



Development of Environment-Based Digital Flipbook Teaching Materials to Enhance Learning Independence among Elementary School Students

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Abstract: This study aims to develop environment-based digital flipbook teaching materials to enhance elementary school students' learning independence, particularly on the topic of food chains. The research employed a Research and Development (R&D) method using the ADDIE model. The instruments used in this research included observation, interviews, questionnaires, and learning outcome tests. Data analysis techniques comprised feasibility testing, effectiveness testing, user response testing (students and teachers), and assessment of students' learning independence level. The results show that the digital flipbook was highly feasible, with media expert validation scoring 90.43% and material expert validation scoring 84.37%. The effectiveness test revealed a significant improvement in learning outcomes, with the average pretest score increasing from 55.52 to 90.34 in the posttest, and an N-Gain score of 78.28% (high category). Moreover, student and teacher responses to the flipbook were highly positive, with percentages of 95.47% and 98.33%, respectively. Additionally, students' learning independence significantly increased, reaching 86.89%, which falls into the very high category. These findings suggest that the environment-based digital flipbook is effective in strengthening conceptual understanding of food chains while fostering learning independence through an interactive, contextual, and enjoyable approach.

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Introduction

Learning independence is one of the key indicators in achieving educational goals. According to Alperi (2019), learning independence refers to a condition in which a person engages in learning activities independently, marked by motivation, initiative, and responsibility in solving learning problems. Independent learners tend to be more active in seeking information and developing a deeper understanding. Kurnia Bungsu et al. (2019) emphasize that independence plays an important role in learning, as it fosters effective and sustainable learning skills. Similarly, Tresnaningsih et al. (2019) stated that independent learning is one of the key factors in learning success.

However, observations at SD Negeri Pontang 1, Pontang District, Serang Regency, Banten Province, revealed that most students still depend heavily on teachers, lack self-confidence, and have not yet utilized technology in their learning processes. Teacher-centered learning remains a barrier to fostering students' learning independence. In fact, as noted by Ningsih & Nurrahmah (2016), learning independence is the ability to manage learning activities independently by utilizing students' own abilities.

In today's educational context, the use of technology offers an alternative approach to promote independent learning. Marits (2021) explains that technology plays an essential role in supporting the teaching and learning process and encourages students to be more active



and independent learners. Students' familiarity with technological devices such as smartphones can be leveraged through the use of digital teaching materials like flipbooks. A flipbook is an interactive learning medium presented in a digital book format that combines text, images, videos, and animations (Setiadi et al., 2021; Yuningsi et al., 2022). Flipbooks allow students to access materials anytime and anywhere, thereby facilitating independent learning. Moreover, teachers can monitor students' learning progress and provide more personalized feedback.

Several previous studies have confirmed the effectiveness of flipbooks as learning media. Yulaika et al. (2020) found that flipbook-based teaching materials improved students' learning outcomes and engagement. Research by Dayanti (2021) showed that the use of multimedia in flipbooks made learning more engaging. However, these studies have not explored external factors influencing the effectiveness of flipbooks, such as teacher readiness or technology access, and have not specifically examined their impact on students' learning independence.

Furthermore, based on an evaluation of the learning outcomes of Grade V students at SD Negeri Pontang 1, the average score for formative tests on the food chain topic remained below the Minimum Mastery Criteria (KKTP), with an average score of 60.25. Teachers encountered difficulties in delivering material using only textbooks, making it hard for students to understand the concept of the roles of living organisms in ecosystems. Malinah and Jamaludin (2023) noted that the food chain concept is challenging because students need to comprehend the roles of various ecosystem components such as producers, consumers, and decomposers. A solid understanding of food chains is essential for raising awareness of the importance of maintaining environmental balance (Silalahi & Budiono, 2023).

From the literature review, it is evident that flipbooks have been proven effective in improving learning outcomes and attracting student interest. However, no study has specifically developed digital flipbook teaching materials based on students' surrounding environments for the food chain topic while linking them to the enhancement of learning independence. Therefore, this study presents a novelty in the development of environment-based digital flipbook teaching materials for the food chain topic to foster students' learning independence. The developed flipbook is expected to help students learn more independently through media that are relevant and relatable to their daily lives.

