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Enhancing Student Learning Outcomes Through the Development of Interactive Flipbooks Using Heyzine

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ABSTRACT

This research aims to develop innovative informatics learning media that are relevant to the characteristics of students at SMP Negeri 16 Malang. The background of this research is based on the challenges faced in informatics learning, including low learning motivation and the lack of optimal technology utilisation. Interactive flipbooks were chosen as the learning media due to their ability to integrate audio-visual elements and support independent learning. This research employs the Research and Development (R&D) method with the ADDIE model. The analysis stage identifies the needs, curriculum, and student characteristics. The design stage involves structuring the flipbook development framework. The development stage focuses on creating a web-based interactive flipbook and expert validation. The implementation stage is conducted with small and large groups to obtain feedback. The evaluation stage measures the effectiveness of the media and ensures its feasibility. The research results indicate that interactive flipbooks have the potential to increase learning motivation and understanding of informatics concepts.

I. INTRODUCTION

The quality of a nation is often reflected in the quality of the education system it implements. This shows how important education is in driving the progress of a country [1]. Furthermore, education is a fundamental right of every individual, which equips them with the ability to face the complexities of life in the future [2]. Investment in education is actually a valuable asset for the quality of human resources, which in turn will make a significant contribution to the progress of human civilisation [3].

In Indonesia, education is a top priority because of its role in shaping a dignified society [4]. However, the world of education in Indonesia has many obstacles. Darman highlights the burden of students in facing many subjects with material that is often abstract [5]. Asmara adds that rigid and traditional learning approaches contribute to the declining interest in learning among the millennial generation [6]. As a result, students experience pressure and stress in the learning process.

Learning media, both in the form of physical and digital tools that contain instructional materials, play an important role in stimulating students to learn [7]. This media serves as a communication bridge between educators and students, creating an interactive and accessible learning experience [8]. Briggs asserts that media can convey messages effectively and involve students in the learning process [9]. Muhson defines learning media as educational software or content delivered through technology to reach students. In general, media includes any means of transmitting information between a source and a receiver [10].

Observation at SMP Negeri 16 Malang shows that informatics learning has not fully utilized technology, especially in class VIII B. This causes learning to be less efficient and creates a passive classroom atmosphere, where students tend to lose focus and turn to their mobile phones. This causes learning to be less efficient and creates a passive classroom atmosphere, where students tend to lose focus and turn to their cell phones. The lack of interesting and relevant

learning media hinders the achievement of learning objectives [11]

To overcome this problem, it is necessary to develop a medium that can be used by learners effectively. This research proposes the use of interactive flipbooks as a potential solution. Interactive flipbooks, as a PDF-like form of digital media, offer a dynamic and engaging way to present information. It combines various media formats, such as text, images, videos, and interactive elements, to create an immersive learning environment.

While previous research has shown the positive impact of interactive media on student learning motivation [12], there remains a gap in understanding the specific effectiveness of interactive flipbooks in informatics learning. This study aims to address this gap by investigating the potential of interactive flipbooks to improve student learning outcomes in informatics, particularly focusing on the use of variable materials and custom blocks, which have not been extensively explored in prior research. By leveraging the flexibility and accessibility of flipbooks, this research seeks to create a student-centred learning resource that encourages active engagement and facilitates the achievement of learning objectives. The study will use a mixed methods approach, combining quantitative assessment of student performance with qualitative feedback to gain a comprehensive understanding of the effectiveness of interactive flipbooks in this specific context. The findings are expected to contribute valuable insights into the design and implementation of interactive learning materials, ultimately improving educational practices in informatics.

II. METHODS

This study adopted a Research and Development (R&D) approach structured within the framework of the ADDIE model. This model was chosen due to its systematic and iterative nature, which allows for continuous evaluation and refinement throughout the development process. The ADDIE model's clear and sequential phases (Analysis, Design, Development, Implementation, and Evaluation) provide a structured framework that guides the development of effective and high-quality learning media. This model includes five essential phases, including needs analysis, solution design, product development, program implementation, and outcome evaluation.

The analysis stage begins with observation of the learning process in class and interviews with teachers and students to identify problems, needs, and characteristics of students in learning informatics, especially variable and custom block materials. A literature study of the curriculum and learning resources was also conducted to determine the relevant material.

Furthermore, at the design stage, researchers developed an interactive flipbook media framework. The advantage of this media lies in the integration of interactive features, such as quizzes, animations, videos, and audio, developed through the Heyzine platform.

