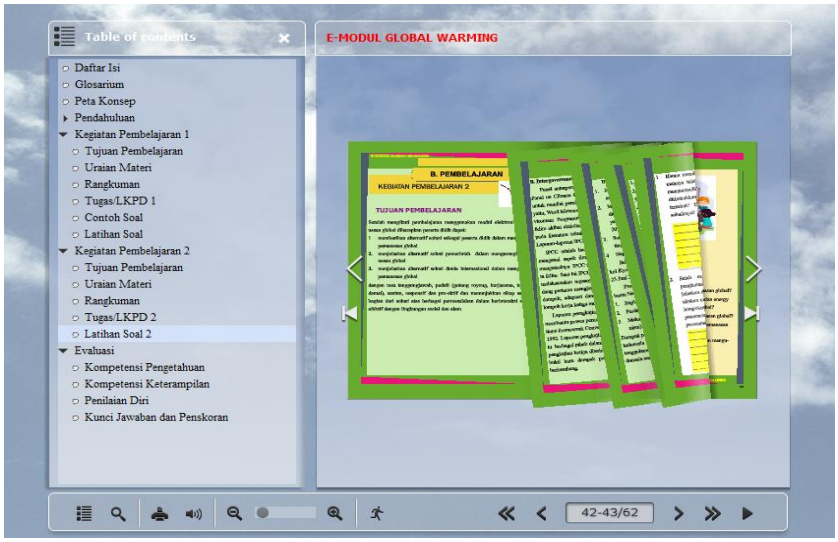

Figure 4. Display navigation menu

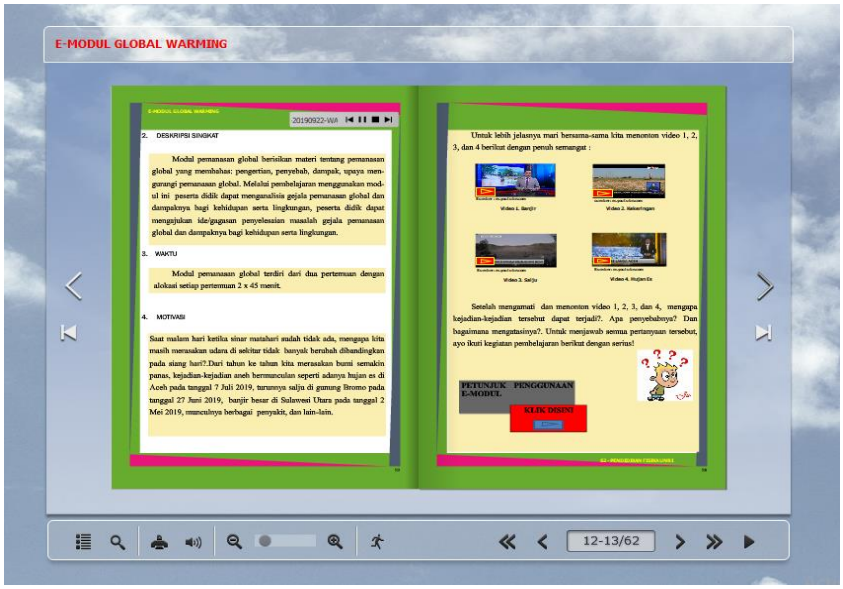

Figure 5. Display of an introductory part of the electronic module

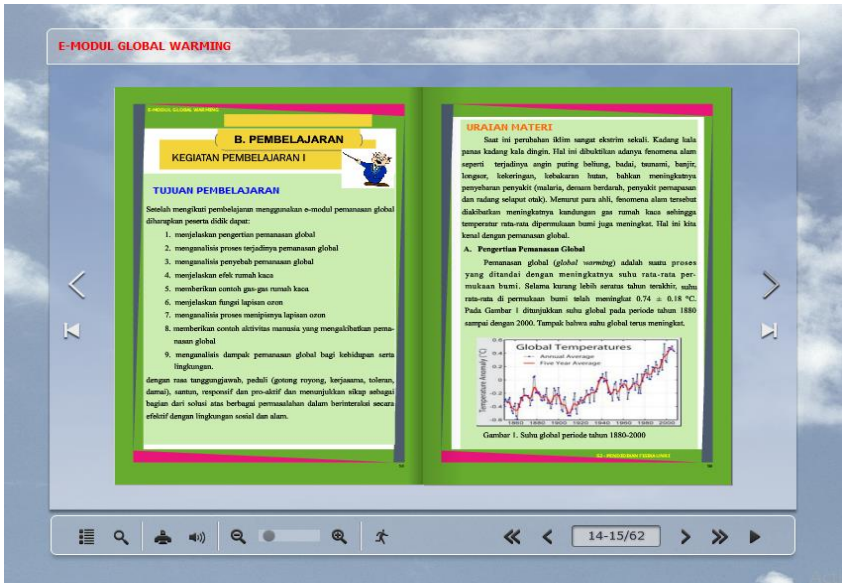

Figure 6. Display of learning activities

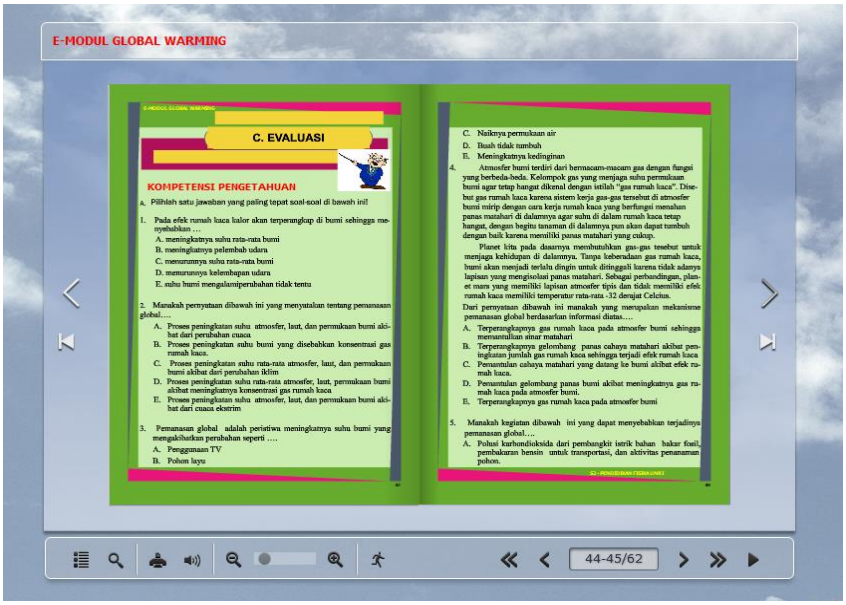

Figure 7. Display evaluation on the electronic module

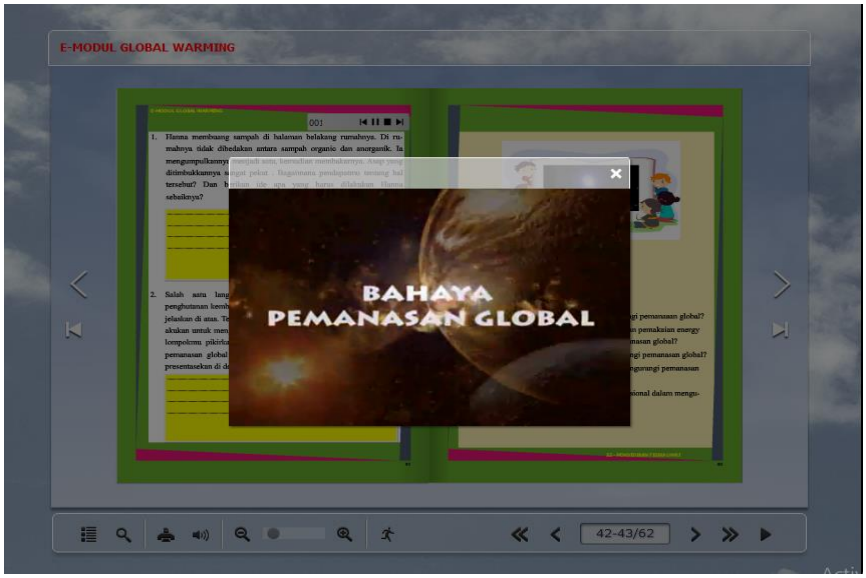

Figure 8. Video views

The results of the validation of the global warming electronic module by material experts showed an average percentage of 88.42% with the category of very feasible / very valid for all components of the assessment. Below is a picture of the results of the material expert validation for each component of the e-module assessment.

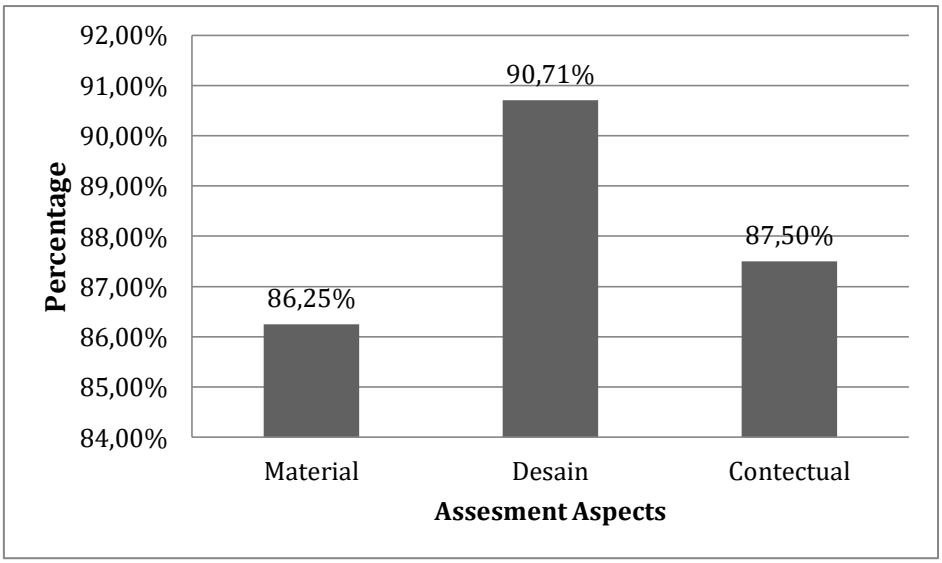

Figure 9. Results of Expert Material Assessment

Based on Figure 9 above, it can be explained that the substance substance components obtained an average percentage of 86.25% with the criteria "very feasible". learning design components obtained 90.71% with the criteria "very feasible". Contextual aspects obtained an average percentage of 87.50% with the criteria "very feasible".