Research Method

This study employed a Research and Development (R&D) method. Research and Development (R&D) is a research approach used to create a specific product and test the effectiveness of the applied method (Hanafi, 2017). According to Fayrus & Slamet (2022), R&D is a type of research used to develop a particular product and evaluate how effective that product is. Needs analysis-based research is necessary to generate specific products and test their effectiveness to ensure they can be utilized by the broader community. Developmental research is a process used to design and validate products used in education. The products developed may include teacher training materials, learning materials, media, assessment tools, and instructional management systems.

This study applied the ADDIE model developed by Robert Maribe Branch, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. Branch (2009) states, "The ADDIE model includes five phases: Analyze, Design, Develop, Implement, and Evaluate." The ADDIE development model serves as a guideline for creating



effective products because it has clear steps, each of which includes detailed components relevant to educational product development.

This research was conducted at SD Negeri Pontang 1, Pontang District, located on Ciptayasa Street KM. 13, Singarajan Village, Serang Regency. The study was carried out during the second semester of the 2024/2025 academic year, specifically in May 2025. The trial subjects in this study were fifth-grade students at SD Negeri Pontang 1 in the second semester of the 2024/2025 academic year. The instruments used in this research included observation, interviews, questionnaires, and learning outcome tests. The data analysis techniques consisted of feasibility testing, effectiveness testing, user response testing (students and teachers), and assessment of students' learning independence level.

Results and Discussion

1) Product Development Results of the Digital Flipbook Teaching Material

A. Analysis Results

Needs Analysis

The needs analysis was conducted through an interview with the fifth-grade teacher at SDN Pontang I on March 28, 2025. The results revealed limitations in the IPAS subject textbooks under the Merdeka Curriculum and the minimal use of ICT in the learning process. This issue aligns with Mulyasa's (2021) findings regarding the limitations of infrastructure and teacher training. Other studies have shown that digital media such as interactive flipbooks can improve students' understanding and learning independence. Therefore, developing digital flipbook teaching materials on the topic of food chains becomes a relevant solution.

Curriculum Analysis

SDN Pontang I implemented the Merdeka Curriculum in the 2024/2025 academic year. This curriculum provides flexibility for both teachers and students in selecting learning methods. Competency Achievements (Capaian Kompetensi – CP) and Learning Objectives (Tujuan Pembelajaran – TP) can be achieved with the support of relevant teaching materials. In the IPAS subject, particularly in the food chain topic, a contextual and visual approach is needed. Digital flipbooks are considered appropriate because they present material interactively, support independent learning, and align with the principles of the Merdeka Curriculum (Rizaldi & Amelia, 2021).

Student Characteristics Analysis

Fifth-grade students are at the end of Piaget's concrete operational stage, characterized by the ability to think logically about concrete objects. Therefore, concrete and visual learning media are essential. Digital flipbooks support this learning style by presenting material interactively and in an easily accessible format. Moreover, when guided wisely, the use of smartphones—supported by school Wi-Fi and clear usage regulations—can foster digital discipline, independence, and positive utilization of technology in learning (Yuliani & Rosnawati, 2022).

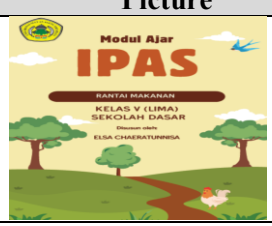




B. Design Results

Initial Design






In the initial design of the digital flipbook teaching material, the researcher prepared a preliminary draft in the form of a storyboard. A storyboard is a visual representation of the concept of a media or application to be developed, providing an initial overview of its structure and development flow (Kunto et al., 2021). The storyboard includes a plan for writing the core content to be developed in the teaching

material. The preparation of this teaching material was aligned with the curriculum analysis results, including the Learning Competencies (Capaian Pembelajaran), Learning Objectives (Tujuan Pembelajaran), and students' needs for effective learning materials.

Table 1. Initial Design of the Digital Flipbook Teaching Material

Part	Picture	Description
Cover		The title of the material ("Food Chain") is displayed along with a thematic illustration in the form of a natural ecosystem image. It also includes the author's name, class, and school identity.
Prololouge		The prologue serves to attract the reader's attention, provide context for the material development, and explain the relevance of the topic to real life and the curriculum.
User guide		The user guide functions to provide clear instructions on how to access and effectively utilize the teaching materia
Learning objectives		Learning objectives serve as benchmarks for the competencies that students are expected to achieve by the end of a certain phase or grade level.
Main content		The main content presents information, concepts, and explanations relevant to the topic, helping students understand the subject matter in a structured and goal-oriented manner according to the expected learning outcomes.



