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Development of Interactive Teaching Materials using The Flip Pdf Corporate Edition Application in Mathematics Learning in Grade IV of Elementary Schools

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A B S T R A C T

This research is motivated by the low use of interactive learning media in Mathematics learning and the limited teaching materials that can facilitate students to learn independently and interestingly. The purpose of this research is to produce interactive teaching materials based on the Flip PDF Corporate Edition application for Mathematics learning for grade IV elementary school that are valid, practical, and effective, and to determine the level of validity, practicality, and effectiveness of the teaching materials developed. This type of research is a development research (R&D) using the ADDIE model. Expert validators are 3 experts (media experts, material experts, and language experts), 3 teachers, and grade IV students at SDN 06 Cimparuh and SDN 16 Cimparuh. The validation results show a validity level of 93.75% from media experts, 88.63% from material experts, and 90.6% from language experts, all of which are included in the "very valid" category. Based on the results of teacher and student responses, it is known that the percentage of practicality of teaching materials at SDN 06 Cimparuh reached 92.15% student responses and 95.8% teacher responses, while at SDN 16 Cimparuh 95.35% student responses and 91.6% teacher responses. In addition, the results of the effectiveness test showed an N-Gain value of 0.8054 at SDN 06 Cimparuh and 0.7825 at SDN 16 Cimparuh, including the high category. Thus, it can be concluded that interactive teaching materials based on Flip PDF Corporate Edition are valid, practical, and effective for use in learning Mathematics for grade IV elementary school.

1. Introduction

The use of technology-based teaching materials, such as interactive e-books, has been proven to increase student interest and learning outcomes (Susilawati & Rusdinal, 2022). The use of interactive teaching materials in learning, especially in

mathematics, contributes significantly to improving student learning outcomes at the elementary school level (Astri et al., 2022). This shows that innovation in the use of digital media can help students understand the concepts taught more effectively (Salsabila et al., 2025).

With technological advances, teachers are continually striving to adapt internally to improve student learning outcomes. One strategy they employ is flexible and contextual learning (Suprihatin & Manik, 2020). With the freedom to choose learning methods and media, teachers have the opportunity to develop teaching materials that are more suited to the needs of the students they teach. According to (Tito, 2024), teachers can explore various innovative learning approaches, including the use of digital technology in preparing interactive teaching materials that can improve students' understanding of the learning material.

Interactive teaching materials are one solution to support student learning outcomes. These materials are designed to actively engage students in the learning process by presenting interactive elements that can enhance conceptual understanding (Handayani et al., 2024). The use of interactive teaching materials such as flipbooks not only enriches students' learning experiences but also allows for more engaging and easier-to-understand presentations of material. This is also explained by (Nurhayati & Langlang Handayani, 2020), the use of digital-based interactive teaching materials, especially those utilizing flipbook technology, can increase the effectiveness of learning because students can more easily understand concepts through more dynamic and interesting visualizations.

One application that can be used to create interactive teaching materials is Flip PDF Corporate Edition. This application allows the creation of interactive e-books with engaging flip effects, thereby increasing student reading interest and comprehension. With features that support multimedia integration, such as video, audio, and animation, Flip PDF Corporate Edition is an effective tool for developing engaging and interactive teaching materials. According to (Hening Prastiwi, 2021). Flip PDF Corporate Edition is an application designed to facilitate the creation of digital teaching materials with interactive features that enable students to be more actively involved in the learning process, thereby significantly improving their learning outcomes. As software that enables the creation of modules or teaching materials with a book-like appearance, Flipbook PDF Corporate Edition provides a more interactive learning experience with its flip-page feature. This is in line with the opinion (Tilova & Amini, 2022) This application is capable of presenting teaching materials in a digital format that resembles a printed book. Furthermore, the innovation offered by Flipbook PDF Corporate Edition makes learning more dynamic by allowing the addition of audio, video, and images to electronic teaching materials (Fadilah & Sulistyowati, 2022), this application also provides various attractive templates that can beautify the appearance of electronic teaching materials.

Based on the results of observations and interviews with 4th grade teachers at SD Negeri 06 Cimparuh and SD Negeri 16 Cimparuh on February 25, 2025, teachers

have not used interactive teaching materials, it was found that learning still relies on videos from YouTube and Student Worksheets (LKS) as the main source. Teachers said that limitations in using interactive learning technology, such as Flip PDF Corporate Edition, are caused by a lack of training and understanding of its use. In addition, from observations in the classroom, it appears that students are less motivated and often show boredom, especially in mathematics learning. Students tend to be passive and only receive material without any deeper interaction.

