



## Smart apps-based digital pop-up book: a technological innovation to enhance learning outcomes in social studies learning

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### **Abstract**

*In today's digital era, integrating interactive media into education is essential for enhancing student engagement and learning outcomes. Many elementary schools struggle to adopt digital learning media due to limited resources, inadequate technological infrastructure, and insufficient teacher training. Traditional teaching methods remain dominant, leading to lower student engagement and comprehension. Initial observations revealed that only 60% of students met the minimum passing grade in the social studies topic of human needs. This finding highlights the need for innovative learning media to improve student understanding. This study develops and evaluates the effectiveness of a smart app-based digital pop-up book as a more interactive and engaging learning tool. The study follows the research and development (R&D) method using the ADDIE model, which consists of analysis, design, development, implementation, and evaluation stages. Data collection involved expert validation, teacher and student response surveys, and pretest-posttest assessments. Validation results indicate a feasibility level of 90% from subject matter experts and 88.2% from media experts. Both small-scale and large-scale trials showed that teachers and students rated this media as highly effective. The N-gain test score of 0.75 indicates a high improvement in learning outcomes. The findings demonstrate that the Smart Apps-Based Digital Pop-Up Book significantly enhances learning effectiveness and student engagement in social studies education. Integrating similar interactive media into elementary school curricula is strongly recommended to improve the overall quality of education.*

**Keywords:** *learning media; digital pop-up book; learning effectiveness; learning outcomes; social learning.*

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## **INTRODUCTION**

The rapid advancement of digital technology has transformed various sectors, including education. However, many schools still struggle to integrate technology effectively due to limited resources and insufficient teacher training (Nandang, 2023). In this context, Digital Pop-Up Books play a crucial role in enhancing accessibility, engagement, and comprehension in learning (Arifin et al., 2024). In the context of 21st-century education, improving students' learning outcomes serves as a measurable indicator of their mastery of critical skills such as problem-solving, digital literacy, and analytical thinking. Instructional innovations, therefore, must focus not only on technology integration but also on enhancing learning outcomes as an indicator of these essential skills. (Desania et al., 2020). This study evaluates learning outcomes through three key indicators: (1) conceptual understanding, which reflects students' analytical thinking skills; (2) student engagement, which represents their ability to collaborate and communicate; and (3) academic improvement, which demonstrates their problem-solving abilities. Higher-order thinking skills (HOTS) are essential for developing students' analytical and problem-solving abilities, enabling them to navigate complex challenges in the 21st century (Febrianti et al., 2021). Research has shown that integrating HOTS-based questions into assessments significantly enhances students' conceptual understanding and critical thinking skills, leading to better academic performance (Nofrion & Wijayanto, 2018).

By incorporating the Smart Apps-Based Digital Pop-Up Book, this study enhances student learning through an interactive approach while reinforcing critical thinking to support deeper comprehension and academic success. Conceptual understanding is measured through pretest and posttest scores, student engagement is observed through participation and interaction, and academic improvement is analyzed using the N-gain test, which reflects students' ability to process information critically (Azizah, 2022).

Despite its importance, the implementation of HOTS-based learning faces challenges, particularly due to inconsistent teacher perceptions and inadequate training (Tyas et al., 2019). Additionally, many students struggle with engagement and social skills, including communication and teamwork (Efendi & Wiradimadja, 2024). Interactive digital media, such as Smart Apps-Based Digital Pop-Up Books, offer a solution by fostering student engagement and collaboration (Susanti, 2023).

The Merdeka Curriculum in Indonesia emphasizes digital learning to develop students' higher-order thinking skills (HOTS). However, its implementation faces challenges due to limited teacher training and resources (Maulana, 2022). Digital Pop-Up Books provide an interactive and engaging learning experience, supporting both teachers and students. Research confirms their effectiveness in various subjects, making them a promising tool to enhance elementary education outcomes (Kanber et al., 2023).

This study develops and evaluates a Smart Apps-Based Digital Pop-Up Book to improve learning outcomes in fourth-grade social studies, particularly in the topic of human needs.

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Unlike conventional static media, this interactive resource integrates enhanced visuals, self-assessment tools, and multimedia elements, making learning more engaging and effective.

The integration of HOTS in the Merdeka Curriculum follows the Revised Bloom's Taxonomy (Maulana, 2022), categorizing cognitive skills into LOTS (Lower-Order Thinking Skills), MOTS (Middle-Order Thinking Skills), and HOTS (Higher-Order Thinking Skills). However, elementary social studies education still faces challenges. In fourth grade at SDN 1 Tempel, Blora Regency, social studies lessons remain teacher-centered, relying heavily on lectures and textbooks, which limit student engagement and comprehension.

Surveys indicate that students prefer digital media, yet its implementation remains limited due to a lack of interactive instructional resources. Research highlights that interactive textbooks improve comprehension by making information more engaging and accessible. Pop-Up Books simplify content, enhance engagement, and support cognitive skill development (Ahmed, 2022). Discussions with teachers and students confirm a preference for Pop-Up Books over traditional textbooks, particularly in 4th-grade Social Studies and Science (Aulia & Wandini, 2024).

A promising solution to these challenges is the Smart Apps-Based Digital Pop-Up Book, which enhances traditional instructional methods by integrating interactive animations, audiovisual explanations, and self-assessment tools. Unlike conventional textbooks and static digital slides, this medium fosters student engagement through real-time interaction and gamified assessments (Putri et al., 2023). Previous research confirms that Digital Pop-Up Books significantly improve students' comprehension and motivation by making abstract concepts more tangible and accessible (Febriyanti & Sulistyawati, 2024; Pinto, 2023).

