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Developing a digital flipbook to improve science learning outcomes for grade IV SDN 026560 Binjai

Wina Mariana Parinduri [1*], Jeena Ann John [2], Titin Rahmayanti Rambe [1], Renni Ramadhani Lubis [1]

[1] STKIP Al Maksum, Langkat, Indonesia, 20811
[2] University of Technology, Bahrain

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Abstract

This study aims to develop and implement a digital flipbook to improve the learning outcomes of IPAS grade IV elementary school students. The research was conducted on grade IV students at SDN 026560 Binjai on the material of the form of substances and their changes. This research is a Research and Development (R&D) study with a 4-D development model: Define, Design, Develop, and Disseminate. The research subjects were fourth-grade students who studied in the odd semester of 2024/2025. The process of developing digital flipbooks to improve the learning outcomes of grade IV students consists of 3 stages of development: the defining stage, the design stage, and the development stage. Based on these stages, the validity of the digital flipbook developed by the researcher was obtained, with the research results from the validity test of media experts in the 93.3% convenient category, material experts of 92.9% in the convenient category, linguists in the 76% valid category, and linguists of 88% in the convenient category. The overall average value of the validity of digital flipbooks is 87.3% with a convenient category, which means that digital flipbooks are suitable to use.

* Corresponding Author.
E-mail address: winamarianaparinduri@gmail.com (Wina Mariana Parinduri)
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1. Introduction

The education system in Indonesia has several core subjects, one of which is science. In the Merdeka Curriculum, at the elementary school level (SD), science and social studies are combined into a single subject called natural and social sciences (IPAS), hoping to encourage children to manage their natural and social environments as a single entity. The Natural and Social Sciences (IPAS) subject is a branch of knowledge that studies living and non-living things

in the universe and their interactions. It views human life as individual and social organisms interacting with their environment.

Knowledge is the logical and systematic combination of various forms of knowledge, considering cause and effect. This knowledge includes natural knowledge and social knowledge. IPAS helps students develop their curiosity about the phenomena occurring around them. This curiosity can motivate students to understand how the universe works and interacts with human life on Earth (Ministry of Education and Culture, 2022). However, in reality, students' curiosity does not emerge in the learning process, causing them to struggle to understand the subject matter, which impacts their learning outcomes.

Learning outcomes are the abilities students acquire after learning experiences from teachers or educators. Some of the experience's students cover the affective, cognitive, and psychomotor domains (Hutapea, 2019). Low learning outcomes among students are one of the challenges in the learning process, which can be attributed to the use of inappropriate learning resources, such as instructional materials. Instructional materials are a crucial supporting factor in imparting knowledge to students. The teaching process becomes more effective with instructional materials, and students grasp concepts more quickly. Teachers can also use Instructional materials as tools and resources to deliver content. However, suppose students do not thoroughly understand the lesson material, and the available teaching materials are also inadequate. In that case, students' ability to grasp the material taught will not be maximised, especially in science education.

Advances influence various aspects of human life in science and technology, such as the constant demand to produce innovations or new products that require new skills from human resources. The influence of science and technology can also be seen in education, where human creativity requires innovation in learning that comes from creating concepts and theories. Digital books have become more popular in recent years due to their smaller size than physical books. They typically include search features, allowing words within the digital book to be quickly searched for and found. Additionally, digital books are efficient as they can be accessed on smartphones and computers.

Digital books are the digital version of printed books. Printed books usually consist of a stack of paper containing text or images, while digital books contain digital information that can be read on mobile phones and computers. Digital technology makes it possible to store, carry, and read books using only a "small" device, smaller than the size of the book itself. Many communication devices, such as mobile phones and computers, can be used as tools for reading digital books.

