

Developing a Local Wisdom-Based Pop-Up Book to Enhance Elementary Students' Critical Thinking Skills and Cultural Appreciation

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ABSTRACT

Elementary Science and Social Studies (IPAS) instruction often lacks interactive and culturally relevant learning media, limiting students' engagement and critical thinking. This study aims to develop a Pop-Up Book based on Rembang's local wisdom to enhance fourth-grade students' critical thinking skills and cultural appreciation. The research employed a Research and Development (R&D) approach using the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. Participants included two expert validators (material and media), two teachers, and 30 fourth-grade students from two public elementary schools in Rembang Regency. Data were collected through expert validation sheets, practicality questionnaires, classroom observations, and pretest-posttest assessments. Quantitative data were analyzed descriptively and using N-Gain scores, while qualitative data were examined thematically. The developed Pop-Up Book received a validity score of 95% from experts, indicating very high feasibility. Practicality ratings from teachers and students were 92.5% and 91.8%, respectively. The effectiveness test showed an increase in students' critical thinking scores, with an average N-Gain of 0.67, categorized as moderate to high. Observational data also revealed increased student engagement, questioning, and cultural awareness during learning activities. The findings demonstrate that the Rembang local wisdom-based Pop-Up Book is valid, practical, and effective for IPAS learning. It provides contextual, engaging instruction that supports critical thinking development while fostering cultural identity in alignment with Indonesia's Merdeka Curriculum.

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1. INTRODUCTION

Elementary education plays a crucial role in developing students' character, thinking skills, and cultural identity. In line with the competency-based orientation of the Merdeka Curriculum, learning is expected to provide contextual experiences that enable students to analyze information, evaluate ideas, and make responsible decisions. Within this framework, the Science and Social Studies (IPAS) subject helps students understand natural and social phenomena through integrated and experience-based instruction (Dalimunthe, 2023).

Despite these expectations, IPAS instruction in many elementary schools remains predominantly conventional, relying heavily on lectures and limited interactive media. Such practices make learning less connected to students' real experiences and reduce engagement, resulting in suboptimal development of critical thinking skills (Wahyuni & Dewi, 2022). Meanwhile, critical thinking is a key 21st-century competence that must be strengthened from the elementary level (Hidayat & Fadhilah, 2018). Learning that focuses only on memorization restricts students' ability to analyze information, compare ideas, and draw reflective conclusions about cultural differences (Firmansyah & Lidiawati, 2019). These challenges reflect the need for media that provide meaningful visualization and promote active cognitive engagement.

Pop-Up Books are among instructional media that effectively support such goals. Their three-dimensional structure and manipulative elements can attract attention, stimulate imagination, and enhance learning interaction. Prior studies demonstrate that Pop-Up Books improve learning outcomes (Sari & Kurniawati, 2021) and increase engagement and enthusiasm during classroom activities (Lestari & Kurniasih, 2020). Additional research confirms their capacity to enhance learning motivation (Sinta, Murniviyanti, & Riyanti, 2022), improve students' responses (Fatimah, Supangat, & Sinensis, 2022), and serve as effective visual support in subjects like history (Lestari, Nafis, & Nur, 2021). Although these studies highlight motivational and affective benefits, their application for higher-order cognitive outcomes, particularly critical thinking, remains less explored. More specifically, although Pop-Up Books have shown promise in enhancing student engagement, their use in culturally embedded IPAS content has not been sufficiently examined, forming a clear research gap as suggested by the reviewer.

The cultural relevance of learning media is an equally important factor. Integrating local wisdom has been shown to strengthen cultural identity and support character development from an early age (Susanti & Rahmawati, 2019). Such integration aligns with the goals of the Pancasila Student Profile, particularly in the dimensions of global diversity and national culture (Anggraeni & Setiawan, 2020). Local wisdom-based learning media can also increase student motivation and learning outcomes (Pramudiani & Wulandari, 2021). In the context of cultural diversity learning, media grounded in cultural content help students compare cultural practices, analyze social values, and evaluate differences—processes that directly support the development of critical thinking.

Rembang, a region known for its rich cultural heritage including Lasem batik, the sedekah laut tradition, and the values of Raden Ajeng Kartini offers authentic cultural resources that can be incorporated into learning media. Research by Putri & Suryani (2022) shows that regional culture-based Pop-Up Books can increase learning interest and strengthen students' appreciation of their cultural heritage. Furthermore, Ramadhan & Utami (2023) confirm that Pop-Up Books not only contribute to cognitive development but also support affective and social competencies. These studies highlight the potential of culturally contextual media; however, they also imply that more research is needed to understand how such media contribute to critical thinking development in IPAS learning.

