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Development of Maths Module on Measurement Using Digital Flipbook in Elementary School

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ABSTRACT

Rapid technological advances drive innovation in teaching materials, shifting printed modules to electronic ones (e-modules). E-modules can present structured teaching materials in electronic format, including audio, visual, and audio-visual for student learning motivation. However, the use of e-modules in primary schools is still limited. This study aims to develop a digital flipbook-based electronic module (e-module) on measurement material to increase the learning motivation of grade 1 students at MI Mambaul Ulum Kandangrejo-Jember. The research method used Research and Development (R&D) with the ADDIE model. The e-module development was conducted at MI Mambaul Ulum Kandangrejo-Jember. Data were collected through validation by media, language, and material experts. The small-scale implementation test involved 5 students, while the large-scale involved 12 students. The results of media expert validation showed a very feasible category with a percentage of 84.80%, material expert validation was also very feasible with a percentage of 81.60%. The small-scale implementation test obtained a result of 90.75% (very feasible), while the large scale was 86.90% (very feasible). Based on these data, it can be concluded that the digital flipbook-based e-module on measurement material to increase the learning motivation of grade 1 students at MI Mambaul Ulum Kandangrejo-Jember is in the category of very feasible and effective to use in learning.

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1. INTRODUCTION

The learning innovation paradigm that leads to technological adaptation means that education must make new breakthroughs, one of which is by developing existing ones. Innovation in learning and scientific progress must be in line with technological developments in order to facilitate various activities, including learning for students and teaching for educators (Mohan, 2019; Sonia, 2017). However, problems in the learning process often arise, so various parties must find smart solutions to overcome them. Therefore, there is a shift in aspects of learning, including in instructional methods that integrate learning media with technological developments. Based on observations and interviews with the homeroom teacher of MI Mambaul Ulum Kandangrejo-Jember, it was found that the school had provided a package book for students, but the book was only loaned while at school and could not be taken home. The material in the package book is less contextualised and difficult for students to understand (Arsyad, 2015; Hayati, Budi, & Handoko, 2015).

This condition highlights the need for alternative learning resources that are more accessible, contextual, and engaging for students. To address these challenges, integrating technology into learning media becomes essential. One such solution is the development of electronic modules (e-modules) that can present structured teaching materials in an interactive format (Herawati & Muhtadi, 2018). E-modules are designed to be accessible anytime and anywhere, allowing students to review and comprehend lessons at their own pace. By leveraging multimedia elements such as audio, visuals, and videos, e-modules aim to enhance students' understanding and motivation, bridging the gap left by traditional learning materials (Maharcika, 2021; Pranata & Yulianti, 2021).

Furthermore, e-modules can be tailored to align with the specific needs and learning levels of students, making the material more relevant and easier to grasp. This adaptability allows educators to create content that is not only informative but also engaging and interactive, fostering a more dynamic learning environment. By utilizing e-modules, educators can address the limitations of conventional teaching methods and provide students with a richer, technology-enhanced educational experience that supports both independent and collaborative learning (Vikiantika *et al.*, 2022).

The integration of e-modules also supports the development of digital literacy skills among students, which are essential in today's technology-driven world (Aji, 2016; Asrizal *et al.*, 2018 Amanullah, 2020). By engaging with digital learning resources, students become more familiar with navigating electronic content, using multimedia tools, and managing their own learning processes. This approach not only enhances their academic performance but also prepares them for future challenges in a digital era. For educators, e-modules offer a flexible platform to innovate their teaching methods, making it easier to update and customize materials according to curriculum changes or students' evolving needs.

Research related to the development of learning media using flipbook applications can be divided into three categories. First, studies that show the positive impact of using digital flipbook-based teaching materials on learning outcomes and the effectiveness of students in the learning process (Yulaika *et al.*, 2020). Second, studies that prove that digital flipbook-based e-modules meet the criteria empirically and theoretically for use in learning (Sa'diyah, 2021). Third, a study that revealed the efficiency of electronic modules reached 86.5% and received positive responses from students and educators (Kuncahyanto, 2018). However, these studies have not discussed the development of electronic modules based on the

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flipbook application in learning Mathematics, especially in Measurement material for elementary school students.

