Development of an E-Module Based on 3D Pageflip Professional on the Concept of Vibration and Wave

Melisa Damayanti R. Saleh[1], Tirtawaty Abdjul[2*], Mohamad Jahja[1], Mursalin[2], Ritin Uloli[2], Asri Arbie[1]

[1] Department of Physics, Universitas Negeri Gorontalo, Gorontalo, Indonesia.
[2] Department of Science Education, Universitas Negeri Gorontalo, Gorontalo, Indonesia.

Abstract: This e-module based on 3D Pageflip Professional can support and facilitate students in the learning process. This research aims to determine the quality of the E-module based on validity, practicality, and effectiveness. The method used is Research and Development (R & D) with a 4D model. This research was conducted in class VIII, namely Class VIII.1 and Class VIII.2, at SMP Negeri 1 Telaga Jaya. Data collection techniques are carried out through observation, questionnaires, tests, and data analysis using descriptive analysis. The research results show that the validity determined through media expert validation reached 3.69 and material expert 3.77, obtaining valid criteria. The practicality is determined through learning implementation, reaching 90% with very good criteria, and student response reaching 87% with good criteria. The effectiveness is determined through student activity, reaching 89% with good criteria and student learning outcomes with an N-Gain value of 0.8 with high N-Gain criteria. Based on the research results, the E-module based on 3D Pageflip Professional is suitable for use and meets the valid, practical, and effective criteria.

Keywords: E-module; Pageflip; Vibration; Wave

Introduction

Educational technology combines teaching, learning, development, management, and technology to solve academic problems (Almufarreh & Arshad, 2023; Anglin, 1995; Antoninis et al., 2023; Guo et al., 2024). Current technological developments are increasing rapidly and continuously evolving, which can be proven by the many innovations made by humans. The world of education has entered the technological era, where media is used as a tool in the learning process. Technology is used appropriately in education to influence the quality of teaching and learning in the classroom (Bonfield et al., 2020; Garlinska et al., 2023; Huda et al., 2024; Kinshuk et al., 2016; Kuzmenko et al., 2023). Education is an essential aspect closely related to the quality of human resources. The quality of education also continues to develop rapidly and positively impacts

current technological and scientific advances (Ghamrawi et al., 2024; Tri, 2024).

Natural science is the branch of science that investigates natural phenomena, encompassing both living and non-living entities, as well as the study of life and the scientific realm (Hanna, 2024; Hidayatullah et al., 2024). Natural science is also a science that studies natural phenomena in the form of facts, concepts, and laws, the truth of which has been tested through a series of research studies (Alameh et al., 2023; Rivadulla, 2023). Science learning is expected to help students understand existing natural phenomena. Based on its characteristics, Science learning can be approached from two perspectives: first, as a product resulting from scientists' work, and second, as a process in which scientists engage to generate knowledge. The view of natural science as a product of the work of scientists in the learning process is carried out by providing students with concepts, laws, theories, and facts about natural

science without allowing them to obtain and construct their concepts. In the learning process, what educators usually do is lecture (Biswal & Behera, 2023; Rahayu et al., 2012; Schwartz et al., 2023).

According to Djamaluddin (2019), learning is a process that changes an individual's personality, reflected in the quality and quantity of their behavior. This includes improving speaking skills, knowledge acquisition, attitudes, habits, understanding, abilities, and critical thinking skills. Learning that is interesting for students can become the focus of their attention on the material that will be presented. The main goal of learning is for students to learn. One way an educator can do this is by creating teaching materials used as a learning resource for students and directing students to think creatively (Algiani et al., 2023; Khairunnisak et al., 2023; Robby et al., 2024).

The e-modules developed as teaching materials are essential at this time to support the learning process and meet the established objectives. Sugianto et al. (2017) explain that electronic modules present self-directed learning materials systematically divided into smaller units to accomplish specific learning goals. These modules are provided in electronic format, incorporating animation, audio, video, and sound, making them more interactive. According to Ghaliyah et al. (2015), modules that are transformed into electronic form are exciting.

Prihatiningtyas et al. 2020), stated that e-modules are very useful for forming a learning process so that educators and students access e-modules using electronic assistance. This teaching material, an e-module, was created with the help of an application called 3D Pageflip Professional (Hendriyani, 2023; Hidayat et al., 2023). 3D Pageflip Professional is a superior application software for creating e-books, digital magazines, e-papers, and other materials (Ferdianto & Nurulfatwa, 2019; Marganda et al., 2021). It has more exciting audio, moving animations, images, and videos. 3D Pageflip Professional is software that can convert PDF files into alternating pages like an actual book and can be viewed from all directions with a 3D effect (Martinopa & Amini, 2023; Nugroho et al., 2023). 3D Pageflip Professional can be operated not only via laptop but also via smartphone and tablet by changing the file format first so that wherever and whenever, students can learn independently. The problem above can be overcome by providing support in learning physics concepts in science to develop an E-Module using an application, namely 3D page flip professional, as an alternative to making it easier to learn physics concepts in science.