While prior studies validate the effectiveness of Digital Pop-Up Books, this research introduces several key innovations. First, it develops a Smart Apps-Based Digital Pop-Up Book, designed for compatibility across multiple devices, offering greater flexibility for students and teachers. Second, this study focuses on social studies learning, specifically human needs, a topic that has received limited attention in previous research. Unlike earlier studies, which primarily examined Pancasila Education, ecosystems, and mathematics, this study integrates interactive animations, background music, and educational videos from YouTube to clarify abstract concepts.

A notable innovation is the Quizizz-based assessment feature, enabling students to evaluate their understanding immediately after the lesson. Additionally, this study measures effectiveness through expert validation, teacher-student feedback, and learning outcome analysis using the N-gain test, which resulted in a high category score of 0.75. This confirms that the Smart Apps-Based Digital Pop-Up Book is valid, engaging, and significantly enhances students' comprehension, particularly in elementary social studies education.

The assessment of learning outcomes in this study is based on three key indicators: (1) conceptual understanding (pretest and posttest scores), (2) student engagement (observational data and feedback), and (3) academic improvement (N-gain test analysis). These learning

outcomes are strongly linked to critical thinking and comprehension skills, essential components of 21st-century education.

By supporting teachers in implementing more innovative, creative, and effective teaching methods, particularly in the Me and My Needs topic, this research addresses the limitations of conventional media. Unlike traditional resources that rely on static slides, this interactive digital tool features enhanced visuals, diverse color schemes, and immersive backgrounds, creating a dynamic learning experience. Background music and direct-access learning videos further enrich the process, while Quizizz-based assessments provide immediate feedback. The Smart Apps-Based Digital Pop-Up Book represents a significant advancement in digital learning resources, offering a more engaging and interactive approach for elementary education.

## **METHOD**

This study employs a Research and Development (R&D) approach to design, develop, and assess the effectiveness of a Smart Apps-Based Digital Pop-Up Book for fourth-grade social studies at SDN 1 Tempel, Blora Regency. Fourth-grade students were selected for this study because they are in a critical transition phase from lower to upper elementary levels. At this stage, students begin to engage with more complex concepts, making them an ideal group to assess the effectiveness of interactive learning media. According to Piaget's theory of cognitive development, fourth-grade students are in the concrete operational stage, where they learn best through visual and interactive media. Therefore, this grade level was deemed most suitable for evaluating the impact of the Smart Apps-Based Digital Pop-Up Book on learning outcomes in social studies. The research follows the ADDIE model, a systematic instructional design framework consisting of five structured stages:

### **Analyze**

The researcher conducted classroom observations and interviews with fourth-grade teachers at SDN 1 Tempel to identify key learning challenges. Additionally, student questionnaires were administered to evaluate their engagement with the existing instructional media.

### **Design**

The researcher designed the structure and content of the Digital Pop-Up Book based on the topic "Me and My Needs." Initial storyboards and interactive elements were developed using Canva, Adobe Illustrator, and PowerPoint to enhance visual engagement and interactivity.

### **Development**

The researcher developed the Digital Pop-Up Book, incorporating animations, background music, and embedded YouTube videos to enhance interactivity and engagement. Additionally, Quizizz-based assessments were integrated to evaluate students' comprehension. The book

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underwent expert validation, receiving a 90% approval rating from subject matter experts and 88.2% from media experts, confirming its content quality and technical feasibility.

### Implementation

The researcher conducted small-scale testing with eight fourth-grade students from SDN Kemiri 02 and large-scale testing with 19 fourth-grade students from SDN 1 Tempel. Additionally, student and teacher feedback were collected through response sheets to assess user experience and instructional effectiveness.

### Evaluation

The researcher evaluated the effectiveness of the media by analyzing pretest and posttest scores. To measure learning improvements, paired sample t-tests and N-gain analysis were conducted. The N-gain score of 0.75, classified as high, demonstrates a significant enhancement in student learning outcomes.

The study population comprised all fourth-grade students at SDN 1 Tempel, with the sample selected through purposive sampling based on its relevance to the research objectives. Data collection methods included pretests and posttests, observations, interviews, and questionnaires. To assess learning effectiveness, the data were analyzed using descriptive statistics, t-tests, and N-gain calculations. The research framework is visually represented in Figure 1.

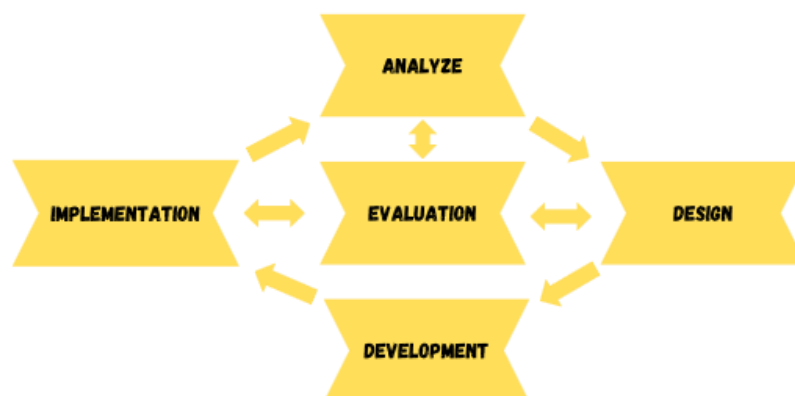


Figure 1. Schema model ADDIE

This study employed both test and non-test methods to assess students' abilities and validate the Smart Apps-Based Digital Pop-Up Book as an effective learning tool. The test method involved administering pretests and posttests to evaluate students' understanding before and after using the developed media. The test comprised 30 multiple-choice questions, carefully selected based on validity and reliability analysis. To ensure accuracy, the researcher applied

item analysis criteria, retaining only questions that met the required validity standards, as presented in Table 1.