This study aims to develop an electronic module (e-module) based on the flipbook application in learning Mathematics, especially in Measurement material for grade I students of MI Mambaul Ulum Kandangrejo-Jember. Specifically, this research seeks to answer three questions: (1) How is the development process of the flipbook application-based electronic module (e-module) for Measurement material? (2) How is the feasibility of the developed flipbook application-based electronic module (e-module)? (3) How is the effectiveness of the flipbook application-based electronic module (e-module) in increasing student learning motivation?.

This research is based on three main arguments. Firstly, the development of flipbook app-based e-modules can be an effective solution to overcome the problem of students' lack of learning motivation caused by the use of limited learning media. Second, e-modules based on flipbook applications can present measurement materials in a more interesting and interactive way, making it easier for students to understand mathematical concepts. Third, the use of electronic modules (e-modules) based on flipbook applications can increase the accessibility of learning materials, because students can access them anytime and anywhere, not limited to schools.

2. METHODS

This research uses the Research and Development (R&D) method with the ADDIE model (Analyze, Design, Development, Implementation, Evaluation) to develop a digital flipbook-based electronic module (e-module). The unit of analysis in this study is an electronic module developed for learning Mathematics, especially Measurement material, for grade 1 students at MI Mambaul Ulum Kandangrejo-Jember.

This research design combines qualitative and quantitative approaches (mixed methods) (Sugiyono, 2013). The main source of data comes from the validation results of media experts, linguists, and material experts, as well as student responses to the developed e-modules. Additional data were obtained through observations and interviews with first grade teachers of MI Mambaul Ulum Kandangrejo-Jember to identify needs and problems in learning.

The data collection process was carried out through several stages. First, validation by media, language, and material experts using an instrument with a Likert scale of 1—5. Second, a small-scale implementation test involving 5 students, followed by a large-scale implementation test involving 12 students. Students gave an assessment of the e-module using an instrument that had been prepared. Data analysis used mixed methods. Quantitative data from expert validation results and implementation tests were analysed using percentage calculations to determine the feasibility level of the e-module. Qualitative data in the form of comments and suggestions from experts and student responses were analysed descriptively to provide a comprehensive picture of the quality and effectiveness of the e-modules developed. The results of this analysis were then used to make improvements and refinements to the final product. This can be seen in **Figure 1** which shows part of the digital flipbook development procedure.

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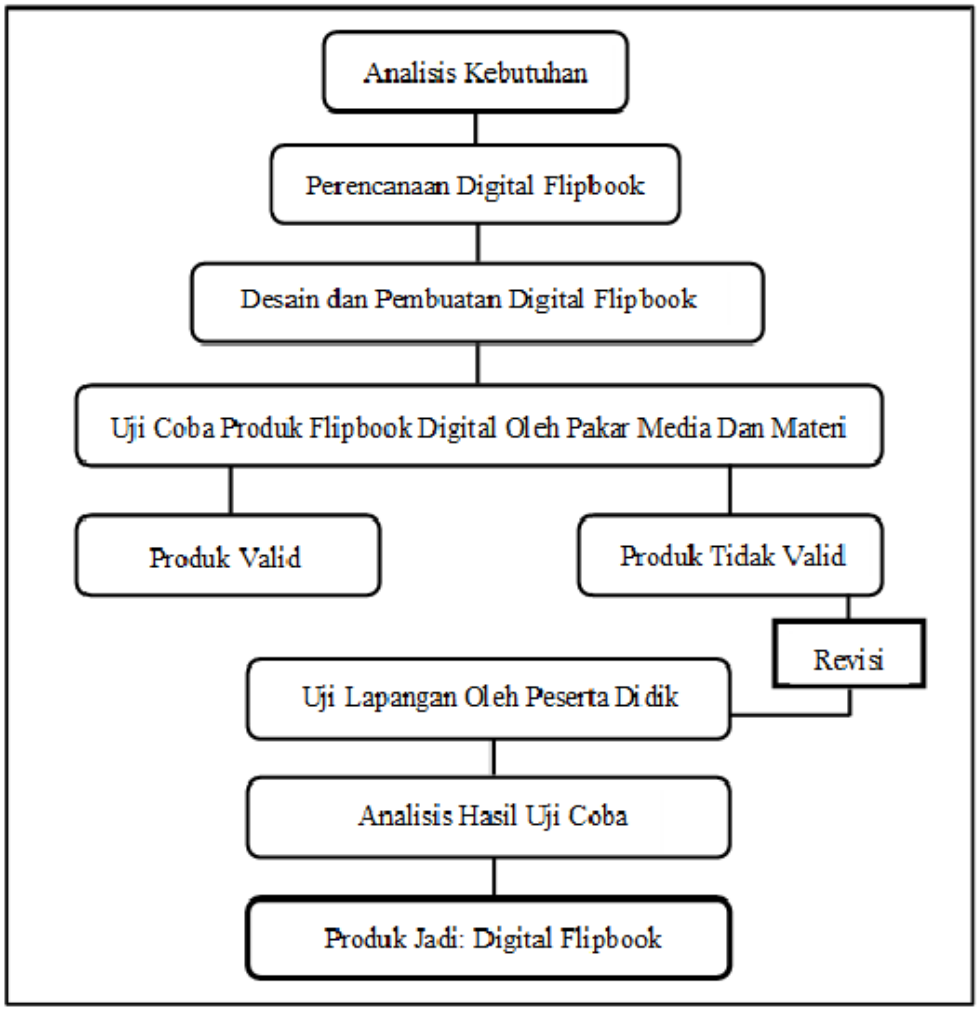