Videos		Videos are used to deliver material dynamically, making it easier to absorb information and enhancing student interest and engagement in the learning process, either independently or under teacher guidance.
Practice questions		Practice questions aim to assess students' understanding of the material learned, while also training critical thinking skills and the application of concepts.
Reflwction		Reflection in the teaching material is used to evaluate the effectiveness and quality of the learning process.
Conclusion		The conclusion is meant to summarize the key findings, affirm the effectiveness of the developed product or strategy, and provide an overall assessment of its quality and impact.
Glossary		A glossary in the teaching material provides a list of important terms along with their definitions in a clear and concise manner.

Criteria Test

The development of the criteria test involves designing an assessment instrument for the digital flipbook teaching material using an evaluation questionnaire aimed at measuring the feasibility of the developed product. The instrument was created based on previously prepared indicators and has undergone a validation process by experts (instrument judgment). The expert validation instruments consisted of media experts and content experts. The aspects evaluated by the media experts included screen design layout, ease of use, consistency, usefulness, graphic design, and integration with the aspect of learning independence. The aspects evaluated by content experts included content/material feasibility, language, presentation, and integration with learning independence as well.



C. Development Results

After the design phase, the researcher developed an environment-based digital flipbook teaching material by reviewing the fifth-grade food chain topic and processing it using Canva and Flip PDF Corporate Edition to make it interactive with visual elements and educational videos. The teaching material was then uploaded to a flipbook builder platform for online access. Product validation involved three content experts and three media experts from FKIP Untirta lecturers and elementary school teachers. The results showed that the teaching material was categorized as “highly feasible” for use. The experts also provided constructive feedback to improve the content and technical aspects of the flipbook, allowing for more optimal development tailored to classroom learning needs.

D. Implementation Stage

After the environment-based digital flipbook was developed and validated, the implementation stage was carried out from May 2–8, 2025, in the fifth-grade class at SD Negeri Pontang 1, involving 29 students. The activity began with a pretest to measure prior knowledge, followed by independent learning using the flipbook, which was accessed via a link and QR code. The learning objectives included understanding the food chain and strengthening learning independence aspects such as responsibility, creativity, and problem-solving. The learning process was structured, beginning with media introduction, material exploration through images and videos, note-taking of key points, reflection, and practice questions. Students also conducted self-assessment to evaluate their learning progress and determine the next steps, resulting in an active, independent, and guided learning experience.

E. Evaluation Results

After the digital flipbook teaching product was implemented for fifth-grade students, the final stage of the research and development process was evaluation. This stage aimed to assess the effectiveness of the developed digital flipbook in fostering students’ learning independence, as measured by the average student learning outcomes (Purwanto, 2012:101). In addition, during this evaluation stage, user responses—both from teachers and students—were analyzed by observing the feasibility and effectiveness of the digital flipbook using the interpretation of the N-Gain effectiveness score, with a percentage above 76% (Nawir & Khaeriyah, 2019). In this study, the researcher also measured the level of students’ learning independence as one of the key indicators for evaluating the effectiveness of the digital flipbook. Learning independence is a relevant aspect in the context of the Merdeka Curriculum, which encourages students to be active, independent, and responsible in their learning process.

2) Feasibility of the Digital Flipbook Teaching Material

A. Media Expert Validation

The evaluation by media expert validators aimed to ensure that the content presented was accurate, relevant, aligned with the curriculum, and easy for students to understand. The media expert assessment of the digital flipbook teaching material was based on six aspects: screen design layout, ease of use, consistency, usefulness, graphic design, and integration of learning independence.