Table 1. Result of question item analysis

Criteria for analysis	Results of the analysis
Question validation	30 valid questions out of 50 questions with a coefficient value of > 0.404
Realism of the question	Cronbach's coefficient alpha = 0.927
Difficulty level	<ul style="list-style-type: none"> <li>• Easy category = 8 questions</li> <li>• Medium category = 19 questions</li> <li>• Difficult category = 8 questions</li> </ul>
Differentiation	<ul style="list-style-type: none"> <li>• Good category = 12 questions</li> <li>• Medium category = 18 questions</li> </ul>
Conclusion	The <i>pretest</i> and <i>posttest</i> questions had 30 questions with valid criteria.

In addition to test-based assessments, non-test methods were employed to validate the feasibility of the developed media. Expert validation played a crucial role in assessing its quality. Material experts evaluated content accuracy, relevance, and alignment with learning objectives, yielding a validity score of 90%. Media experts assessed technical feasibility, visual design, and usability, resulting in a score of 88.2%. Additionally, teacher validation provided insights into the practical application of the media in classroom settings, with an approval rate of 94%. Student validation focused on engagement, interactivity, and clarity, generating an overall approval rating of 85%.

To determine the validity of the developed media, specific criteria were applied. A product is considered valid if it achieves a minimum validity score of 80% based on expert assessments. Additionally, a paired sample t-test was conducted to analyze the significance of learning improvements. The results indicated an N-gain score of 0.75, classified as high, confirming the effectiveness of the Digital Pop-Up Book in enhancing student learning outcomes.

The large-scale testing involved 19 fourth-grade students at SD Negeri 1 Tempel, representing the entire population of fourth-grade students in the school. This study employed a total population sampling approach, ensuring that all students were included based on their school attendance and the relevance of the Digital Pop-Up Book to their curriculum. Although the sample size was relatively small, it provided a comprehensive representation of the target group, allowing for a thorough evaluation of the media's effectiveness without the need for additional sampling techniques. Moreover, the manageable number of students facilitated detailed observations of engagement and learning progress, enabling a more in-depth analysis of the instructional media's impact.

The primary objective of this testing phase was to assess both the effectiveness and practicality of the developed product by analyzing student learning outcomes. The evaluation was conducted by comparing pretest and posttest scores using a normality test, a paired sample t-test, and an N-gain test. These statistical analyses provided quantitative insights into the extent to which the Digital Pop-Up Book improved student comprehension and engagement in social studies.

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A combination of non-test data collection methods supported the statistical analysis, including observations, interviews, document analysis, and questionnaires. These qualitative methods offered deeper insights into students' engagement, motivation, and the overall practicality of the digital media. The measurement of learning improvement was based on quantitative data, whereas non-test data contextualized the results by identifying factors affecting student performance, implementation challenges, and teachers' perspectives on the media's effectiveness. The inclusion of both approaches ensured a comprehensive evaluation of the Digital Pop-Up Book's impact on the learning process.

To enhance the validity and reliability of the research findings, data triangulation was applied by comparing observational, interview, and questionnaire data. The test and non-test instruments underwent a validation process before implementation in the trial phase. Validation of test instruments began with a trial test administered to fifth-grade students who had previously studied the material. A total of 50 test items were initially developed and analyzed for statistical validity. The final selection resulted in 30 valid multiple-choice questions, which were used for pretest and posttest assessments for fourth-grade students.

Subject matter experts validated the test instruments to ensure that the questions accurately reflected the content of the Digital Pop-Up Book and aligned with the intended learning objectives. This validation process also included an evaluation of the learning tools associated with the media. While the test questions were initially deemed appropriate, expert feedback led to revisions and the addition of new questions to enhance content accuracy and alignment with educational standards.

Media experts conducted a comprehensive validation of the design and feasibility of the Digital Pop-Up Book, focusing on visual appeal, user-friendly navigation, and technical functionality to ensure its effectiveness in a classroom setting. The validation covered key aspects such as interactivity, aesthetic design, and accessibility, aiming to create an engaging and pedagogically sound learning experience for students.

Non-test instruments, including questionnaires, observation sheets, and interview guidelines, underwent validation by a supervising lecturer, who is also an education expert. This validation process ensured that the instruments demonstrated clarity, relevance, and consistency in measuring student engagement, learning motivation, and the overall effectiveness of the media in the learning process. Expert opinions were gathered using structured questionnaires and analyzed through a percentage-based validity formula to determine the feasibility and reliability of the instruments. The formula applied is as follows:

$$NP = \frac{R}{SM} \times 100\% \quad (1)$$

Information:

NP = The desired percent value

R = The value obtained

SM = Maximum value

The expert validation results were analyzed to assess the feasibility of the developed product. The findings from this evaluation are summarized in the following table.