Based on initial observations conducted at SDN 026560 Binjai, several problems were found in the learning process. This can be seen in the teaching and learning process, where learning prioritises enrichment materials such as books. However, students today focus on spending their free time on their cell phones rather than studying and reading books. As a result, learning affected student learning outcomes. This issue is evident from the IPAS learning outcomes of fourth-grade students at SDN 026560 Binjai, which remain low and have not yet met the minimum completion criteria set. The low IPAS learning outcomes can be seen from the results of students' daily tests, where only 5 out of 25 students scored above the minimum passing grade (KKM) of 70, meaning that only 20% of students scored above the KKM, while 80% scored below it.

Therefore, one of the researchers' efforts to address this issue is to develop teaching materials in the form of digital flipbooks as a learning resource. A flipbook is a visual medium consisting of sheets of paper arranged like a calendar, measuring 21 x 28 cm, bound at the top

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(Susilana & Riyana, 2009). However, with advancements in science and technology, flipbooks can now be presented in a digital format that includes multimedia elements, making the user more interactive with the medium. The researcher developed a conventional flipbook from paper sheets into a digital flipbook in this study. A digital flipbook is a form of self-learning material that is systematically arranged into the smallest learning units to achieve specific learning objectives, presented in a digital format that includes multimedia elements such as videos, images, and audio, making users more interactive with the media.

Using digital learning media through flipbooks can illustrate the material on the Form of Matter and Its Changes in Grade IV at SDN 026560 Binjai. The use of modern media or tools such as flipbooks in teaching is not intended to replace good teaching methods, but rather to complement and support the active involvement of teachers and students in delivering material or information. By using digital textbooks, it is hoped that there is maximum interaction between teachers and students, thereby achieving appropriate learning outcomes.

2. Literature Review

The learning process plays a significant role in education across schools. Their learning experience greatly influences students' success in achieving educational goals. There are various views on learning, and these opinions can vary. Success or failure in learning achievement depends heavily on the students' experiences during the learning process, in which teachers are controllers and developers of the material taught to them.

In line with the above statement, Tanjung, et al (2023) learning is an everyday occurrence at school, but also a complex process. The complexity of learning can be viewed from two perspectives: the student and the teacher. From the student's perspective, learning is experienced as a process. Students undergo mental processes when dealing with learning materials, which include natural phenomena, animals, plants, humans, and information compiled from textbooks. From the teacher's perspective, the learning process appears as behaviour related to learning about a particular subject.

2.1 Digital flipbook

One example of a digital book with three-dimensional technology is a flipbook, where pages can be opened like a book. Digital books through flipbooks can also contain moving animations, audio-visuals, and videos. Unfortunately, few teachers are aware that flipbook digital books have a significant positive impact on students. This is due to a lack of ability to use the information technology that is currently being developed.

Ramdania et al. (2007) state that using digital flipbooks in learning can improve student learning outcomes. This is true given the attractive nature of flipbooks, which contain animations, audio, and video. Students are more interested in their interactive appearance compared to printed books. This latest technology also presents an excellent opportunity for using digital books in science education in distance learning.

The digital book to be developed is created and designed using the Canva application. Canva is an online design program that provides various tools, such as presentations, resumes, posters, pamphlets, brochures, graphics, infographics, banners, bookmarks, bulletins, and so on, available in the Canva application. The presentations available on Canva include creative, educational, business, advertising, technology, and other topics. The digital book designed in Canva is then converted into a flipbook by changing its appearance using the HeyZine website, which is directly available on the Canva website.

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Heyzine flipbook is a free online PDF-to-flipbook converter that provides an electronic book effect that can be opened on each page like a real book. The advantage of digital flipbooks differs from printed modules, as they are not merely words or images that can sometimes bore students and make it difficult for them to understand. Instead, they include engaging elements such as videos, songs, audio, animations, or moving graphics that can be integrated into the digital book. These elements make digital books more engaging, encouraging students to read and study them (Abror et al., 2020). Additionally, by using HeyZine Flipbook, students can easily access e-modules anytime and anywhere using their phones, as teachers can share links and students can open or even download them for free.

