Development of e-module using flip pdf professional on temperature and heat material

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Abstract. Research and development are intended to determine the feasibility and the responses of students and educators to the development of e-modules using flip pdf professional on temperature and heat material. The method used was adopted from Borg & Gall development model. The validation product of e-modules using flip pdf professional as learning media have fulfilled very good criteria with a percentage of material expert evaluations of 92.08%, media experts of 89.1%, and religious experts of 90%. While the responses of students and educators obtained very good criteria with percentage for small group trials of 88.15%, field trials of 88.03%, and educator response tests of 85.96%. Based on the results, the development of e-module using flip pdf professional can be used as a learning media.

1. Introduction

The development of information and communication technology at this time has been very rapid.[1] The progress of information and communication technology has a great impact on human life[2] and plays an important role in various fields. One of them is in the field of education. The use of technology in education helps to learn activities in developing, processing and presenting the material. In addition, it also serves to create a learning atmosphere that can attract students' interest and learning motivation.[3] The use of technology in the learning process must be adapted to the educational needs in order to achieve goals in learning.

The use of technology in the learning process is more directed at the use of media. This has an impact on the presentation of teaching materials that are used as sources of learning information.[4] Currently, the use of teaching materials in the form of print media is gradually turning to digital media (electronics). Therefore, it does not rule out the possibility that teachers are required to be able to integrate information and communication technology in the learning process so that it is more interesting and can eliminate the impression of being stiff in teaching.

Learning media become an important thing in learning.[5] Learning media is a means of communication that serves to convey the contents of learning messages to students.[6] Interesting learning media will provide a positive stimulus to students to pay attention to the material delivered so that the objectives of the material more easily conveyed to students and can help students understand the learning material. The lack of use of learning media in schools can inhibit learning activities and
can affect student learning outcomes. Also, the media used in learning should be interesting and effective so that it can influence the optimization of the achievement of learning objectives.

The use and development of learning media are divided into several, namely print-based media, visual-based media, audio-visual based media, and computer-based media. Learning media consist of sophisticated media presentations are media that can complete five forms of information, namely symbols, sounds, and movements. The media which includes the five forms of information are live images (films) and television (video).[7]

In the physics learning process, it requires the activities of students in the process of thinking and seeking an understanding of objects, analyzing and constructing that knowledge so that new knowledge is formed in the individual.[8] Physics is very important to learn because it is closely related to everyday life. One of them is temperature and heat material. This material contains changes in temperature, heat and heat transfer which are a little difficult to learn because they are abstract in nature, which can lead to different thoughts. In the process of learning physics in school, the interaction between students, educators and subject matter is needed, so that educators must be motivated to use their skills in processing teaching materials[9], namely by providing interesting and efficient learning resources as learning media.

One important thing that needs to be considered in supporting physics learning is that the delivery of concepts can be better, namely the availability of learning support, one of which is learning media. Learning media that can facilitate students in observing physical phenomena are by observing images, animations, simulations, and learning videos. One of the media that meets these criteria as learning media is an electronic module (e-module).

Technology in schools such as computer devices to support learning resources has not been fully utilized. This is also supported based on pre-research in several Senior High Schools/ Islamic Senior High Schools in Bandar Lampung by interviewing teachers and distributing questionnaires to class XI students. Based on pre-research results, facilities in schools have not been used optimally, teachers rarely use interactive media, and students find it difficult to understand the material because of the lack of use of interesting learning media such as audio-visual media.

E-module is a form of independent teaching material that is arranged systematically with language that is easily understood into the smallest learning unit, presented in an electronic format in which there are animations, audio, videos that make users more interactive with the program.[10] Characteristics of modules electronics as above need to be owned by students because electronic modules have the potential to increase student motivation.[11] One program that can be used to create learning media in the form of an e-module is Flip PDF Professional.

The flip pdf professional is different from the other pdf. It can combine the material in the form of pdf files with images, animations and learning videos that are still rarely used in physics learning

2. Research Methods

The method used in this study is the method of research and development (research and development). The purpose of this study is to produce e-module products using flip pdf professional on temperature and heat material.