Table 2. Eligibility criteria

No.	Percentage	Criteria
1	76% - 100%	Very Feasible
2	51% - 75%	Feasible
3	26% - 50%	Feasible Enough
4	0% - 25%	Less Feasible

Source: (Purwanto, 2019)

Data processing is also utilized to evaluate the effectiveness of the test instrument by applying the N-gain calculation method, as proposed by (Hake, 1999), using the following formula:

$$N - gain = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}} \quad (1)$$

The results of the N-gain calculation are utilized to categorize the percentage of N-gain achieved by the developed media, as shown in the following table:

Table 3. N-gain value sharing category

No.	Percentage	Category
1	N-gain < 0.3	Low
2	0.3 ≤ N-gain < 0.7	Medium
3	N-gain > 0.7	High

The Digital Pop-Up Book was developed using Canva, Adobe Illustrator, and PowerPoint, ensuring compatibility with both Android and iOS devices. It features interactive elements, including animations, educational videos, background music, and integration with Quizizz for student assessment.

## RESULTS AND DISCUSSION

The research findings on social studies learning in fourth grade at SD Negeri 1 Tempel, Blora Regency, were obtained through multiple stages aligned with the applied theoretical framework. These stages include analysis, design, development, implementation, and evaluation of the developed media. The sequence of steps followed in the media development process is outlined below.

Initial observations indicated that only 60% of students met the minimum passing grade in social studies, particularly on the topic of human needs. This suggests a relatively low understanding of primary, secondary, and tertiary needs. One contributing factor is the predominant use of lecture-based instruction and textbooks, which offer limited interactivity and engagement. These findings highlight the need for innovative learning media that can enhance student participation and comprehension more effectively.

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During the analysis phase, the researcher identified learning challenges by observing fourth-grade social studies classes at SD Negeri 1 Tempel, Blora Regency. The findings revealed that instruction remains heavily lecture-based, with students passively listening to the teacher and taking notes. As a result, the learning process becomes monotonous, leading to limited student engagement and comprehension.

Interviews with fourth-grade homeroom teachers further supported these findings, revealing that digital media is rarely utilized in instruction. Most lessons rely primarily on whiteboards and textbooks as the main teaching resources. Teachers cited limited instructional time and a lack of familiarity with digital tools as key barriers to integrating technology into the classroom. Additionally, the use of instructional media in social studies remains minimal, contributing to low student motivation in the subject.

Further supporting evidence was gathered through questionnaires distributed to fourth-grade students at SD Negeri 1 Tempel. Of the 19 students surveyed, 16 reported that their teachers relied solely on textbooks as a learning medium for social studies. The absence of engaging instructional materials resulted in students perceiving the subject as difficult and uninteresting.

The challenges identified in the study underscore the need for interactive learning tools to enhance students' enthusiasm for learning. In response, the researcher developed a Digital Pop-Up Book featuring engaging visuals and integrated learning videos to support students' comprehension. Additionally, the media includes background music to sustain student engagement and offers high flexibility, allowing students to access it conveniently at any time. Following data collection through observations, interviews, and questionnaires during the analysis phase, the researcher proceeded with the design and development of the Digital Pop-Up Book.

This study introduces several innovations compared to previous research on Digital Pop-Up Book development. Unlike conventional PowerPoint-based digital pop-ups, this media integrates designs created with Adobe Illustrator to enhance visual appeal. Furthermore, PowerPoint Morph transitions were employed to produce a more dynamic and interactive pop-up effect. To improve student engagement and comprehension, the media incorporates background music and embedded educational videos from YouTube, which clarify key concepts. A key advantage of this media is its integration with Quizizz, which enables direct assessment of student learning outcomes, making the learning process more interactive and measurable.

Following the analysis phase, which confirmed the absence of instructional media for this material, the study proceeded to the design phase. This stage involved the development of the Digital Pop-Up Book using multiple applications to ensure optimal functionality and visual appeal.

The design phase began with the selection of instructional content based on feedback from teachers and students, collected through questionnaires. The results indicated that the selected material focused on the topic of human needs. Once the content was determined, the next step

involved structuring the media framework, outlining the contents of each page in the Digital Pop-Up Book. To ensure an aesthetically appealing and student-centered design, the framework was developed using Canva, aligning with students' learning needs and preferences.

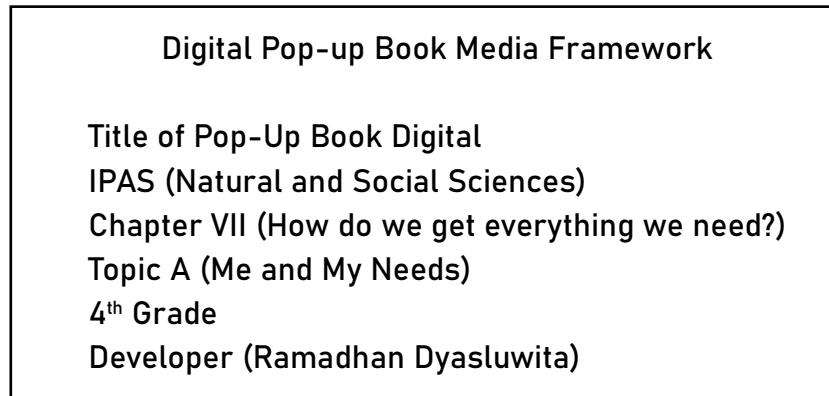


Figure 2. Framework of media coverage of content

The developed framework is implemented using Adobe Illustrator, which serves as the primary tool for designing the cover of the Digital Pop-Up Book.