Method

This research employs qualitative methods and a research and development approach, commonly known as Research and Development (R&D), following the 4D model (Define, Design, Develop, and Disseminate) illustrated in Figure 1. However, this study was limited to the Define, Design, and Develop stages. The analysis technique applied in this research is descriptive analysis. The researchers developed an e-module based on the 3D Pageflip Professional in this context. The study was conducted at SMP Negeri 1 Telaga Jaya in Buhu Village, District of Telaga Jaya, Gorontalo Regency.
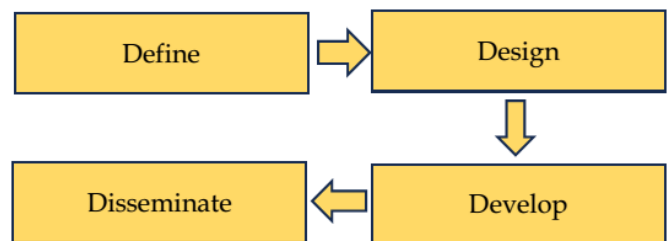

Figure 1. Flowchart of 4D model development

Preliminary studies first collect information needed to analyze the problem by conducting observations at SMP Negeri 1 Telaga Jaya. The researcher made observations during the teaching and learning process in the classroom carried out by the class VIII science subject teacher. The observations results used as a basis for researchers to draw conclusions about problems at school and be able to find solutions to these problems.

Result and Discussion

E-module Validation Based on 3D Pageflip Professional

This research involves two validation stages: the module's validity and the learning material's validation. The developed e-module results in a product, specifically a professional 3D page flip e-module focused on vibration and wave material that is appropriate for use. However, this cannot be separated from the role of validators who provide suggestions to be considered in carrying out revisions to obtain the second product (draft 2).

Evaluators validate the developed e-module, considering various aspects, including its appearance, writing and language quality, image presentation, functionality, and overall benefits. This process yields an overall average score from the validators. The results of the validation for the professional 3D page flip-based e-module are shown in Table 1.

Table 1 indicates that the e-module validated by the evaluators received an average of 3.69, which falls into the valid category (ranging from 3.00 to 3.75). Overall,

the validators' assessments suggest that the e-modules are valid and can be utilized with minor revisions. Revisions were made to ensure that the professional 3D page flip e-module is suitable for trials and applicable in classroom learning. This aligns with Hasanah et al. (2023), who noted that a validation stage by an evaluator is necessary before testing the e-module to enhance its quality for classroom use. The validation by experts in Table 2.

Table 1. Results of E-Module Validation

Indicators	Average indicators	Criteria
Writing display	3.61	
Image display	3.58	
E-module function	3.80	valid
Benefits of e-modules	3.78	
Overall Average	3.69	

According to Table 2, the overall average score from validators for the validation of learning materials is 3.77, placing it in the very valid category (with a range of 3.00 to 3.75). Overall, the validators' evaluations indicate that the learning materials are very valid and can be utilized with minor revisions. This aligns with the findings of Qamariah et al. (2023), who state that teaching materials in e-modules enhance students' learning experiences by making activities more engaging.

Table 2. Learning Material Validation Results

Indicators	Average indicators	Criteria
Content	3.83	
Construction	3.72	Very valid
Language	3.78	
Overall Average	3.77	

Practical of E-Module based on 3D Pageflip Professional

The practicality of the 3D Pageflip Professional-based e-module was assessed through the analysis of learning implementation and student response questionnaires. Based on the trials conducted by the researchers, the findings on the practicality of the 3D

Pageflip Professional e-modules encompass both e-module implementation and student feedback.

Data Analysis of E-Module Implementation

Learning implementation data was obtained through observation sheets, which observers filled out. The sheets measured the implementation or non-implementation of learning exercises designed in the E-module. Based on the observations, the percentage of learning implementation was obtained in 2 meetings in 2 classes. The following are the results of implementing the E-module in 2 meetings in 2 courses with 46 students with limited trials, as seen in Table 3.

Table 3. Percentage Results of Learning Implementation

Classes	Meetings	Percentage (%)	Average (%)	Criteria
VIII.1	1	87	89	Good
	2	91		
VIII.2	1	87	91	Good
	2	95		
Overall average			90	Good

Table 3 indicates that the average percentage for implementing the professional 3D page flip e-module falls within the "Good" category, on score of 90%. This data suggests that the developed professional 3D page flip e-module is practical. This conclusion aligns with the findings of Sari et al. (2022), who noted that technology-based e-modules can enhance motivation, simplify learning, and improve students' skills. Similarly, Sembiring et al. (2021) stated that the revised e-module is appropriate for use in school learning processes, as it fosters a positive learning environment for students.