The research model applied in this development research is the ADDIE model. According to (Tegeh & Kirna, 2013) ADDIE is a systematic learning design model. Despite its well-organized structure, it remains simple to implement. Therefore, ADDIE can be used to assist in the development of electronic teaching materials based on the Flip PDF Corporate Edition. The ADDIE model consists of five main stages: Analysis, Design, Development, Implementation, and Evaluation. Each stage in this model is designed to ensure that electronic learning materials developed using Flip PDF Corporate Edition are structured, effective, and aligned with learning needs. Based on the problems above, the aim of this research is to develop interactive teaching materials using the Flip PDF Corporate Edition application in mathematics learning in grade IV of elementary school that meets the criteria of being valid, practical, and effective.

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2. Methodology

The type of research used in this study is research and development. According to Borg and Gall, development research aims to develop and validate educational products. Meanwhile, Kantun (2013) explains that development research functions to produce and refine a product or learning media. Unlike research that focuses on testing theories, development research starts from real-world problems in classroom learning, which require new innovations in the form of software or hardware as alternative solutions.

Based on this perspective, it can be concluded that development research is the process of developing and validating an educational product that aims to present new innovations and solutions to challenges in the learning process. While various development research models exist, this study uses the ADDIE model. The ADDIE model consists of five main stages: Analysis, Design, Development, Implementation, and Evaluation, which allows the process of developing teaching materials to be carried out systematically and oriented towards student needs and learning effectiveness. In the analysis stage, researchers examined various important aspects related to learning needs. The analysis focused on student conditions, the characteristics of the mathematics material, the availability of learning media, and the obstacles faced by teachers in delivering the material. The results of this analysis became the basis for designing interactive teaching materials based on the Flip PDF Corporate Edition application, so that the developed product truly fits the learning needs of the fourth grade students of SDN 06 Cimparuh and SDN 16 Cimparuh.

In the design stage, researchers began to design interactive teaching materials by utilizing the Flip PDF Corporate Edition application which focused on learning mathematics in grade IV, especially on fractions. The design of this teaching material aims to help teachers in delivering the material in a more interesting and interactive way, while also making it easier for students to understand the concepts being studied. In the implementation stage, the interactive teaching materials that have been developed and declared valid by the validators are then implemented in the learning process. This implementation was carried out on grade IV students at SDN 06 Cimparuh, totaling 18 people and at SDN 16 Cimparuh, totaling 11 people, so that the total number of students involved was 29 people. The use of interactive teaching materials based on Flip PDF Corporate Edition aims to determine how effective the teaching materials are when applied directly in teaching and learning activities.In the evaluation phase, the interactive teaching materials developed using the Flip PDF Corporate Edition application were thoroughly evaluated through the involvement of teachers and fourth-grade students at SDN 06 Cimparuh and SDN 16 Cimparuh. The evaluation was conducted using a practicality questionnaire to determine the extent to which these teaching materials were practical for use in the mathematics learning process. The questionnaire was given to teachers and students as direct users, so that the assessments obtained truly reflect the real experience of using these interactive teaching materials in the classroom.

The validity of the interactive teaching materials based on the Flip PDF Corporate Edition application for fourth-grade mathematics was tested before being implemented in schools. Validation was carried out by three expert lecturers with competencies in their respective fields. Material experts are responsible for assessing the accuracy and suitability of the content of teaching materials with the applicable curriculum. Linguists assess the readability, clarity, and appropriateness of language used in teaching materials to ensure they are easily understood by students. If the assessed teaching materials do not meet the specified criteria, revisions will be made based on expert input before being implemented in the fourth grade students of SDN 06 Cimparuh and SDN 16 Cimparuh.

In this study, the practicality instrument was tested on students and teachers at SDN 06 Cimparuh and SDN 16 Cimparuh. Through this practicality test, direct feedback was obtained from users regarding the practicality aspects of the interactive teaching materials that had been developed, so that it could be known whether the learning media was truly in accordance with the needs and characteristics of students in learning. Student response questionnaires were given with the aim of knowing the opinions and level of practicality of the interactive teaching materials that had been developed and implemented. Effectiveness data was obtained through learning outcome tests administered to students before (pre-test) and after (post-test) using interactive learning materials at SDN 06 Cimparuh and SDN 16 Cimparuh. The test results were then analyzed using the N-Gain Score technique to determine the increase in students' understanding of the mathematics material. This data was used to assess the effectiveness of the learning materials in improving student learning outcomes.