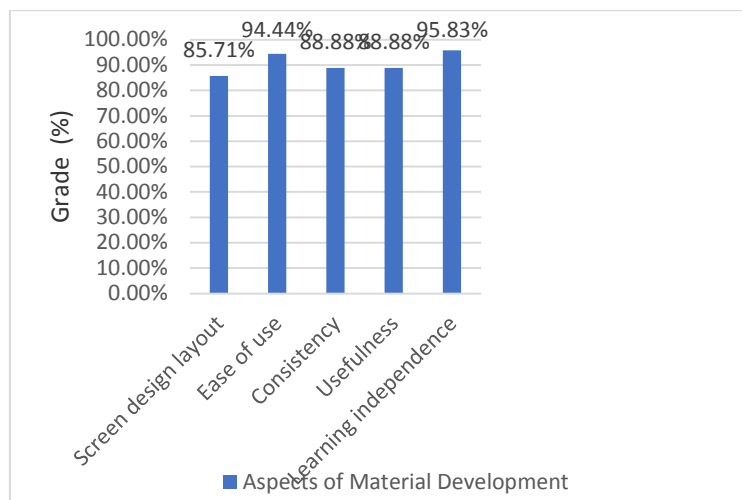


Figure 1. Results of Media Aspect Evaluation

Based on the analysis of six media feasibility assessment aspects by three expert validators, the digital flipbook teaching material was declared "highly feasible" for use, with the highest score in the aspect of learning independence (95.83%) and the lowest in screen design layout (85.71%). The media was considered effective in promoting student independent learning in line with the principles of the Merdeka Curriculum, as supported by Damayanti & Sulastri (2022). However, the validators provided some suggestions for improvement, particularly regarding the visual appearance, which was considered monotonous, even though the text color was appropriate for readability (Sungkono & Lestari, 2021). It was recommended to add visual elements such as icons, infographics, animations, and QR codes to facilitate content access and enhance interactivity, in accordance with findings by Wijaya & Kurniawati (2023), in order to refine the media and make it more engaging and optimal for students.

B. Content Expert Validation

The evaluation conducted by content expert validators aimed to ensure that the material content presented was accurate, relevant, aligned with the curriculum, and easily understood by students. The validation results included both qualitative data in the form of feedback and suggestions for improvement, and quantitative data in the form of scores converted into feasibility ratings. The validation was carried out using an assessment instrument comprising 23 indicators, divided into four aspects: content/material feasibility, language, presentation, and learning independence.

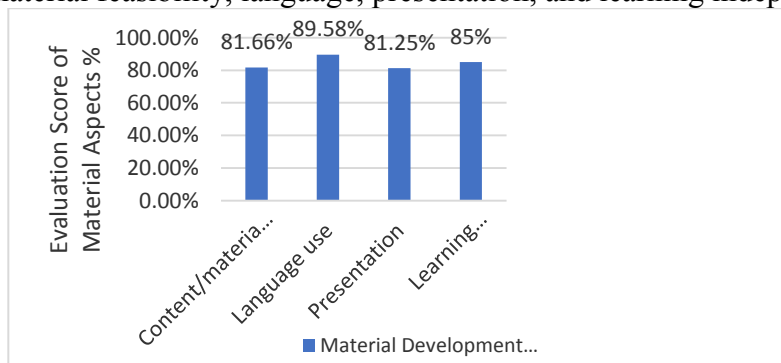


Figure 2. Results of Material Aspect Evaluation



The results of the content expert assessment for the environment-based digital flipbook teaching material showed that the media was generally categorized as “very good,” although the presentation aspect still needed improvement, having received the lowest score of 81.25%. Enhancements were recommended particularly in the visual layout, structure of the material, and delivery flow to make it more systematic and engaging, in line with the characteristics of elementary school students (Sadiman et al., 2020). Meanwhile, the language aspect received the highest score of 89.58%, indicating that the language style and sentence structure in the flipbook were appropriate for students’ cognitive abilities and supported active engagement in independent learning, as emphasized by Muslich (2018).

3) Effectiveness of the Digital Flipbook Teaching Material

A. Learning Outcomes Test

Based on the pretest results, students’ average score was only 55.52 out of 100, indicating low initial understanding of the food chain topic. This suggests that conventional learning approaches had not been optimal in helping students build concepts independently. Slavin (2019) states that low initial mastery levels require more active and contextual learning strategies, while Piaget (in Papalia et al., 2021) emphasizes the importance of concrete approaches for elementary students. Therefore, the use of digital teaching materials such as flipbooks becomes a relevant alternative as they present material visually and engagingly, matching students’ cognitive development needs,

After using the flipbook, the average posttest score increased significantly to 90.34, showing that students were better able to understand the material through interactive digital media. This was supported by an N-Gain score of 0.7828, which falls into the high category (Ramdhani et al., 2020), indicating the effectiveness of the teaching material in bridging students’ understanding gaps. Flipbook-based learning, which is multimodal—combining text, images, and video—facilitates active engagement and strengthens information retention (Mayer, 2021). These findings are consistent with the study by Putra and Amelia (2023), which found that interactive media can enhance critical thinking and learning independence, in line with the Merdeka Curriculum’s emphasis on active and self-directed learning (Kemendikbudristek, 2022).