The development stage is focused on making interactive flipbook media based on the design that has been prepared. Content in the form of text, images, illustrations, videos, and audio were developed in an integrated and attractive manner. Interactive features were implemented to increase student engagement, while user-friendly navigation allowed students to explore the flipbook smoothly. Editing and revision processes were conducted to ensure the quality and suitability of the media.

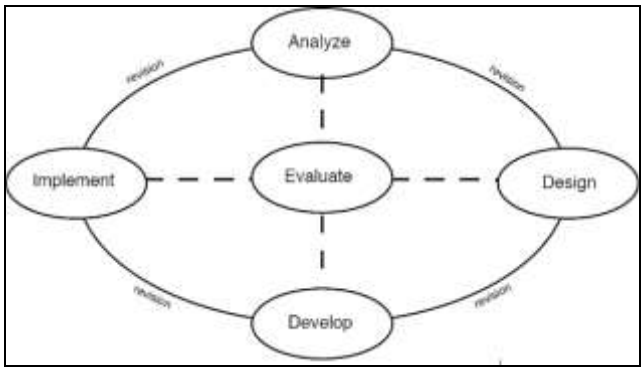

Fig. 1 Model ADDIE

The interactive flipbook media was then tested on VIII grade students of SMP Negeri 16 Malang. The trial was carried out in stages, starting from small group trials with 6 students, large group trials with 15 students, to field trials involving all VIII B students. Participants for the small group trial were selected based on their varying levels of academic achievement in informatics, as reflected in their previous test scores. This ensured a diverse representation of learning abilities within the group. The large group trial participants were selected randomly from the pool of VIII-grade students who did not participate in the small group trial.

Participants for the small and large group trials were selected using simple random sampling from the pool of VIII-grade students. All participants were also required to have basic computer literacy skills to effectively interact with the flipbook media. This method ensured that every student had an equal chance of being selected, minimising potential bias in the sample. To maintain the integrity of the random sampling process, student names were assigned numbers, and a random number generator was used to select participants.

The learning media assessment process is carried out through several stages to ensure its suitability and effectiveness in the teaching and learning process. First, validation by experts, both material experts and media experts, is carried out to assess the quality of the media from various aspects, including content, design, and the suitability of its use in the learning context. Second, responses from students were collected through questionnaires to determine the level of interest, ease of use, and benefits of the media in supporting the learning process. Third, the measurement of the improvement of student learning outcomes was carried out by organising a learning outcome test consisting of pre-test and post-test. All data collected was then analysed using quantitative and qualitative approaches. This analysis aims to determine the level of feasibility and effectiveness of interactive flipbook media in improving student learning outcomes, especially in

informatics subjects, with a focus on variable and custom block material.

III. Result and Discussion

In an effort to increase the effectiveness of informatics learning, especially on variable and custom block materials, interactive learning media based on digital flipbooks were introduced to the experimental group. This group consists of 32 students who are members of class VIII B at SMP Negeri 16 Malang.

A. Media Expert and Material Expert Validation

Before interactive flipbook media is implemented in learning, the validation stage by media experts and material experts is a top priority. This validation aims to ensure the quality and feasibility of the flipbook before students use it.

Media experts reviewed the flipbook with a focus on technical and design aspects. As a result, the interactive flipbook received a predicate of "Very Good" with a score of 96%. Some of the factors assessed include title, colour, font size and type, visual appearance, images, and flipbook functionality. All of these aspects are considered to have met the criteria so as to create learning media that is attractive and easy to use.

Meanwhile, the material experts assessed the flipbook in terms of content and its suitability for learning objectives. The aspects that are the focus of the assessment include the suitability of the material with the learning objectives, the completeness of the material, clarity, ease of understanding, and the accuracy of the questions. As a result, the material expert also gave a predicate of "Very Good" with a score of 92%. This shows that the material in the flipbook is presented accurately, completely, and easily understood by students.

TABLE I. Expert Validation

Validator	Percentage (%)	Category
Media Expert	96	Very good
Material Expert	92	Very good

Overall, the validation results from media experts and material experts show that interactive flipbook media are feasible and ready to be used in the learning process. Interactive flipbooks are expected to increase learning effectiveness and student motivation in learning variable and custom block material.

B. Media Feasibility Test for Learners

The results of the feasibility test of this interactive flipbook media have gone through a series of rigorous validation processes, starting with the feasibility test by media experts and material experts. At this stage, the flipbook media received an excellent assessment, with media expert validation reaching 96% and material expert validation at 92%. These figures indicate that, technically and pedagogically, this media has met high-quality standards and is ready for further testing.