The e-module development model used in this study is the development model of Borg and Gall, where the development model consists of ten steps, which include: 1) Potential and problems, 2) Data collection, 3) Product design, 4) Design validation, 5) Design revision, 6) Product testing, 7) Product revision, 8) Usage testing, 9) Product revision, 10) Mass production.[12]

Several stages of development above, the researcher limits the research steps to the seventh stage, namely the product revision stage, similar to previous research[13][14]
The instruments used in this study were non-test instruments in the form of media expert validation sheets, material expert validation sheets, religious expert validation sheets, questionnaire responses for students and educators. A research instrument is a tool used to collect research data.[15] Instruments in this study used a Likert scale of 1-5 with the highest score of 5 and the lowest score of 1. Likert scale is used to measure attitudes, opinions, perceptions of a person or group about social events or symptoms.[16]

### Table 1. The scale of media assessment criteria

| Category       | Score |
|----------------|-------|
| Very good      | 5     |
| Good           | 4     |
| Enough         | 3     |
| Less           | 2     |
| Very Less      | 1     |

Data analysis was performed by calculating the percentage of each aspect with the Likert scale formula.[1]

\[
X_i = \frac{\sum S}{S_{max}} \times 100\% 
\]

Description:
- \(S_{max}\) = Maximum score
- \(\sum S\) = Scores
- \(X_i\) = Value of questionnaire for each aspect

Assessments of validators, students, and educators are averaged and the percentage of assessment results is interpreted in the table.[17]

### Table 2. Assessment criteria

| Description | Criteria    |
|-------------|-------------|
| 81%– 100%   | Very good   |
| 61% – 80%   | Good        |
| 41% – 60%   | Enough      |
| 21% – 40%   | Not Good    |
| 0% – 20%    | Very Bad    |

3. Results and Discussion

Based on a series of development steps that have been carried out, the research and development products in the form of e-module are produced using flip pdf professional on temperature and heat material. The results and discussion on this research and development are explained as follows:

3.1. Potential and Problems

Potential and problems were carried out at Senior High School 1 Ambarawa, Islamic Senior High School Al-Hikmah Bandar Lampung, Islamic Senior High School IT Ar-Raihan Bandar Lampung by observing, interviewing and distributing questionnaires to students' responses. The purpose of this introduction is to obtain aspects of the needs analysis. The results of the analysis show that the means of learning in a complete school are learning media, but in the use of learning media it has not been
used optimally. Teachers often use printed books, power points and have never developed media such as e-module using flip pdf professional.

3.2. Data Collection
Data collection is used to collect and find out information about students' needs for the product developed. The researcher analyzes from interviews that educators and students need an e-module that can minimize problems in the learning process so that learning becomes more efficient and effective.

3.3. Product Design
After the preliminary stage, the next step is to develop the product design. The media specifications developed are in the form of an e-module that can help students in the learning process. In the first stage, which is to determine an attractive cover design using Corel Draw, then make a material concept that fits the core competencies and basic competencies in the 2013 curriculum along with images, videos, simulations, evaluation tests which are then inserted into flip pdf professional application.

3.4. Design Validation
After the e-module is designed, the next step is the product is validated by experts following their fields of expertise, namely, material experts, media experts, religious expert. Validation by experts is done twice, namely the validation of the initial product assessment and the validation of the assessment after the product is revised. The results of validation by experts are as follows:

3.4.1. Validation by media experts
The results of media expert validation on the e-module using Flip PDF Professional can be seen in table 3.
Table 3. Results of the percentage of media experts

| Aspect Assessment        | Percentage of the initial | Percentage after revision |
|--------------------------|---------------------------|--------------------------|
| Visual display           | 80%                       | 90.48%                   |
| Usage of letters         | 76.67%                    | 85%                      |
| Physical criteria        | 80%                       | 93.3%                    |
| Sound                    | 80%                       | 80%                      |
| Easiness of the usage    | 93.3%                     | 96.67%                   |
| Average                  | 82%                       | 89.1%                    |

At the beginning of product validation, the percentage of assessment was 82% after several revisions were made according to the validator's suggestions, each of the measured aspects of the assessment had increased to 89.1% with the criteria of assessment that is very good.

3.4.2. Validation of material experts

The results of the material expert validation on the development of e-modules using Flip PDF Professional can be seen in Table 4.