4) User Response Results (Students and Teachers)

In addition to measuring the effectiveness of the environment-based digital flipbook teaching material through students’ learning outcomes, the researcher also collected and analyzed qualitative user response data from both students and teachers. Responses were gathered from 29 students and 2 fifth-grade teachers at SD Negeri Pontang 1 who had used the teaching material in the food chain topic.

A. Student Responses

The analysis of student response tests showed that the environment-based digital flipbook received a score of 92.19%, categorized as “very good.” This high level of positive response reflects that the flipbook successfully fulfilled the aspects of effectiveness, efficiency, and appeal in the learning process. The interactive and visually dynamic flipbook increased students’ motivation to learn, in line with Arsyad’s (2021) view that media combining visual, audio, and text elements can enhance engagement and material internalization. Moreover, the digital flipbook



allowed students to study independently at their own pace, supporting adaptive and student-centered learning as emphasized in the Merdeka Curriculum. According to Warsita (2020), digital learning materials that are accessible and user-friendly can enhance learning independence. Features such as interactive videos, engaging illustrations, and practice questions helped students develop independent and reflective study habits. Therefore, the digital flipbook teaching material is a viable and innovative alternative for effective learning media.

B. Teacher Responses

In addition to student feedback, the researcher also collected and analyzed responses from teachers as primary users and facilitators in the learning process. Teacher responses are significant because they are not only implementers of learning but also act as guides in using media and as evaluators in assessing the effectiveness of digital flipbook teaching materials in real classroom contexts. According to Sadiman et al. (2020), teacher involvement in teaching material evaluation is essential to ensure that developed media align with classroom needs and student characteristics. Therefore, the researcher involved two fifth-grade teachers from SD Negeri Pontang 1 and SD Negeri Domas to provide feedback on the use of the developed digital flipbook.

5) Students' Learning Independence Level Results

The researcher evaluated students' learning independence levels using a questionnaire that measured responsibility, activeness, creativity, problem-solving ability, and sustainability of learning during the use of the environment-based digital flipbook on the food chain topic. Based on the questionnaire completed by 29 fifth-grade students, the average score was 86.89%, indicating a "very high" level of learning independence. This result shows that the interactive flipbook effectively encouraged students to study independently, manage their time, and actively explore the material. These findings align with the views of Musfiqon and Nurdyansyah (2019) and Widyastuti and Arifin (2021), who argue that interactive digital media can enhance intrinsic motivation and flexible learning, thus supporting the development of sustainable and self-directed learning habits.

Conclusion

The research results indicate that the digital flipbook teaching material is highly feasible for use, with validation scores of 90.43% from media experts and 84.37% from content experts. In terms of effectiveness, there was a significant improvement in student learning outcomes—from an average of 55.52 (pretest) to 90.34 (posttest), with an N-Gain score of 78.28% (high category). Both student and teacher responses were highly positive, scoring 95.47% and 98.33% respectively, indicating that the flipbook is engaging, easy to use, and supports active conceptual understanding. Furthermore, students' learning independence significantly increased with a score of 86.89% (very high category). Thus, the flipbook is proven to be effective in enhancing students' understanding and learning independence through an interactive and enjoyable approach.

Recommendation

Based on the findings of this study, it is recommended that teachers begin integrating environment-based digital flipbook teaching materials into the learning process, particularly for the food chain topic, as the media has proven to enhance students' learning independence



through engaging and contextual content. Teachers are also encouraged to utilize the surrounding environment as a relevant learning resource and to provide opportunities for students to access and study the flipbook both inside and outside the classroom. For future researchers, it is suggested to develop similar teaching materials for different subjects and grade levels using more robust research methods, such as experimental designs, and to broaden the sample size for greater generalizability. Additionally, researchers may explore the development of flipbooks with additional interactive features and investigate the long-term impact of their use on the formation of independent learning habits among students.

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