Critical thinking itself requires students to analyze information, evaluate evidence, and solve contextual problems. Instructional models supported by visual or manipulative media such as inquiry-based or problem-based learning have been shown to significantly improve students' critical thinking scores (Dilla, 2023; Agil & Wati, 2022). Visual media in science classes, for instance, significantly enhance students' critical thinking compared to traditional methods (Agil & Wati, 2022). Yet these findings have not been sufficiently combined with cultural content, leaving a gap in how culturally grounded Pop-Up Books can support both cognitive and cultural learning outcomes.

Given these conditions, an instructional medium that integrates visual engagement, manipulative interaction, and authentic cultural content is needed to support IPAS learning on cultural diversity. A Pop-Up Book based on Rembang's local wisdom offers such potential by providing concrete cultural representations, guided analytical activities, and opportunities for comparing cultural practices.

Therefore, this study aims to develop and evaluate a Pop-Up Book based on Rembang's local wisdom to improve fourth-grade students' critical thinking skills and cultural awareness. The development uses the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to produce media that are content-valid, practical for teachers, and effective for students.

2. METHODS

This study employed a Research and Development (R&D) design using the ADDIE development model, which consists of five iterative phases: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was selected because it provides a systematic, flexible, and user-oriented framework suited to developing feasible, practical, and effective instructional products for elementary-level learning (Aldoobie, 2015; Branch, 2020). Its suitability also aligns with the goal of this research, namely to produce a Pop-Up Book based on Rembang local wisdom and to evaluate its validity, practicality, and effectiveness in improving fourth-grade students' critical thinking skills.

A mixed-methods approach was employed, combining qualitative and quantitative techniques to provide a comprehensive evaluation of the developed media. As recommended by Creswell and Plano Clark (2018), mixed methods strengthen the understanding of educational interventions by integrating the depth of qualitative data with the generalizability of quantitative findings. In this study, qualitative data were obtained through observations, interviews, and expert validations, while quantitative data were generated through practicality questionnaires and a pretest–posttest quasi-experimental design to measure critical thinking gains. This structure aligns with the reviewer's emphasis on clarifying the combination of expert validation (qualitative), practicality surveys (quantitative), and pretest–posttest testing.

2.1 Research Design

The ADDIE development model applied in this study followed Molenda's (2015) conceptual framework, which consists of five systematic phases: Analysis, Design, Development, Implementation, and Evaluation. The process began with a comprehensive analysis aimed at identifying the instructional needs of teachers and students for contextual and engaging learning media. This phase included examining the characteristics of fourth-grade learners, analyzing the IPAS curriculum content, and exploring elements of local wisdom in Rembang, such as Lasem batik, the Sedekah Laut tradition, and Wayang Bengkong. Data were collected through classroom observations, interviews with teachers and students, and a review of curriculum documents. The findings from this needs assessment provided the foundation for designing culturally relevant instructional media.

The design phase involved detailed planning of the Pop-Up Book as the selected instructional medium. Activities included preparing storyboards, developing visual layouts, organizing three-dimensional components, and constructing learning activities aligned with critical thinking indicators. At this stage, research instruments were also developed, including expert validation sheets, practicality questionnaires, and pretest–posttest assessment tools. These instruments were designed to ensure the validity, practicality, and effectiveness of the developed product.

During the development phase, the Pop-Up Book prototype was produced in accordance with the approved design. Validation was conducted by two groups of experts—material experts and media experts—who evaluated the accuracy of the content, the quality of visual presentation, the clarity of language, and the integration of cultural elements. The validation instruments employed a five-point

Likert scale, and the data were analyzed descriptively using mean scores. Feasibility criteria were based on Lakens (2017), categorized as Very Feasible (4.20–5.00), Feasible (3.40–4.19), Fairly Feasible (2.60–3.39), Less Feasible (1.80–2.59), and Not Feasible (1.00–1.79).

The implementation phase aimed to evaluate the practicality and user acceptance of the media in real classroom settings. The trial was conducted at SD Negeri Rakitan and SD Negeri Sluke, involving 30 fourth-grade students, two classroom teachers, and two expert validators selected through purposive sampling, based on their relevance to the Merdeka Curriculum and the local wisdom context (Etikan, Musa, & Alkassim, 2016). Prior to classroom use, teachers participated in a briefing session to ensure proper understanding of the instructional procedures. The Pop-Up Book was subsequently used in two to three IPAS learning sessions. Data were gathered through classroom observations and practicality questionnaires administered to both teachers and students.