3. Results and Conclusion

Data Presentation

The development model used is the ADDIE model, which consists of five main stages: Analysis, Design, Development, Implementation, and Evaluation. In this study, the presentation of development results focuses on data obtained from trials involving experts and students. This data serves as the basis for revisions and improvements, while also ensuring that the resulting interactive teaching materials are truly suitable for use in fourth-grade mathematics learning at both schools.

Analysis Stage

The initial stage of this research began with school observations to obtain a concrete picture of the ongoing learning process. Observations were conducted at SDN 06 Cimparuh and SDN 16 Cimparuh, specifically in fourth-grade mathematics instruction. The observations revealed that the learning process still requires media innovations that can increase student engagement and help them better understand the material.

Design Stage

The design process was carried out by considering the results of the needs analysis, student characteristics, and curriculum requirements. The interactive teaching materials were designed to combine text, images, illustrations, and interactive features that support students' understanding of fractions. Furthermore, the design also took into account aspects of attractiveness, readability, and ease of navigation so that students could use them independently or with teacher guidance. The stages of designing these interactive teaching materials included developing a content framework based on the learning outcomes of the Independent Curriculum, designing a storyboard for the presentation flow, selecting appropriate visual and interactive elements, and organizing the materials into Flip PDF Corporate Edition format. Each stage was systematically designed so that the final product could truly support the mathematics learning process in grade IV of SDN 06 Cimparuh and SDN 16 Cimparuh. The following is a display of the Flip PDF Corporate Edition teaching materials.

Development Stage

The designed interactive teaching materials were then validated based on these three aspects. The results of the first validation provided an overview of the product's strengths and weaknesses, and were supplemented with suggestions and input from experts. Based on these results, the researchers made revisions to improve the teaching materials and meet the expected standards. This validation activity aimed to determine the level of validity of the developed interactive teaching materials. Through the validation and revision process, interactive teaching materials based on Flip PDF Corporate Edition were produced that were

suitable and valid for use in mathematics learning in grade IV of SDN 06 Cimparuh and SDN 16 Cimparuh. The media (Figure 1) displays clear learning instructions and navigation buttons that make it easy for students to understand and use.

Figure 1. shows the learning instructions and navigation buttons.

The media (Figure 2) displays learning outcomes and learning objectives.

Figure 2. presents the learning outcomes and objectives clearly to help students understand the direction of learning activities.

Implementation Stage

At this stage, students use interactive teaching materials during the mathematics learning process, specifically fractions, with the guidance of the class teacher. Through this implementation, researchers can observe the extent to which the teaching materials are able to help students understand the concept of fractions, increase engagement in learning activities, and provide a more interesting learning experience compared to the use of conventional teaching materials. The results of this implementation stage also serve as a basis for researchers to assess the level of practicality of interactive teaching materials, both from the perspective of students and teachers. Thus, the implementation process not only tests the feasibility of teaching materials in supporting learning outcomes, but also provides a real picture of the application of interactive teaching materials in grade IV of SDN 06 Cimparuh and SDN 16 Cimparuh.

Evaluation Stage

In the evaluation phase, the interactive teaching materials developed using the Flip PDF Corporate Edition application were thoroughly evaluated through the involvement of teachers and fourth-grade students at SDN 06 Cimparuh and SDN 16 Cimparuh. The evaluation was conducted using a practicality questionnaire as well as pre- and post-test questions to determine the extent to which these teaching materials were practical for use in the mathematics learning process. The questionnaires were given to teachers and students as direct users, so that the assessments obtained truly reflect real experiences in using these interactive teaching materials in the classroom.

Validation Test Results

Media Expert Validity Test Analysis

The validity test was conducted once on August 20, 2025. The validation results showed that each statement received a value range between 3 and 4 with a total score of 36. The validation data from the interactive teaching materials from the validator are presented in the following table 1.

Table 1. Media Validity Test

No	Assessment Items	Score
1	The layout and arrangement of the interactive teaching materials are presented consistently.	3
2	The alignment of the content of interactive teaching materials with the table of contents is maintained.	4
3	The use of text, images and videos in interactive teaching materials is arranged proportionally.	4
4	The background of the interactive teaching material display is designed to be attractive.	3
5	The images and videos used are in accordance with the content of the interactive teaching materials	4
6	The use of images and videos helps clarify the concepts presented in interactive teaching materials.	4
7	The choice of colors in interactive teaching materials is attractive and supports readability.	4
8	Variations in the use of fonts in interactive teaching materials are not excessive and are easy to read	3
9	Interactive teaching materials are easy for users to operate	4
	Total Score	**33**

Analysis of Language Expert Validity Test

The validity test of the language aspects of the interactive teaching materials was conducted by Dr. Jendriadi, M.Pd on June 19, 2025. This validation process was carried out once with the results showing that each statement had a score range between 3 and 4. The total score obtained was 29. These results indicate that the interactive teaching materials developed are appropriate in terms of language and

are suitable for use in the learning process. Data from the validation results of interactive teaching materials by language experts are presented in table 2 below.