2.2 Advantages of flipbook digital books

The advantage of flipbooks is that they help improve students' mastery of abstract concepts or events that cannot be presented in class (Andarini et al., 2013). In addition, the use of flipbook digital media in learning has many advantages, including:

a. Provides a variety of learning materials, from simple images to videos that can be played with a single click, animations, and music.
b. Flipbooks are also efficient, as they can be used indoors or outdoors. The flipbook application generates documents that only need to be downloaded and saved on a smartphone or laptop to be accessed anytime, anywhere.
c. Flipbooks can also increase student activity and interest in learning. Learning effectiveness can increase if the classroom environment is enjoyable and diverse.

2.3 Disadvantages of digital flipbook media

In addition to having many advantages, digital flipbooks have disadvantages, such as only being usable by individuals or small groups of up to 4-5 people (Wahyuliyani et al., 2016). Other disadvantages include:

a. Depending on the power source, such as a power point, if the power source is turned off, this learning media cannot be displayed to students.
b. In addition, it is unsuitable for long materials because not all materials can be presented, and it will be difficult for students to understand them.
c. Flipbooks are limited to individuals and unsuitable for group use.

3. Method

This study was conducted at SDN 026560 Binjai, at Jalan Markisah No. 21, Limau Mungkur Village, Binjai Barat in Binjai. Based on the results of the initial observations conducted at the school, it was found that the lack of variety in teaching materials used by teachers impacts students' learning outcomes. Additionally, the researcher chose to conduct this study at the school because no previous research has been conducted on teaching materials. This study only focused on Grade IV. The study was conducted during the odd semester of 2024/2025.

The research type used is the 4-D (Four D) developmental research method. This model was developed by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melyn I Semmel (1974). The 4-D model was chosen since it is recommended for learning device development. The developed product was subsequently tested for validity and product testing. The 4-D model development consists of four stages: Define, Design, Development, and Disseminate (Trianto, 2015). However, this study was only conducted up to the development stage due to time constraints during the research process, and the learning outcomes were measured only among

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fourth-grade students at SDN 026560 Binjai. The following steps, based on the 4D development model, are:

These steps are described as follows:

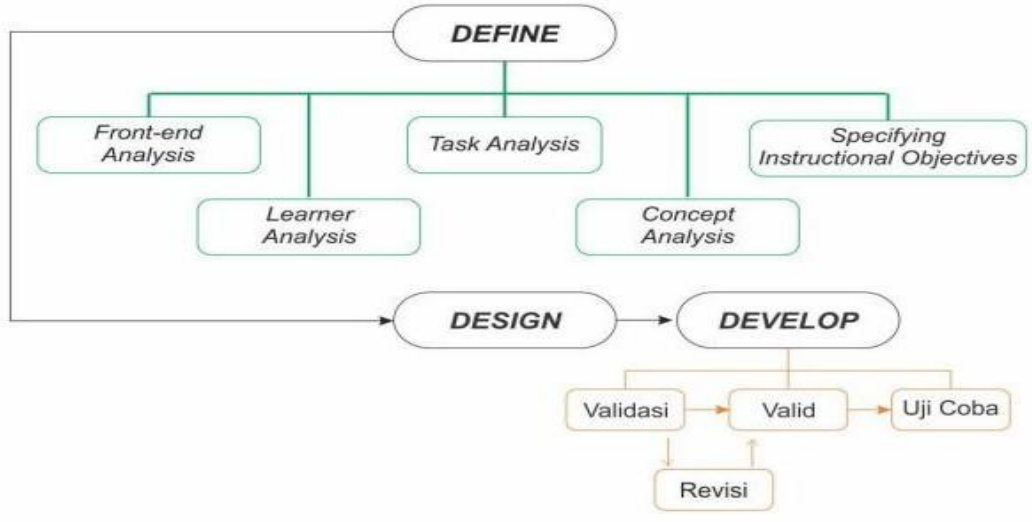

Figure 1. Diagram of the 4D model stages to the 3D stage

Define

The first stage in developing the 4D model is the definition stage. This stage aims to establish and define the learning process requirements and collect various data about the digital book to be developed. In this stage, the researcher conducts a definition to analyse the needs of the digital flipbook to be developed at SDN 026560 Binjai, with material on the form of matter and its changes. In the definition stage, five activities are described: initial-final analysis, student analysis, concept analysis, task analysis, and learning objective specifications.