Furthermore, the media was tested through three stages of testing, namely testing in small groups, large groups, and field tests. Small group testing was carried out on six students of class VIII B who were randomly selected. The results showed that the interactive flipbook media obtained a feasibility level of 96.2%, which, if converted on a Likert scale, was included in the "very good" category. This indicates that students find this media very interesting and effective in supporting their learning process.

Testing was continued in a large group involving 15 students of class VIII B. The results of this large group trial showed a feasibility level of 95.3%, which also fell into the "very good" category. These results reinforce previous findings, indicating that interactive flipbook media has consistency in feasibility and attractiveness, even when applied on a wider scale.

The last stage was a field trial involving all 32 students from class VIII B. In this trial, the interactive flipbook media obtained a feasibility score of 91.2%, which is still in the "very good" category. Although there was a slight decrease in percentage compared to testing in small and large groups, these results still show that this media is feasible to use on a larger class scale.

TABLE II. Results Of Feasibility Test On Learners

Test	Percentage (%)	Category
Small Group Trial	96,2%	Very good
Large Group Trial	95,3%	Very good
Field Trial	91,2%	Very good

Based on the overall results, through the validation process by experts and trials with students, this interactive flipbook media is proven to have very high feasibility both in terms of technical and pedagogical. Testing at various scales shows the consistency of the effectiveness and attractiveness of this media, so it can be concluded that the interactive flipbook is very feasible to use in supporting learning, especially in materials that require an understanding of abstract concepts such as variables and custom blocks in informatics learning.

C. Instrument Validity and Reliability Test

Before the media was implemented and the test instruments were used, validity and reliability tests were conducted to ensure the quality of the research instruments.

D. Validity Test

Instrument validity is a crucial aspect of research. To ensure that the items are suitable for use and able to produce accurate data, a validity test is carried out before the questions are tested on students.

In this study, the validity test was carried out on 20 multiple choice questions that would be tested on 32 students of class VIII B SMP Negeri 16 Malang. The method used to test the validity of the items is product-moment correlation with the help of the SPSS program. Criteria for the validity of the instrument are determined by comparing the value of count with

r_{tabel} (0.349). A question item is declared valid if the value of $r_{count} > r_{tabel}$

The results of the analysis showed that all items met the validity criteria. The next step is to test the reliability of the instrument to ensure consistency of measurement.

E. Reliability Test

The next stage after all items are declared valid through the validity test is the reliability test. The reliability test aims to determine the level of consistency and accuracy of the questions that have been tested. Reliability measurement in this study was carried out by utilising SPSS software and using the Cronbach Alpha formula. The results of the reliability analysis with SPSS can be seen in the following table. The number of respondents involved in this analysis was 32 students. Since all data were filled in, the percentage of valid data reached 100%.

TABLE III. RELIABILITY TEST RESULTS

Cronbach's Alpha	N of Items
0.818	20

From the attached table, it can be seen that the N of items or the number of items is 20 items with a Cronbach's Alpha value of 0.818. Since Cronbach's Alpha value is 0.818> 0.349, it can be concluded that all items are reliable or consistent.

F. Normality Test

Before further analysis is carried out, it is necessary to ensure that the data used meets the assumption of normality. For this reason, data normality testing was carried out by utilising the Kolmogorov-Smirnov test. This testing process was carried out using SPSS version 25 statistical software.

TABLE IV. NORMALITY TEST RESULTS

Class	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Pre-test	0.181	31	0.009
Post-test	0.147	31	0.075

Based on the results of the normality test that has been carried out, both pretest and posttest data show normal distribution. This is indicated by the significance value of the pretest data of 0.181, which is greater than 0.05. Similarly, the post-test data also showed a significant value of 0.147, exceeding the critical limit of 0.05. Thus, it can be concluded that the normality assumption is met for both data.

G. Hypothesis Test

This study tested the significance of differences in student learning outcomes before and after the application of interactive flipbook learning media. Data analysis used a *Paired Sample T-Test*, which was processed through *SPSS 25 for Windows* software.

Based on the data analysis, a striking difference was found between the students' pretest and posttest scores after they underwent learning utilising interactive flipbook media. The average pretest score was recorded at 77.21, while the average posttest score reached 88.43. The t-test results showed a value of -14.384 with degrees of freedom (df) = 31 and a significance level of 0.000 (smaller than 0.05). These findings indicate that the use of interactive flipbook media has a significant positive effect on improving student learning outcomes, especially on variable and custom block material.