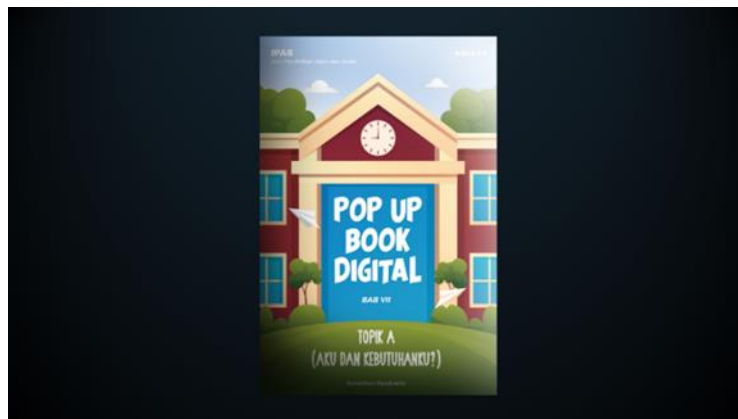


Figure 3. Cover a pop-up book digital

The framework serves as a structural guide for organizing content within the media, ensuring seamless integration of instructional materials. After finalizing the design of the Digital Pop-Up Book cover or start page, the next step involves selecting appropriate assets. These assets are carefully chosen to align with the instructional content, particularly those related to human needs, to enhance the media's relevance and effectiveness. Once the assets are determined, they are incorporated into PowerPoint, which serves as the platform for delivering the media in a slide-based format. PowerPoint was selected due to its advanced transition features, which enhance interactivity and engagement. Specifically, the Morph transition is utilized to create an embossed book effect, making the Digital Pop-Up Book more visually dynamic and immersive. A preview of the media slides is presented in Figure 4.

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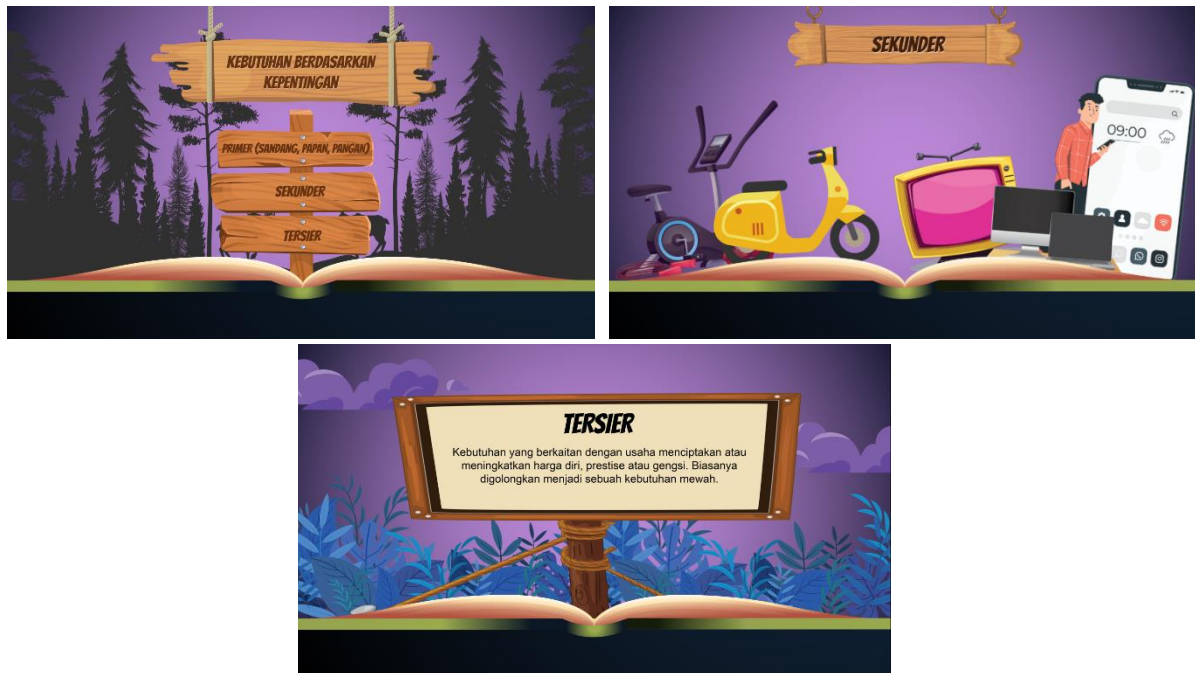


Figure 4. Digital pop-up book slide show

The Digital Pop-Up Book media not only features visually appealing designs but also incorporates background music to enhance user comfort. Additionally, this media includes learning videos sourced from YouTube, carefully adapted to align with the instructional material, thereby supporting students' comprehension. The integration of these videos ensures that the media goes beyond textual content, offering interactive and engaging elements that make learning more dynamic and informative.



Figure 5. Learning videos in a digital pop-up book

The final page of the Digital Pop-Up Book includes an interactive link that allows users to access Quizizz with a single click. This feature allows students to assess their understanding of

the material engagingly and interactively, reinforcing learning outcomes through immediate evaluation.



Figure 6. Link Quizizz

After the media development process is completed, a feasibility assessment is conducted by subject matter experts and media experts to evaluate its suitability for use in learning. This assessment examines content accuracy, alignment with learning objectives, technical feasibility, and overall usability. The feasibility level of the Digital Pop-Up Book is summarized in the following table:

Table 4. Expert validation recap

Part	Expert Material	Expert Media
Value	54	60
Maximum Value	60	68
Presentation	90%	88,2%
Category	Very Feasible	

The validation results confirm that the Digital Pop-Up Book is very feasible, with material experts assigning a score of 90% and media experts providing a rating of 88.2%. These findings align with previous studies, such as those conducted by (Mertasari & Ganing, 2021) and (Miranti & Refelita, 2023), which also reported high validation scores for similar instructional media. Compared to prior research that utilized PowerPoint-based digital pop-ups (Pinto, 2023), this study integrates Smart Apps technology, enhancing the media’s flexibility and accessibility across different devices. The higher validation scores in this study (90% and 88.2%) suggest that the inclusion of interactive features, such as embedded videos and Quizizz-based assessments, improves both usability and instructional effectiveness, offering students a more engaging learning experience.