Design

After the definition stage is complete, the design stage follows. This stage aims to design a digital book for the researcher to develop. The product resulting from the design phase is an initial product called Draft 1, which is used in IPAS learning. In addition to designing the book, the researcher also designs validity sheets, observation sheets for student activities, observation sheets for teachers in managing learning, student response questionnaires, and student learning outcome tests.

Develop

This development stage aims to modify the initial design of the digital book, which has been revised based on expert input and trials with students. Another objective is to produce draft 1 of the digital book and research instruments. Activities such as assessment/validity by subject matter experts, media experts, language experts, and learning experts are carried out at this stage.

4. Results

The development of digital flipbook books was carried out by researchers based on teaching material development procedures following the curriculum of SDN 026560 Binjai, namely the independent curriculum. The researchers obtained several research results from the product development process using Thiagarajan's 4D development model (1974). The 4D model consists of four stages: Define (Definition), Design (Design), Development (Development), and Disseminate (Dissemination) (Trianto, 2015). The 4D model was chosen because it is recommended for instructional material development. However, due to time constraints, the research development was carried out in only three stages (3D). The following explains the data analysis and research results obtained in each stage of the development model.

4.1 Description of the definition stage

The initial stage of this research is the definition stage, which aims to determine and define learning process requirements and collect various data about the digital books to be developed. In the definition stage, five activities are described: initial-final analysis, student analysis, concept analysis, task analysis, and learning objective specifications. The five steps can be explained as follows:

a. Front-end analysis

This stage is carried out to analyse the fundamental problems encountered in IPAS learning activities at SDN 06560 Binjai. The analysis conducted in the initial-final analysis stage is to determine the availability of teaching materials and the needs for teaching materials that students at SDN 026560 Binjai use. The researcher conducted observations at SDN 026560 Binjai as the target to obtain the required information. The observation was conducted on August 19, 2024, at 10:00 a.m. in the teacher's room and classroom IV of SDN 026560 Binjai. The following information was obtained based on the researcher's interview with the fourth-grade teacher, the homeroom teacher and the IPAS teacher at SDN 026560 Binjai.

1. The learning conducted in class IV of SDN 026560 Binjai is based on the independent curriculum.
2. Teaching modules created by teachers based on the independent curriculum.
3. Students only have teaching materials in the form of textbooks or printed books, which consist of summaries of material and exercises that lack precise supporting data or images.
4. Students do not have any other reference books except for the printed books provided by the school (which are only used during class time and are not taken home).
5. Teachers deliver the material systematically according to the material in the printed books.
6. The learning media still used are the equipment available in the classroom, namely, blackboards and markers. Teachers never use learning media that can support teaching and learning activities due to their lack of ability to use technological tools.
7. A lack of understanding of the material and the absence of summative tests at the end of the material cause a decline in student learning outcomes.

b. Learner analysis

An analysis of students in grade IV at SDN 026560 Binjai revealed low enthusiasm for learning. This was because the learning process conducted by teachers was too monotonous, using only textbooks provided by the school. However, students at SDN 026560 Binjai have a desire to work on and learn a particular subject, topic, or section. This, of course, also affects

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their learning outcomes. Therefore, upon observing this issue, the researcher was motivated to create something that could spark students' interest in participating in the learning process, thereby improving their learning outcomes.