This research focuses on the development of interactive flipbook media as a form of effort to improve learning outcomes, especially on variable and custom block material. This interactive flipbook media was developed by considering pedagogical and technological aspects and through careful validation and effectiveness testing stages. Based on the validation that has been done before, this flipbook shows a very high level of validity, with a media expert validation value reaching 96% and material expert validation of 92%.

The high percentage of media expert validation indicates that this interactive flipbook has good quality in terms of technical and design. Media experts especially appreciate the attractive and interactive flipbook design, easy-to-use navigation, and integration of multimedia elements that strengthen the presentation of material. This is in line with Mayer's [13] Multimedia theory states that the integrated use of visual and audio elements can improve student understanding and retention. Meanwhile, the material expert validation showed that the flipbook content was relevant to the learning objectives and presented in an accurate, complete, and easy-to-understand manner. The completeness of the material, clarity of explanation, and accuracy of the exercise questions in the flipbook support students in constructing knowledge independently, in accordance with the principles of constructivism in learning.

This flipbook does not only present information passively, but invites students to interact more deeply with the content through self-navigation and visual elements. The media feasibility test in small groups, large groups, and field tests showed excellent results with a feasibility percentage above 90%. This indicates that this interactive flipbook is well-received by students and is seen as an interesting and effective learning media [14], [15]. These findings are in line with previous studies that have shown interactive Multimedia can improve learning outcomes by increasing user satisfaction and engagement. It also helps in better concept representation compared to conventional formats [16]. However, while prior studies often focused on video or game-based media, this research contributes to the literature by exploring the potential of interactive flipbooks as a viable and engaging learning tool.

The effectiveness of this interactive flipbook media is also evident from the results of the pretest and posttest tests conducted. The average pretest score of students was 77.21, while after using the flipbook, the posttest score increased significantly to 88.43. Statistical analysis using paired sample t-test showed a significance level of 0.000, indicating that this increase was not a coincidence but a real result of the intervention using interactive flipbooks [17],

This research is also based on the theoretical foundation of constructivism proposed by Piaget [18]. It states that effective learning occurs when students actively build their understanding through exploration and direct experience. The

use of interactive flipbooks provides space for students to learn independently, in line with the discovery learning approach, where students are encouraged to find knowledge through independent exploration of the material [19].

Practically, the implications of this research for the world of education are very important. The development of interactive media, especially flipbooks, can be an effective solution to facing the challenges of learning in a digital era that is increasingly dependent on technology. [20], [21]. However, it is important to acknowledge the limitations of this study. The research was conducted with a specific group of VIII grade students in one school, which may limit the generalizability of the findings. Future research could explore the effectiveness of this interactive flipbook with different age groups and in diverse learning environments.

This research not only contributes to the existing literature but also opens opportunities for further development in the future. One of the recommended development directions is the integration of richer multimedia elements and the adaptation of content that is more responsive to students' individual needs. Adjusting the level of difficulty and presentation of material based on students' ability levels can be an important step in optimising the use of interactive flipbooks in various learning contexts. While this study demonstrates the potential of interactive flipbooks, scalability presents a challenge. Wider implementation may require significant resources for development, teacher training, and ongoing technical support. Furthermore, ensuring accessibility for all students, including those with disabilities or limited internet access, is crucial for equitable implementation. Thus, interactive flipbook media has great potential to be an adaptive and effective learning tool in the future, both in the context of face-to-face learning and technology-based distance learning.

IV. Conclusion

This study shows that the utilisation of interactive flipbook learning media has a positive impact on improving the learning outcomes of 8th-grade students at SMP Negeri 16 Malang on variable and custom block material. This is evidenced by a significant increase in student scores after applying interactive flipbooks in the learning process. The effectiveness of this media is supported by the validity and reliability that has been tested. Interactive flipbooks are able to increase students' active participation in learning because they present material with attractive visual elements and allow students to explore the material independently. Furthermore, this media also plays a role in facilitating students' understanding of the abstract concepts of variables and custom blocks. The characteristics of this interactive flipbook are in accordance with the principles of constructivism and support the realisation of active learning in the digital era. Nevertheless, the development of interactive flipbooks can still be optimised. Integration of more varied multimedia elements and customisation of content with the characteristics of each student are steps that can be taken to increase the effectiveness of this media, both in the context of face-to-face learning and distance learning.

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