Figure 1. Digital Flipbook Development Procedure ADDIE Model

The developed product will be validated by three experts, namely media experts, language experts and material experts, in order to evaluate the success of the product. Validation is carried out using a Likert scale of 1—5, where experts will choose one of the five available options. **Table 1** below shows the assessment along with the categories applied in the validity test conducted by experts.

Table 1. Validation Instrument Scores and Categories

Score	**5**	**4**	**3**	**2**	**1**
Categories	Very Feasible	Feasible	Enough Feasible	Not Feasible	Very Inappropriate

Data that has been collected from the validation test by media experts and experts, media implementation teste-module based on digital flipbook will then be analysed. The data that has been collected will be analysed using the formula in accordance with **Table 2** below.

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Table 2. Percentage Formula of Validation Results

Percentage	Category
81% - 100%	Very Decent
61% - 80%	Feasible
41% - 60%	Fair
21% - 40%	Not Feasible
< 20%	Very Not Feasible

$$P = \frac{f}{n} \times 100\%$$

With information:
P = Percentage sought
f = Number of scores from data collection
n = Maximum score

3. RESULTS AND DISCUSSION

This study aims to develop a digital flipbook-based electronic module (e-module) for Mathematics class I MI with a focus on Measurement material. The main findings of this study indicate that the developed e-module has a very high level of feasibility based on expert assessment and implementation test on students. The following can be seen in **Figure 2** is an example of the display of a digital flipbook.

Figure 2. Flipbook Application Display

Table 3 and 4 explain that the results of the material expert validation showed a feasibility percentage of 81.60%, while the media expert validation reached 84.80%. Both of these results fall into the "very feasible" category. This finding is in line with research by **Sa'diyah's (2021)** which also found that digital flipbook-based e-modules are empirically and theoretically feasible to use in learning, with validation results reaching 0.91. This indicates a positive trend in the development of effective digital teaching materials for primary school level.

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Table 3. Results of The Validation Test by Material Experts

Aspect	Percentage	Category
Material	92.50%	Very Decent
Language and Writing	86.25%	Very Decent
Average percentage	**81.60%**	**Very Feasible**

Table 4. Results of The Validation Test by Media Experts

Aspect	Percentage	Category
Physical Display	84.00%	Very Feasible
Media Content	93.33%	Very Feasible
Language	80.00%	Worth
Correlation with Menu	80.00%	Worth
Innovation	86.66%	Very Feasible
Average percentage	**84.80%**	**Very Feasible**

This finding is in line with Sa'diyah's (2021) which also found that digital flipbook-based e-modules are empirically and theoretically feasible to use in learning, with validation results reaching 0.91. This indicates a positive trend in the development of effective digital teaching materials for elementary school level.