The researcher interviewed several students to find out what they liked about learning. The students gave various answers pointing to their preferences in understanding learning, including looking at pictures, watching videos, etc. Given the various situations and conditions, the researcher decided to create teaching materials in the form of digital flipbooks with attractive pictures or educational learning videos to improve learning outcomes.

c. Concept analysis

Concept analysis was conducted to identify important concepts to be included in the digital flipbook. The first step taken by the researcher was to analyse the learning outcomes (CP) and learning objectives (ATP) for the fourth-grade IPAS subject on the forms of matter and their changes. The learning outcomes for this material were that students learn about the states of matter and their changes. Following the learning objectives, it is expected that students are able to 1) identify the states of matter and 2) analyse changes in the states of matter. The sequence of concepts to be organised in the digital flipbook includes a) Material: What is it? b) What Exactly Are the States of Matter? c) How Do the States of Matter Change? After analysing the learning outcomes and learning objectives, the material included in the digital book covers the topic of the states of matter and their changes by the curriculum used at SDN 026560 Binjai, which is the Merdeka Curriculum.

d. Task analysis

In the task analysis stage, researchers analysed the tasks that students must master so that they could be given to students. In this study, evaluation tests were analysed based on the learning objectives listed in the teaching module with material on the form of matter and its changes.

e. Specifying instructional objectives

Learning objectives are formulated to combine task analysis and material analysis objectives into specific learning objectives. From the concept analysis, learning objectives must be achieved in the digital flipbook material on the physical form of substances and their changes have been obtained. The formulation of learning objectives in the material on the physical form of substances and their changes was based on the learning outcomes and learning objective flow listed in the independent curriculum.

4.2 Description of the design stage

This stage aims to design a digital book for researchers to develop. The product resulting from the design stage is an initial product called draft 1, which was used in IPAS learning. In addition to designing the book, researchers also designed validity sheets, student activity observation sheets, teacher observation sheets in managing learning, student response questionnaires, and student learning outcome tests. This activity consists of four stages, namely:

a. Criterion test construction

This study used two tests in the product trial: a pre-test and a post-test. The pretest was conducted at the beginning of the learning process before the students used the digital

flipbook. In contrast, the post-test was conducted at the end of the learning process after the students were taught using the digital flipbook. 17 multiple-choice questions were used and tested to determine their validity. The questions also had a grid in the form of IPAS knowledge material on the nature of substances and their changes. The digital flipbook test differed from the pre-test and post-test questions. The test in the digital flipbook consisted of interactive questions, observation, writing, and practice.

b. Media selection

The selection of media is crucial for efficient learning activities and makes students more active and interested in participating in learning. In this development study, the researcher chose digital books, such as flipbooks, on the Heyzine application as the media. The Heyzine application is quite interesting and efficient in developing interactive modules because it has features that can contain audio-visual and learning videos.

c. Format selection

The format of the digital book was developed based on previous developments and the adoption of relevant sources. The digital book features text, moving images, videos, animations, audio-visuals, and other multimedia content.

d. Initial design

This stage was completed by compiling a preliminary design for the digital flipbook. The following are the steps researchers took in the product's preliminary design.

Digital flipbook design

The preliminary design of the digital flipbook product was carried out in the following stages:

1. Researchers first analyse the material form of substances and their changes, which were packaged into a digital flipbook.
2. After analysing, researchers created a digital flipbook design using the Canva application, which was developed into a digital book.
3. The next step was to create a digital flipbook according to the design. The flipbook was created online using the Canva application in an A4 paper size format.
4. The editing process was carried out on the Canva application, including selecting the paper size, adding colours to the book, writing the cover and text, and selecting images.
5. The completed design was subsequently uploaded to the Heyzine application.
6. The Heyzine application redesigned the digital book by adding educational videos and audio-visual content, selecting the book format, and determining how to flip the pages.
7. The developed digital book includes practice questions as assignments for students.
8. The final step was to save the digital flipbook in PDF format. It should contain links and barcodes that automatically redirect users to the Heyzine website to view the digital flipbook.

4.3 Description of development stages

This development stage aims to modify the initial design of the digital book based on expert input and trials with students. The results of these initial modifications were referred to as draft 1. Subject matter experts, media, language, and learning experts also conducted assessments/validity checks at this stage.