Data Analysis of Student Response

The analysis of student responses to the e-module was derived from the student questionnaire. This student response questionnaire consists of positive and negative statements, four indicators, and 13 statements. The results of the analysis of student responses in two classes with a total of 46 students can be seen in Table 4.

Table 4. Percentage of Student Responses

Indicators	Percentage (%)
Students' opinions about learning using 3D Pageflip Professional-Based E-Modules	80
Students' impressions regarding learning using E-Modules based on 3D Pageflip Professional	85
Students' opinions regarding the appearance and language used in the 3D Pageflip Professional-based e-module	88
Student learning outcomes after participating in learning using e-modules based on 3D Pageflip Professional	85
Average	84.50

Table 4 indicates that the average percentage score of student responses to the professional 3D page flip-based e-module is 84.50%, which falls into the "very good" category. This states that the learning process

using the professional 3D page flip-based E-module that researchers have developed has received a positive response from students' responses. Based on the questionnaire results, students' reactions to the 3D

Pageflip Professional-based e-module were stated to be "practical" or easy to use in the learning process. This concerns previous research by Nisa et al. (2020), which found that e-modules are practical materials for building learning competencies. Reswita et al. (2022) also stated the same thing, saying that e-modules based on 3D page flip professionals are suitable for use in the learning process. Besides increasing learning motivation, e-modules can also quickly help students achieve their needs in 21st-century learning.

Effectiveness of E-module Based on 3D Pageflip Professional

The effectiveness of the 3D Pageflip Professional-based e-module was assessed through the analysis of student activity and test results related to student learning outcomes. This evaluation was based on the tests and observations, leading to the following outcomes for student activities and learning result assessments (Awila et al., 2024).

Data Analysis of Student Activity

The effectiveness of the professional 3D page flip e-module was evaluated by analyzing student activities. Observers monitored student engagement during the learning process over two sessions in two different classes, recording the activities performed by students on the student activity observation sheet throughout the teaching and learning process. The following is analysis data on student activities carried out during two meetings in 2 classes with 46 students in Table 5.

Table 5. Percentage of Student Activity Results

Classes	Meetings	Percentage (%)	Average (%)	Criteria
VIII.1	1	89	90	Very good
	2	91		
VIII.2	1	88	88	Very good
	2	89		
Average			89	Very good

According to Table 5, the average percentage of student activity was 89%, which falls within the "very good" category. Based on these criteria, the professional 3D page flip-based e-module developed by the researchers is effective for the learning process. Kurniawati et al. (2021) argue that the effectiveness test measures the level of success in using e-modules based on 3D Pageflip Professional and students as users.

Analysis of Learning Result Tests

The results of the analysis of the cognitive learning outcomes test are obtained through the assessment sheet of the test results, namely Pretest and Posttest. Forty-six students were divided into two classes for this learning outcomes test. This learning outcomes test is prepared and adjusted based on learning indicators. The cognitive

level of the learning outcome tests used starts from C1-C3 is C1 (Knowledge), C2 (Understanding), and C3 (Application). The average score of the learning outcomes test is calculated using the N-Gain formula for the pretest and posttest scores carried out with limited trials, along with the learning outcomes for limited trials in Table 6.

Table 6. N-Gain Learning Results

Classes	Pretest	Posttest	N-Gain	Information
VIII.1	39.60	85.20	0.70	High
VIII.2	38.50	89.80	0.80	High
Average			0.80	High

According to Table 6, the trials showed that class VIII.1 achieved an average pretest score of 39.60% and an average posttest score of 85.20%. In contrast, class VIII.2 had an average N-Gain value of 38.50% in the pretest and an average posttest score of 89.80%. Overall, the average N-Gain value from the professional 3D page flip-based e-module trial is 0.80, which falls into the high category. Therefore, the developed professional 3D page flip-based e-module can be effective. This finding supports Akker's assertion (Arham & Dwiningsih, 2016) that the effectiveness of learning media can be evaluated based on the quality of learning outcomes, student attitudes, and motivation.

Conclusion

According to the research conducted by the researchers, the development of a professional 3D page flip-based e-module on vibration and wave material was carried out with a focus on the quality of the developed e-module. The validity assessment yielded an average score of 3.69, placing it in the valid category. Additionally, the validation process resulted in an average score of 3.77, which was also categorized as valid. The analysis of learning implementation showed an average practicality score of 90%, which falls into the "Very Good" category. Furthermore, the average score for student responses to the questionnaire was 84.50%, categorizing it as "Very Good." The effectiveness of student activity was reflected in an average score of 89%, considered "Very Good." Lastly, the analysis of learning outcomes, measured by the N-Gain value, yielded a score of 0.80, indicating a "high" category. Therefore, the 3D Pageflip Professional E-Module effectively teaches class VIII at SMP Negeri 1 Telaga Jaya.

Conflicts of Interest
The authors declare no conflict of interest.

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