Table 2. Language Validity Test

No	Assessment Items	Evaluation
1.	The type and size of letters in Interactive Teaching Materials Using Flip Pdf Corporate Edition in Mathematics learning in Grade IV Elementary School are easy for students to read.	4
2.	The information presented in the Interactive Teaching Materials Using Flip Pdf Corporate Edition in Mathematics learning in Grade IV Elementary School is conveyed clearly and is easy for students to understand.	4
3.	The use of sentences in Interactive Teaching Materials Using Flip Pdf Corporate Edition in Mathematics learning in Grade IV Elementary School is simple, clear, and easy for students to understand.	3
4.	Interactive teaching materials are prepared by following good and correct Indonesian language rules in accordance with the General Guidelines for Indonesian Spelling (PUEBI).	3
5.	The sentences used in Interactive Teaching Materials Using Flip Pdf Corporate Edition in Mathematics learning in Grade IV Elementary School are in accordance with the level of understanding and abilities of students.	3
6.	Consistency of language style in all contents of Interactive Teaching Materials Using Flip Pdf Corporate Edition in Mathematics learning in Grade IV Elementary School.	3
7.	Consistency of sentence structure throughout the contents of Interactive Teaching Materials Using Flip Pdf Corporate Edition in Mathematics learning in Grade IV Elementary School.	4
8.	The suitability of the use of terms in Interactive Teaching Materials Using Flip Pdf Corporate Edition in Mathematics learning in Grade IV Elementary School with Grade IV students.	3
9.	Suitability of vocabulary in Interactive Teaching Materials Using Flip Pdf Corporate Edition in Mathematics learning in Grade IV Elementary School with Grade IV students.	3
	Total number	30

Analysis of Material Expert Validity Test

The data collection for the validity test of the material aspects was carried out on June 17, 2025. The validation process was carried out once, where each statement item was in the value range of 3 to 4. The assessment results showed that the interactive teaching material obtained a total score of 35, which means it has met the eligibility criteria. The data from the validation results of the interactive teaching material from the material validator are presented in Table 3 below.

Table 3. Material Validity Test

No.	Rated aspect	Assessment Score
1	Compliance of material with the Independent Curriculum	4
2	The material in interactive teaching materials can support the achievement of core competencies.	3

3	The description of the material in the interactive teaching materials is clear and complete.	3
4	The systematic presentation of the material is consistent	3
5	Teaching materials are developed according to the needs of students	4
6	The teaching materials developed can provide opportunities for students to learn independently according to their respective abilities.	4
7	Interactive teaching materials are developed in accordance with the Learning Implementation Plan.	4
8	The content of interactive teaching materials broadens students' knowledge and insight.	3
9	Displaying learning videos and images that help students	4
10	The accuracy of the videos and images presented in interactive teaching materials	3
	Total number	**35**

The validation results of interactive teaching materials using the Flip PDF Corporate Edition application for fourth-grade Mathematics at SD Negeri 06 Cimparuh and SD Negeri 16 Cimparuh were obtained overall from three validators. The results can be seen in Table 4.

Table 4. Validation Results

No	Validated Aspects	Validator Assessment Score	Information
1	Material Aspect	87.50%	Very Valid
2	Language Aspects	83.33%	Very Valid
3	Teaching Materials Aspects	91.66%	Very Valid
	Average	**87.50%**	**Very Valid**

This interactive teaching material includes the preparation of a content framework based on the learning outcomes of the Independent Curriculum, designing a storyboard for the flow of material presentation, selecting appropriate visual and interactive elements, and organizing the material into Flip PDF Corporate Edition format. Each stage is systematically designed so that the final product can truly support the mathematics learning process in grade IV of SDN 06 Cimparuh and SDN 16 Cimparuh. The following is a display of the Flip PDF Corporate Edition teaching material. The media (Figure 3) Providing a cover page that matches the media that has a display that gives an attractive impression.