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a. Draft 1

Draft 1 is the result of the design stage that has been developed. Subject matter, media, language, and learning experts tested draft 1. It was deemed insufficient and uninteresting during the digital flipbook validation process conducted by subject matter, media, language, and learning experts. Therefore, improvements are needed based on feedback from the validators.

b. Expert appraisal

After compiling draft one, it was validated by experts or validators. These validators assessed the digital book based on its content, media, language and learning. Three validators specialising in content, media, and language are lecturers at STKIP Al-Maksum Langkat, while one validator specialising in language is an IPAS teacher who is also a fourth-grade homeroom teacher at SDN 026560 Binjai.

The validation of learning tools was carried out by providing files containing barcodes and links that would direct users to the Heyzine website, which displays digital flipbooks. Validators then assessed each validation sheet, which contained scores on a scale of 1 to 5. The validation sheets also included notes providing suggestions and input for improving the digital flipbooks.

a. Validation analysis of digital flipbook books by subject matter experts

Subject matter experts conducted the validity assessment of the digital flipbook to evaluate the validity of the digital flipbook based on aspects such as the alignment of the content with learning outcomes, learning objectives, the sequence of learning objectives, the clarity of the content, and the students' ability to comprehend the material presented in the developed digital flipbook. One lecturer from STKIP Al-Maksum Langkat conducted this assessment. The assessment was conducted at STKIP Al-Maksum Langkat on May 15, 2024. The calculation results in the percentage value table provided by the subject matter expert validator are 92% with a category of highly valid, so no further revision is necessary. However, the validator added suggestions and corrections in the form of notes as improvements to the digital flipbook.

b. Validity assessment of digital flipbook books by media experts

Media experts conducted a validity assessment of digital flipbook books to evaluate the validity of digital flipbook books based on book size, colour display, image quality, video, sound, and text clarity for reading in the developed digital flipbook books. One lecturer from STKIP Al-Maksum Langkat conducted this evaluation. The evaluation was conducted at STKIP Al-Maksum Langkat on May 18, 2024. The expert validator's eligibility percentage is 93.3% with a category of highly valid, so no further revision is needed. However, the validator added suggestions and corrections in the form of notes as improvements to the digital flipbook.

c. Validity assessment of digital flipbook books by language experts

The validity assessment of digital flipbook books by language experts was conducted to evaluate the validity of digital flipbook books based on the aspect of language usage that is easy to understand for elementary school children, by the intellectual level of the students, as well as the communicative and interactive nature of the content included in the developed digital flipbook books. One lecturer from STKIP Al-Maksum Langkat conducted this assessment. The assessment was conducted at STKIP Al-Maksum Langkat on May 11, 2024. The results of the

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percentage feasibility provided by the subject matter expert validator are 76% valid, meaning that no further revisions are necessary. However, the validator added suggestions and corrections in notes to improve the digital flipbook.

5. Discussion

5.1 Development of digital flipbook

The digital flipbook was developed using Thiagarajan's modified 4D development model, which consists of four stages: define, design, develop, and disseminate. This study aims to determine digital flipbooks' validity, practicality, and effectiveness in improving IPAS learning outcomes for fourth-grade students at SDN 026560 Binjai. This study was limited to the development stage only due to time constraints during the research. The definition stage was carried out to obtain an overview of the problems faced in IPAS learning, the condition of the students, and the teaching materials used to support the learning process. The initial observation on August 19, 2024, revealed that the fourth-grade homeroom teacher, who is also the IPAS teacher, explained that the students' enthusiasm for learning was relatively low due to the limited teaching materials used, which also affected the students' learning outcomes. The learning media available in the classroom were only a blackboard and markers. The teacher also never used learning media that could support learning activities due to the teacher's limited ability to use technology. The researcher developed teaching materials as a digital flipbook based on analysing the problems in the IPAS learning process in the fourth grade of SDN 026560 Binjai. The researcher chose to develop a digital flipbook to improve student learning outcomes.