Following the validation process, an assessment of the media’s practicality was conducted to evaluate its usability in real classroom settings. The results indicate that teacher validation reached 94%, while student responses were 89% in small-scale trials and 90% in large-scale trials. These findings are consistent with the study by (Narahayaan et al., 2024), which also

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found Digital Pop-Up Books to be highly practical. In comparison, (Islami et al., 2024) reported practicality ratings of 80% in limited trials and 95% in field trials. The integration of Smart Apps features in this study may have contributed to the slightly higher practicality ratings, as these features enhance the accessibility and interactivity of the learning media.

Beyond practicality, the effectiveness of the Digital Pop-Up Book in improving student learning outcomes was assessed using the N-gain test. The results yielded an N-gain score of 0.75, categorizing the media as highly effective. This finding is in line with research by (Haris & Maziyah, 2022), which highlights the role of Digital Pop-Up Books in facilitating student learning activities. Additionally, (Khasanah et al., 2022) emphasized the importance of instructional media in enhancing student learning outcomes.

Previous research has demonstrated that traditional Pop-Up Books effectively enhance student engagement and critical thinking skills (Rahmayanti & Setiawan, 2023). However, these conventional media often lack interactivity and accessibility. The Smart Apps-Based Digital Pop-Up Book developed in this study overcomes these limitations by integrating multimedia elements, enabling students to engage more actively in the learning process.

The large-scale testing was conducted on 19 fourth-grade students at SD Negeri 1 Tempel, representing the entire population of fourth-grade students in the school. This school was selected because it is one of the top-performing elementary schools in the region and is known for its diverse student abilities. The variation in student competencies provided an ideal environment to assess the effectiveness of the Smart Apps-Based Digital Pop-Up Book across different learning levels. The limited number of students in this grade was due to the school's class size policy, which ensures optimal teacher-student interaction and personalized learning experiences.

To strengthen the validity of the findings, the study was conducted in two trial stages: small-scale and large-scale testing. Given the limited number of fourth-grade students at SD Negeri 1 Tempel (only 19 students), an initial small-scale trial was first conducted at SD Negeri Kemiri 02, which shares similar student characteristics and academic abilities. Based on these considerations, eight students from SD Negeri Kemiri 02 were selected for the small-scale trial.

This study employed a total population sampling approach, ensuring that all available students were included based on school attendance and curriculum relevance. Although the sample size was relatively small, it provided a comprehensive representation of the targeted student group, allowing for a thorough evaluation of the media's effectiveness without requiring additional sampling techniques. Previous research suggests that small-scale studies using total population sampling can still yield valid and meaningful insights in educational research. Moreover, the manageable number of students facilitated detailed observations of engagement and learning progress, ensuring a more in-depth analysis of the instructional media's impact.

The results from both small-scale and large-scale trials indicate that the Digital Pop-Up Book significantly improved student engagement and comprehension, demonstrating its potential as an effective interactive learning tool for elementary social studies.

Table 5. Results of teacher and student responses about media in small-scale testing

<b>Part</b>	<b>Teacher</b>	<b>Learners (8 students)</b>
Value	79	342
Maximum Value	84	384
Percentage	94%	89%
Criteria	Very Feasible	

Table 5 shows that both teachers and students provided highly positive feedback on the Digital Pop-Up Book media, indicating its practical applicability in teaching and learning activities. Based on these results, the media is categorized as highly effective in small-scale trials.

Following the small-scale trial, a large-scale trial was conducted in three stages. The first stage involved administering a pretest to students to assess their initial understanding of the material. In the second stage, the instructional process was carried out using the Digital Pop-Up Book, followed by the distribution of response sheets to both students and teachers to evaluate their perceptions of the media’s effectiveness and usability. In the final stage, a posttest was administered to measure the impact of the media on students’ comprehension and learning outcomes.

Table 6. Pre-test and post-test result

<b>Part</b>	<b>Average</b>	<b>Average number of tempos</b>
Pretest	35,96	48,08
Posttest	84,04	

Referring to Table 6, the average student learning outcomes in large-scale trials increased by 48 points. This improvement signifies a substantial enhancement in student performance in social studies, particularly on the topic of human needs, among fourth-grade students at SD Negeri 1 Tempel before and after using the Digital Pop-Up Book media.

Furthermore, the analysis of the N-gain test corroborates these findings, indicating a significant increase in the average pretest and posttest scores. This result confirms the effectiveness of the Digital Pop-Up Book in improving students’ comprehension of the subject matter, demonstrating its potential as an engaging and interactive instructional tool.

Table 7. N-gain test result

<b>Average Distance</b>	<b>N-gain</b>	<b>Criterion</b>
48,08	0,75	high

As shown in Table 7, the average score from large-scale media trials, which is 48.08, indicates that fourth-grade students at SD Negeri 1 Tempel experienced an average N-gain

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increase of 0.75, categorized as high. This improvement further reinforces the effectiveness of the Digital Pop-Up Book in enhancing student learning outcomes on the topic of human needs.