Table 5 and 6 present the implementation tests on small groups (5 students) and large groups (12 students) resulted in feasibility percentages of 90.75% and 86.90% respectively, both of which fall into the "very feasible" category.

Table 5. Small Group Test Results

Respondents	Score Acquisition (Maximum Score 80)	Percentage	Category
1	73	91.25%	Very Feasible
2	69	86.25%	Very Feasible
3	71	88.75%	Very Feasible
4	77	96.25%	Very Feasible
5	73	91.25%	Very Feasible
Average	**363/400**	**90.75%**	**Very Feasible**

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Table 6: Large Group Test Results

Respondents	Score Acquisition (Maximum Score 80)	Percentage	Category
1	65	81.25%	Very Feasible
2	68	85.00%	Very Feasible
3	71	88.75%	Very Feasible
4	77	96.25%	Very Feasible
5	73	91.25%	Very Feasible
6	66	82.50%	Very Feasible
7	69	86.25%	Very Feasible
8	75	93.75%	Very Feasible
9	69	86.25%	Very Feasible
10	73	91.25%	Very Feasible
11	65	81.25%	Very Feasible
12	64	80.00%	Worth
Average			**Very Feasible**

Implementation tests on small groups (5 students) and large groups (12 students) resulted in feasibility percentages of 90.75% and 86.90% respectively, both of which were included in the "very feasible" category.The high level of student acceptance of this e-module confirms the findings of Yasa et al. (2018) on the ability of e-modules to present information in a structured, interesting, and interactive manner. In addition, this result also supports Anandari's (2019) observation regarding the accessibility of e-modules that allow students to learn anywhere and anytime.

Analysis of the research results shows several important implications. First, the use of digital flipbook-based e-modules has the potential to increase students' learning motivation and interest in understanding the subject matter. This is in line with the findings of Mulyadi *et al.,* (2016) who stated that the use of flipbook media can improve students' creative thinking skills. Second, this e-module supports independent learning, in accordance with the opinion of Wijayanto & Zuhri (2014) which states that e-modules allow students to learn independently.

However, this study also revealed challenges in the implementation of digital flipbook-based e-modules. The dependence on internet connection to access the module online, as identified by Nurwidiyanti & Sari (2022), is a major obstacle. To overcome this, Puspitasari *et al.* (2020) suggested providing a PDF version of the e-module that can be accessed offline.

The practical implication of this research is the need to improve technological infrastructure in elementary schools to support the implementation of digital teaching materials. In addition, training for teachers in the use and development of digital teaching materials is also important to maximize the potential of e-modules in improving the quality of learning.

Although this study showed positive results, there are some limitations that need to be noted. First, this study only focused on one subject and one grade level. Secondly, the long-term effectiveness of using e-modules on student learning outcomes has not been studied in depth. For future research, it is recommended to explore the long-term effectiveness of using digital flipbook-based e-modules on student learning outcomes. In addition, the

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development of e-modules for other subjects and grade levels also needs to be done to expand the benefits of this technology in basic education.

In conclusion, the development of a digital flipbook-based e-module for learning Mathematics at the elementary school level proved to be very feasible and effective. This research contributes to the broadening of understanding of the integration of digital technology in learning at the primary level, while paving the way for further innovations in the development of interactive teaching materials to improve the quality of education in the digital era.

4. CONCLUSION

This study has shown that the development of a digital flipbook-based electronic module (e-module) for learning Mathematics Measurement material in grade 1 MI Mambaul Ulum Kandangrejo-Jember is very feasible and effective. The results of material and media expert validation showed a very high level of feasibility, 81.60% and 84.80% respectively. The implementation test in small and large groups also produced a very good percentage of feasibility, namely 90.75% and 86.90%. These findings indicate the potential of e-modules in increasing students' learning motivation through a more interesting and interactive presentation of materials, as well as supporting independent learning. This research strengthens the understanding of the integration of digital technology in learning at the primary school level. Theoretically, the findings support the concept that the use of interactive learning media can increase students' interest and motivation to learn. Practically, the results of this study have implications for the need to improve technological infrastructure in primary schools and training for teachers in the development and use of digital teaching materials. Educational institutions need to consider developing similar e-modules for other subjects to maximize the potential of technology in improving learning quality.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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