In the design stage, researchers design the digital flipbook that will be developed. In the design stage, several steps are carried out: test preparation, media selection, format selection, and initial design. In this stage, the initial step taken by the researcher is to develop a validation questionnaire, teaching modules, and an initial design for the digital flipbook. The researcher also developed a student response questionnaire, a teacher's guide for managing the learning process, and a learning outcome test to measure the practicality and effectiveness of the digital flipbook. The test instruments developed for the product trial are a pre-test and a post-test.

The second step is the selection of media. The researcher chose to develop a digital flipbook because most students prefer books with many images combined with audio and video learning materials, which makes them more interested in understanding the content. The presentation of materials in the developed digital flipbook was structured according to learning outcomes and the learning objective sequence. The third step is the selection of formats that display text, moving images, videos, animations, audiovisuals, and other multimedia.

The final stage is to design the initial layout of the digital flipbook using the Canva application, which was developed into a digital book. The editing process in Canva included selecting the paper size, choosing the book colour, writing the cover and text, and selecting images. The finished design, including educational videos and audiovisual content, is then uploaded to the Heyzine application.

The third stage is development, which involves several steps, including expert validation and product testing. Draft 1, the initial design of the digital flipbook, was tested by subject matter experts, media experts, language experts, and learning experts.

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a. Subject matter expert validation

Subject matter expert validation was conducted on May 15, 2024. The subject matter expert validation was addressed to Mrs. Titin Rahmayanti Rambe, M.Pd, a Natural Sciences Education Program lecturer at STKIP Al-Maksum Langkat. The expert material assessment received a score of 92% and was categorised as highly valid; thus, no further revisions are necessary. However, the validator added a note for improvement: "The learning outcomes should be specified, and the learning objectives should be aligned with the Merdeka Curriculum."

b. Media expert validation

Media expert validation was conducted on May 18, 2024. It was addressed to Mr. Tedy Putra, M.Si, a Natural Sciences Education Study Program lecturer at STKIP Al-Maksum Langkat. The media expert evaluation received a score of 93.3% in the highly valid category, so no further revisions are needed. However, the validator added the note for improvement: "Add an introduction and table of contents."

c. Language expert validation

Language expert validation was conducted on May 11, 2024. The language expert validation was conducted by Mrs. Elfi Lailan Syamita Lubis, M.Pd, a lecturer in the English Education Program at STKIP Al-Maksum Langkat. The language expert evaluation scored 76% with the category "valid," so no further revisions are needed. However, the validator added the following improvement note: "Adjust to language that is easy for elementary school students to understand."

d. Expert validation of learning

Expert validation was conducted on August 26, 2024. Language expert validation was directed at Mrs. Dewi Sri Rahayu, S. Pd, both the homeroom teacher and IPAS teacher at SDN 026560 Binjai. The expert learning assessment received a score of 88% with a valid category, so no further revisions are needed. However, the validator added a note for improvement: "Add text or reading material so that students also read, not just watch the video."

Overall, the average validity score for the digital flipbook was 87.3, with a highly valid category. After the validation and revision stages were completed, the final step taken by the researcher in developing the digital flipbook was the development testing phase. The researcher conducted the user testing as the IPAS subject teacher for Grade IV and the Grade IV students of SDN 026560 Binjai. The product testing activity was conducted in two phases: small-group testing and large-group testing. The small-group testing was conducted with five students. The testing was conducted on September 2 and 3, 2024, in the fourth-grade classroom at SDN 026560 Binjai—the small-group testing aimed to assess the students' responses to using the developed digital book. Based on the responses of the five students, the average response rate was 86%, indicating that the digital book is suitable for use. However, the students suggested adding pages to the developed digital flipbook. The subsequent trial was a large-scale trial with 25 students. The large-scale trial was conducted to assess the practicality and effectiveness of the developed digital book. The researcher also observed improvements in students' learning outcomes before using the digital book (pre-test) and after using the digital book (post-test).