The results of the validation of the global warming electronic module by media experts showed an average percentage of 85.63% with the category of very feasible / very valid for all components of the assessment. Below is a picture of the results of the media expert validation for each component of the e-module assessment.

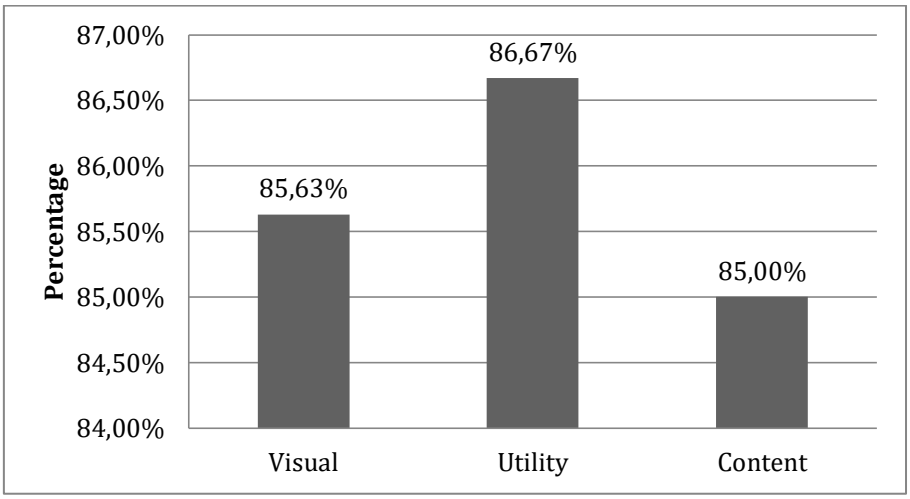

Figure 10. Results of the Media Expert Rating

Based on Figure 10 above, it can be explained that the visual communication display component obtained an average percentage of 85.63% with the criteria "very feasible". The component of software utilization is obtained 86.67% with the criteria "very feasible". The content component of the e-module content obtained an average percentage of 85.00% with the criteria of "very feasible".

Practicality test consisting of 4 physics subject teachers obtained the following results:

Table 8. Teacher's Response to E-Modules

No	Respondent (Teacher)	Score Percentage (%)
1	Praktisi I	88,89
2	Praktisi II	83,33
3	Praktisi III	86,67
4	Praktisi IV	83,33
	Total	342,22
	Average	85,56

Based on Table 8 above, it can be seen that the results of the assessment of teacher responses to the development of e-modules using the flipbook application obtained an average percentage score of 85.56% with the criterion "very practical" used in learning activities.

Practicality test for small scale consisting of 15 students who have studied global warming material (class XII SMAN 1 Tapung) obtained an average percentage

score of 91.33% with a very practical category. Whereas the field test was carried out in class XI MIA 1 SMAN 1 Tapung which amounted to 34 students and the percentage of the average score was 93.33% with a very practical category.

Improved learning outcomes seen from the pretest and posttest students of class XI MIA 1 SMAN 1 Tapung. Student learning outcomes on the subject of global warming before the use of e-modules obtained an average value (mean) pretest of 40.82 with a standard deviation (standard deviation) of 11.389. As for the learning outcomes of students after the use of e-modules obtained an average (mean) posttest value of 80.00 with a standard deviation (standard deviation) of 10.138. Then it can be concluded that the average value of students has increased by 39.18 from the average value before the use of e-modules that is, 40.82 to 80.00 after using e-modules in learning activities.

The pretest and posttest scores of students' physics learning outcomes using the N-Gain test results are 0.66 where $0.7 > 0.66 \geq 0.3$, the increase in physics learning outcomes of students between before using the e-module and after using the e-module The module is stated in the medium category. While the results of the posttest reduction applying e-modules with posttest or repetition without applying e-modules (posttest data taken from the learning outcomes of students of the previous year on global warming material) were obtained $\Delta X > 0$. Then it can be concluded, that the use of e-modules of global warming contextual based using flipbook applications said to be "effective" can help students improve learning outcomes in physics.

4. Conclusion

Based on research that has been conducted on the development of hdules using the flipbook application, it can be concluded that the contextual electronic-based global warming modules using the flipbook application is declared to be feasible, practical and effective in the physics learning process at the high school level. Suggestions that can be submitted by researchers based on the results of this study, so that contextual based global warming electronic modules using the flipbook application are made online so that it makes it easier for users to access them. In addition to saving time, the evaluation in the e-module should be designed so that students can work at home and immediately know the value obtained and the teacher can know the value of their students.

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