This finding aligns with research conducted by (Febriyanti & Sulistyawati, 2024), which also reported a significant increase in student engagement and understanding through the use of a Digital Pop-Up Book in Pancasila Education. However, while previous studies primarily focused on student engagement, this study extends the discussion by integrating Smart Apps features and evaluating their impact on higher-order thinking skills. These results suggest that incorporating interactive elements, such as Quizizz-based assessments and embedded educational videos, not only enhances student engagement but also fosters critical thinking and conceptual understanding.

Following the trials, the media was further assessed by fourth-grade teachers to evaluate its feasibility and effectiveness in teaching the human needs material. The results of the teachers' evaluations are presented in the following section.

Table 8. Results of teacher and student responses about media in large-scale testing

Part	Teacher	Learners (19 students)
Value	79	823
Maximum Value	84	912
Percentage	94%	90%
Criteria	Very Feasible	

Table 8 illustrates that both teachers and students responded very positively to the Digital Pop-Up Book media. The large-scale trial, conducted with 19 fourth-grade students, utilized the Digital Pop-Up Book in the Integrated Natural and Social Sciences (IPAS) subject, specifically focusing on human needs material. This trial aimed to assess the media's effectiveness in enhancing student learning outcomes.

The teacher evaluation results yielded a high score, categorizing the media as "very good." Based on these findings, the Digital Pop-Up Book is deemed highly feasible for use in classroom instruction. This confirms that the Digital Pop-Up Book is an effective and efficient instructional tool, as it significantly improves student learning outcomes.

## CONCLUSION

This study aimed to develop and evaluate a Smart Apps-Based Digital Pop-Up Book as an interactive learning tool to enhance fourth-grade students' understanding and engagement in Ilmu Pengetahuan Alam dan Sosial (IPAS) at SD Negeri 1 Tempel. The research assessed the validity, practicality, and effectiveness of the developed media through expert validation, teacher and student feedback, and pretest-posttest evaluations.

The findings indicate that the Digital Pop-Up Book is highly valid, with subject matter experts rating it 90% and media experts 88.2%, classifying it as very feasible for classroom implementation. The practicality assessment also yielded positive results, with 94% approval from teachers and 90% positive responses from students in large-scale trials, demonstrating

that the media is engaging and user-friendly. Furthermore, the effectiveness evaluation using the N-gain test resulted in a score of 0.75 (high category), confirming that the Digital Pop-Up Book significantly improves students' learning outcomes.

Despite these promising results, this study has some limitations. First, the sample size was relatively small, as the trials were conducted in a limited number of elementary schools, which may limit the generalizability of the findings. Second, the study primarily measured short-term learning outcomes, without assessing long-term retention and conceptual understanding over time. Third, the research was focused solely on IPAS subjects, leaving its effectiveness in other disciplines unexplored.

For future research, it is recommended to expand the sample size and conduct trials across multiple schools to improve the generalizability of the findings. Additionally, longitudinal studies should be conducted to assess the long-term impact of the Digital Pop-Up Book on student learning retention. Another important aspect to explore is its application in different subjects and its adaptability to various educational settings. Addressing these aspects will allow future studies to refine the use of Digital Pop-Up Books in elementary education, ensuring their broader effectiveness in enhancing student engagement and learning outcomes.

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#### REFERENCES

- Ahmed, K. K. (2022). An Interactive Philosophical Vision for Textbook Design to Increase Information Value. *International Symposium on Graphic Engineering and Design*, 607–616. <https://doi.org/10.24867/GRID-2022-p67>.
- Arifin, A. Z., Sari, Y. F., & Sudrajat. (2024). Blended Learning as an Alternative Learning Method to Support the Digital Education Era. *Jurnal Teori dan Praksis Pembelajaran IPS*, 9(2), 92–101. <http://dx.doi.org/10.17977/um022v9i22024p92>.
- Aulia, R., & Wandini, R. R. (2024). Karakteristik Pembelajaran IPS SD. *Indonesian Research Journal on Education*, 4(1), 4034–4040. <https://doi.org/10.31004/irje.v4i1.449>.
- Azizah, M. (2022). Integration of Critical and Creative Thinking Skills in Solving HOTS Questions through the SOLE Model on Counting Rules. *Ideguru: Jurnal Karya Ilmiah Guru*, 7(2), 179-187. <https://doi.org/10.51169/ideguru.v7i2.352>.
- Desania, F., Sinaga, B., Lubis, A., & Syahputra, E. (2020). Analysis of Students' Critical Thinking Skills through Problem-Based Learning Approach Using HOTS Questions in SMA N 13 Medan. *International Journal of Scientific & Technology Research*, 9(03), 131–137.