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5.2 The practicality of using digital flipbooks

The product was ready for testing once the digital flipbook was deemed suitable/valid. The digital flipbook was tested at SDN 026560 Binjai. This was done to determine the practical value of the developed digital book. To determine the practical value, the researcher analysed the observation sheets of student activities and teacher sheets in managing learning. When the researcher conducted learning using the digital flipbook, the researcher observed the activities of the students, which were observed by the fourth-grade homeroom teacher at SDN 026560 Binjai. The number of students observed was 25. Based on the observations conducted through the student observation sheets, the researcher obtained a score of 75.7%; in the second session, the researcher obtained a score of 80.0%; and in the third session, the researcher obtained a score of 85.7%. The overall observation score for student activities from the first, second, and third sessions was 80.5%, categorised as practical.

The product was ready for testing once the digital flipbook was deemed suitable/valid. The digital flipbook was tested at SDN 026560 Binjai. This was done to determine the practical value of the developed digital book. To determine the practical value, the researcher analysed the observation sheets of student activities and teacher sheets in managing learning. When the researcher conducted learning using the digital flipbook, the researcher observed the activities of the students, which were observed by the fourth-grade homeroom teacher at SDN 026560 Binjai. The number of students observed was 25. Based on the observations conducted through the student observation sheets, the researcher obtained a score of 75.7%; in the second session, the researcher obtained a score of 80.0%; and in the third session, the researcher obtained a score of 85.7%. The overall observation score for student activities from the first, second, and third sessions was 80.5%, categorised as practical.

5.3 The effectiveness of using digital flipbooks

Developing digital flipbook books to improve learning outcomes in IPAS for fourth-grade students at SDN 026560 Binjai has proven quite effective. The researcher conducted the study with three meetings for a large-scale trial. The research was based on the teaching modules developed by the researcher. The large-scale trial aimed to determine student learning outcomes, student responses, and improvements in student learning outcomes. The effectiveness of using digital flipbooks could be determined from student learning outcomes and improvements through pre-test and post-test questions. The questions presented were multiple-choice questions tested to ensure validity and reliability, resulting in 17 questions with an easy-to-moderate difficulty level.

The pre-test results showed an average score of 40.0%, categorised as incomplete, with 25 students requiring guidance. Meanwhile, the post-test results showed an average score of 81.4%, categorised as complete, with 18 students categorised as excellent, three as good, and four requiring guidance. Therefore, based on these results, it can be concluded that using digital flipbooks is effective. The responses from the 25 students who used the digital flipbook during learning had an average of 67.6%, indicating that the digital flipbook is effective. The N-Gain calculation to determine the effectiveness of the digital flipbook yielded a value of 0.7 (high category).

6. Conclusion and Implications

The conclusions from the research results presented in the previous chapters are as follows:

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a. Developing a digital flipbook to improve learning outcomes for fourth-grade students at SDN 026560 Binjai through three development stages: the definition, design, and development. Based on these stages, the validity of the digital flipbook developed by the researcher received a score of 92% from subject matter experts, categorised as highly valid; a score of 93.3% from media experts, categorised as highly valid; a score of 76% from language experts, categorised as valid; and a score of 88% from learning experts, categorised as highly valid. The overall average validity score of the digital flipbook was 87.3%, categorised as highly valid, meaning the digital flipbook is suitable for use.
b. The digital flipbook's practicality was measured through active student observation and teachers' ability to manage learning. The fourth-grade homeroom teacher at SDN 026560 Binjai conducted the assessment during the researcher's implementation of learning activities using the digital flipbook. Active student observation scored 80.5% in the practical category, and teacher observation of their ability to manage learning scored 84.7% in the convenient category. Thus, based on the overall criteria obtained, the digital flipbook meets the practicality criteria for use.
c. The improvement and completion of student learning outcomes and student response questionnaires measure the effectiveness of the digital flipbook. Student learning outcomes improved with an N-Gain score of 74.7%, falling into the “sufficiently effective” category, and the completion rate of student learning outcomes scored 84% in the “very effective” category. The student response survey on the digital flipbook scored 67.7% in the “very effective” category. Thus, based on the overall criteria obtained, the digital flipbook met the effectiveness criteria for use.

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