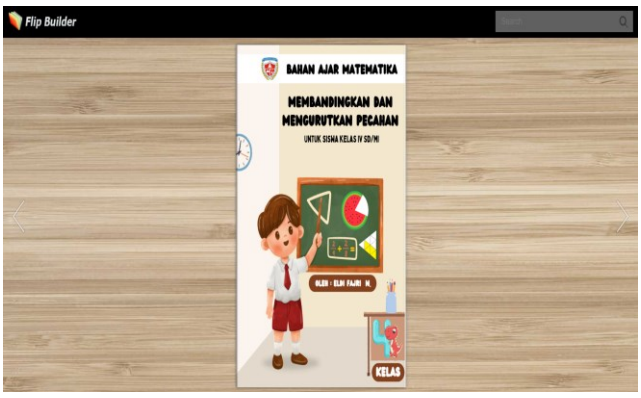

Figure 3. Cover page

Media (Figure 4) The researcher's profile is included in the contents of the Corporate Edition Flip Pdf

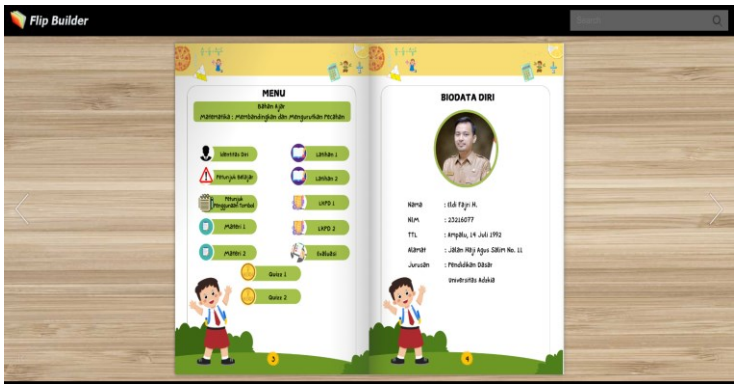

Figure 4. Researcher Profile

The media (Figure 5) contains material that is in accordance with the learning outcomes in grade IV, especially on fraction material.

Figure 5. fraction material

The interactive teaching materials, which had passed the validity testing stage and were declared valid, were then implemented to determine their practicality. The implementation was carried out on 8 fourth-grade students at SD Negeri 06 Cimparuh and 11 at SD Negeri 16 Cimparuh. Practicality data collection took place on August 24, 2025. Following the implementation of the interactive teaching materials based on the Flip PDF Corporate Edition application, fourth-grade teachers were asked to assess the practicality of the teaching materials by completing a prepared teacher response questionnaire. Based on the practicality test results, the assessment was categorized as very practical.The results can be seen in table 5

Table 5. Teacher responses

Name	Score	Criteria
SDN 16 Ciparuh	94.28%	Very practical
SDN 06 Ciparuh	97.14%	Very practical

A student response questionnaire was administered to determine the opinions and practicality of the interactive teaching materials that had been developed and

implemented. The questionnaire was completed by 18 fourth-grade students at SD Negeri 06 Cimparuh and 11 students at SD Negeri 16 Cimparuh on August 24, 2025. The results can be seen in Table 6.

Table 6. Student responses

Name	Score	Criteria
SDN 16 Ciparuh	94.2%	Very practical
SDN 06 Ciparuh	90.35%	Very practical

The effectiveness analysis was conducted using the N-Gain Score technique to quantitatively measure improvements in student learning outcomes. The N-Gain Score calculations from both schools were then analyzed to assess the extent to which the Flip PDF Corporate Edition interactive learning materials contributed to improved student understanding of the material. The results can be seen in Table 7.

Table 7. Results of effectiveness data

Name	N Gain Score	Criteria
SDN 16 Ciparuh	0.7877	Very effective
SDN 06 Ciparuh	0.8090	Very effective

4. Conclusion

Based on the research results, it can be concluded that the interactive teaching materials based on the Flip PDF Corporate Edition application developed for mathematics learning in grade IV of elementary schools have met the criteria of validity, practicality, and effectiveness. Validation by experts showed a very high level of feasibility indicating that the content, language, and presentation of the teaching materials are in accordance with student needs and the direction of the Independent Curriculum. Practicality tests conducted by teachers and students received positive responses, indicating that the teaching materials are easy to use, interesting, and able to support an active learning process. In addition, the results of the effectiveness test showed a significant increase in student learning outcomes with a high N-Gain Score category, confirming that the use of this interactive teaching material can optimally improve the understanding of mathematical concepts. Thus, teaching materials based on Flip PDF Corporate Edition are worthy of being recommended as an innovative learning media that supports the implementation of the Independent Curriculum in elementary schools.

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