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- Febrianti, W., Zulyusri, Z., & Lufri, L. (2021). Meta Analisis: Pengembangan Soal HOTS untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik. *Bioilmi: Jurnal Pendidikan*, 7(1), 39-45. <https://doi.org/10.19109/bioilmi.v7i1.9506>.
- Febriyanti, R. A., & Sulistyawati, I. (2024). Penerapan Media Pop Up Book Digital pada Pembelajaran Pendidikan Pancasila Materi Bhinneka Tunggal Ika untuk Siswa Kelas IV Sekolah Dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, 1(3), 1-10. <https://doi.org/10.47134/pgsd.v1i3.325>.
- Hake, R. R. (1999). *Analyzing Change/ Gain Scores*.
- Haris, A. A., & Maziyah, L. (2022). Pengembangan Media Pembelajaran Kosakata Bahasa Arab Berbasis Buku Pop Up untuk Siswa Madrasah Ibtidaiyah. *JoLLA: Journal of Language, Literature, and Arts*, 2(6), 822–837. <https://doi.org/10.17977/um064v2i62022p822-837>.
- Islami, N. F., Ilmi, L. A., & MZ, A. F. S. A. (2024). Urgensi Pengembangan Media Pop-Up Book Digital Berbasis Powerpoint sebagai Media Pembelajaran Bahasa Indonesia Siswa Sekolah Dasar. *Jurnal Studi Guru Dan Pembelajaran*, 7(2), 704–714. <https://doi.org/10.30605/jsgp.7.2.2024.4195>.
- Kanber, H. A., Al-Taai, S. H. H., & Al-Dulaimi, W. A. M. (2023). The Role of Digital Content Systems Used in Managing Arab Academic Scientific Journals: An Analytical Study. *Periodicals of Engineering and Natural Sciences*, 11(2), 232–247. <https://doi.org/10.21533/pen.v11i2.3526.g1273>.
- Khasanah, L. A. I. U., MZ, AF. S., & Irmaningrum, R. N. (2022). Pengaruh Penggunaan Media Flipchart Terhadap Hasil Belajar Menulis Surat Resmi Siswa Kelas V di Sekolah Dasar. *Jurnal Jendela Pendidikan*, 2(01), 125–130. <https://doi.org/10.57008/jjp.v2i01.141>.
- Maulana, R. (2022). Analisis Capaian Pembelajaran Bahasa Arab dengan Taksonomi Bloom Revisi. *Jurnal PTK dan Pendidikan*, 8(2), 85–96. <https://doi.org/10.18592/ptk.v8i2.7621>.
- Mertasari, P. S., & Ganing, N. N. (2021). Pengembangan Media Pembelajaran Powtoon Berbasis Problem Based Learning pada Materi Ekosistem Muatan IPA Kelas V Sekolah Dasar. *Jurnal Ilmiah Pendidikan Profesi Guru*, 4(2), 288–298. <https://doi.org/10.23887/jippg.v4i2.32848>.
- Miranti, I., & Refelita, F. (2023). Pengembangan Media Pop Up Book Materi Minyak Bumi Berbasis Sosio-Scientific Issue (SSI). *Journal of Chemistry Education and Integration*, 2(1), 58-66. <https://doi.org/10.24014/jcei.v2i1.21625>.
- Nandang, J. S., Fathoni, A., & Prastiwi, Y. (2023). *Analisis Pembelajaran Mengintegrasikan Keterampilan Abad 21 Sebagai Kesiapan Sekolah Mewujudkan Kurikulum Merdeka Di Sekolah Dasar* (Doctoral dissertation, Universitas Muhammadiyah Surakarta).
- Narahayaan, A., Aji, S. D., Sulistyowati, P., & Iswahyudi, D. (2024). Pengembangan Media Pembelajaran Pop-Up Book sebagai Pengenalan Simbol Sila-Sila Pancasila di Sekolah

- Dasar. *Pijar : Jurnal Penelitian Bidang Pendidikan dan Pembelajaran*, 4(1), 18–23. <https://doi.org/10.56393/pijar.v4i1.2426>.
- Nofrion, N., & Wijayanto, B. (2018). Learning Activities in Higher Order Thinking Skill (HOTS) Oriented Learning Context. *Geosfera Indonesia*, 3(2), 122–130. <https://doi.org/10.19184/GEOSI.V3I2.8126>.
- Pinto, L. P. (2023). *Pengembangan Media Pembelajaran Bangun Ruang Sisi Datar Menggunakan Pop-Up Book dengan Aplikasi Power Point dan Geogebra untuk Memfasilitasi Kemampuan Berpikir Kritis Matematis* [Skripsi, UIN Sultan Syarif Kasim].
- Purwanto, N. (2019). *Prinsip-prinsip dan Teknik Evaluasi Pengajaran*. Bandung: PT Remaja Rosdakarya.
- Putri, G. D. Y., Popiyanto, Y., & Pratiwi, D. E. (2023). Pengembangan Media Pop Up Book Pada Pembelajaran Ilmu Pengetahuan Sosial Materi Keberagaman Budaya Bangsa di Kelas IV SDN Bangkingan II/ 442 Surabaya. *Khirani: Jurnal Pendidikan Anak Usia Dini*, 1(3), 15–22. <https://doi.org/10.47861/khirani.v1i3.345>.
- Rahmayanti, S., & Setiawan, T. (2023). Learning Science with Digital Pop-Up Book Media. *Jurnal Penelitian Pendidikan IPA*, 9(10), 8085–8090. <https://doi.org/10.29303/jppipa.v9i10.4339>.
- Susanti, R. (2023). Pembelajaran Berbasis Praktikum untuk Meningkatkan Hasil Belajar Dengan Soal HOTS Mata Pelajaran IPA. *TEACHING: Jurnal Inovasi Keguruan dan Ilmu Pendidikan*, 3(1), 74-82. <https://doi.org/10.51878/teaching.v3i1.2166>.
- Tyas, M. A., Nurkamto, J., Marmanto, S., & Laksani, H. (2019). Developing Higher Order Thinking Skills (HOTS) – Based Questions: Indonesian EFL Teachers’ Challenges. *Proceedings of the International Conference on Future of Education*, 2(1), 52–63. <https://doi.org/10.17501/26307413.2019.2106>.