Table 4. Results of the percentage of material experts

| Aspect Assessment        | Percentage of the initial | Percentage after revision |
|--------------------------|---------------------------|--------------------------|
| Presentations            | 88.3%                     | 98.3%                    |
| Contents                 | 80%                       | 90%                      |
| Language                 | 80%                       | 90%                      |
| Scientific approach      | 80%                       | 90%                      |
| Average                  | 82.08%                    | 92.08%                   |

The initial e-module validation results using flip pdf professional by material experts get an average percentage rating of 82.08%, after revisions that are in accordance with the validator's suggestions, each of the measured aspects of the assessment increases and results in a percentage average rating amounting to 92.08% with the assessment criteria that is very good.

3.4.3. Validation of religious experts

The results of the religious expert validation that will be used in the validation and trial on the development of the e-module using flip pdf professional can be seen in Table 5.

Table 5. Results of the percentage of religious experts

| Aspect Assessment        | Percentage of the initial | Percentage after revision |
|--------------------------|---------------------------|--------------------------|
| Accuracy of contents     | 66.67%                    | 86.67%                   |
| Language                 | 80%                       | 93.33%                   |
| Average                  | 73.3%                     | 90%                      |

The results of the initial validation assessment of religious experts get a percentage of the average rating of 73.3% and after several revisions were made according to the validator's suggestions, each of the measured aspects of the assessment increased so that the average assessment after revision increased to 90% with the criteria assessment is very good.

3.5. Product Testing

After e-module using flip pdf professional through validation tests by experts, then the e-module is tested by educators and students to find out the responses and responses of teachers and students
regarding e-modules that have been developed. The results of the XI SHS/Islamic SHS class XI physics educator response test can be seen in Figure 6.

![Figure 6. Percentage graph of educator assessment](image)

The aspects assessed in the educator's response test are aspects of content, presentation, language, visual appearance, sound, and use. The average percentage of educator's assessment is 85.96% with very good assessment criteria.

Next is a small group trial conducted by 10 students at each school in Senior High School 1 Ambarawa, Islamic Senior High School Al-Hikmah Bandar Lampung, Islamic Senior High School IT Ar-Raihan Bandar Lampung with aspects assessed are aspects of presentation, material, language, and ease of use. The average percentage of students' responses to the small group trials was 88.15% with very good criteria.

![Figure 7. Percentage graph of the results of small group trials](image)

Field trials were conducted on 79 respondents from the three schools, namely Senior High School 1 Ambarawa, Islamic Senior High School Al-Hikmah Bandar Lampung, Islamic Senior High School IT Ar-Raihan Bandar Lampung. Aspects assessed in field trials are aspects of presentation, material, language, and ease of use. The average percentage of students' responses to the field trial was 88.03% with very good criteria. The following is a graph of the percentage of field trials.
3.6. Product Revision
At this stage, the product is revised based on the results of the trial response of students and educators. After going through several stages of validation, small group trials and field trials, the e-module developed were stated to be very good as physics learning media. Previous studies concluded that interactive electronic books using flip pdf professional received very good responses by students. In addition, it was appropriate to be used to train students' higher-order thinking skills.[18]

3.7. Final product
The final product is to produce e-module using flip pdf professional on temperature and heat materials that have gone through the preliminary stage, product design, validation to material experts, media experts, and religious experts, to physics teachers and through small group trials and trials the field so that it gets very good results after the final revision. The following are the final results of e-module products using flip pdf professional.

Table 6. The display of final product e-module

| Title                  | Display                  |
|------------------------|--------------------------|
| Front view             | ![Front view](image)     |
The display of material (temperature and heat)
4. Conclusions and Suggestions

4.1. Conclusion
Based on the results and discussion it can be concluded that 1) this study produces a product in the form of e-modules using flip pdf professional on temperature and heat material; 2) the assessment of material experts, media experts, and religious experts are very good criteria with percentage 92.08%, 89.1%, 90%, 3) the assessment of the responses educators and students obtained very good criteria with the percentage of educator responses is 85.96%, small group trials are 88.15% and field trials is 88.03%. The e-module can be used independently by students. E-module using flip pdf professional apply technology so learning can be accessed using a laptop or computer that can help understand the temperature and heat material. So, that the e-module using flip pdf professional can be used as learning media in physics material.

4.2. Suggestion
The suggestions for users and further research are: 1) research and development of e-module using flip pdf professional which is developed only on temperature and heat material. Furthermore, it needs to be
further developed for other materials with more varied content, 2) continuing development until the stage of mass production.

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