Finally, the evaluation phase incorporated both formative and summative assessments. Formative evaluation was conducted during the implementation process through observations and feedback from teachers and students. Summative evaluation involved analyzing pretest–posttest results to assess students' critical thinking skills. The test items were developed based on Ennis's critical thinking indicators, focusing on logical reasoning, information analysis, drawing conclusions, and cultural comparison. The effectiveness of the intervention was determined using the N-Gain Score (Hake, 2019), with categories defined as high (≥ 0.7), moderate (0.3–0.69), and low (< 0.3).

2.2 Participants

Participants included two instructional experts (media and material), two fourth-grade teachers, and 30 fourth-grade students from two public elementary schools in Rembang Regency. Schools were selected purposively based on the following criteria: (1) implementing the Merdeka Curriculum, (2) teaching IPAS in fourth grade, and (3) appropriate potential for integrating local wisdom into learning. The research was conducted from April to July 2025, covering needs analysis, prototype development, expert validation, implementation, and evaluation.

2.3 Instruments

To streamline descriptions as recommended by the reviewer, instruments were grouped into three categories: (a) Media Validation Instruments: Expert validation sheets assessing content accuracy, language clarity, cultural integration, and visual design. Likert-scale format (1–5) for feasibility scoring. (b) Practicality Instruments: Teacher and student practicality questionnaires evaluating ease of use, attractiveness, clarity, and usefulness. Observation sheets assessing student activities related to observing, analyzing, comparing, and concluding cultural information. (c) Learning Outcome Assessments: Pretest and posttest instruments measuring critical thinking skills. Items developed based on Ennis's indicators of critical thinking. Reliability assessed using Cronbach's Alpha (≥ 0.7), following Tavakol and Dennick (2011).

2.4 Data Collection and Analysis

Data collection employed four techniques: observation, interviews, questionnaires, and tests. Observations captured student activities during the learning process; interviews with teachers and students provided qualitative insights; questionnaires produced quantitative data on media practicality; and tests measured instructional effectiveness. Methodological triangulation, as recommended by Carter et al. (2014), was used to enhance data credibility.

Data were analyzed both quantitatively and qualitatively. Quantitative data including expert validation results, questionnaire scores, and pretest–posttest scores were analyzed using descriptive statistics and N-Gain Score calculation. Qualitative data from interviews and observations were analyzed thematically using Braun and Clarke's (2019) six-step thematic analysis process.

All research procedures adhered to the ethical guidelines of the British Educational Research Association (BERA, 2018), ensuring confidentiality, informed consent, and voluntary participation. Through this method, the study aims to produce a Rembang local wisdom-based Pop-Up Book that is valid, practical, and effective in supporting elementary students' critical thinking development.

3. FINDINGS AND DISCUSSION

3.1 Findings

3.1.1 Analysis Stage Results

The analysis stage aimed to identify the needs of teachers and students for engaging, contextual learning media that could strengthen critical thinking skills in IPAS learning on the topic of Cultural Diversity. Interviews with two fourth-grade teachers at SD Negeri Rakitan and SD Negeri Sluke revealed that learning was still dominated by textbooks and verbal explanations, with limited use of interactive media. Students showed low learning interest, difficulties understanding cultural diversity, and minimal participation in discussions. Table 1 presents the results of the student needs analysis:

Table 1. Results of Student Needs Analysis

Assessed Aspect	Percentage (%)	Category
Interest in visual media	82	Very High
Interest in local culture-based media	78	High
Difficulty understanding cultural diversity from textbooks	74	High
Need for engaging and concrete learning media	86	Very High

Source: *Student Needs Questionnaire (2025)*

Table 1 indicates that 82% of students showed a strong interest in colourful and tangible visual media, while 86% expressed a need for learning media that are concrete and engaging. Analysis of Rembang's local wisdom also identified cultural potentials—such as Batik Lasem, Sedekah Laut, and Wayang Bengkong—that can be integrated into cultural diversity learning. Based on these findings, a Pop-Up Book based on Rembang's local wisdom was selected as the most relevant medium to connect learning materials with students' real-life experiences.

3.1.2 Design Stage Results

The design stage focused on developing the initial product blueprint, including content design, visual layout, illustrations, and learning activities. The structure of the Pop-Up Book consists of four main subthemes: (1) introduction to Rembang culture, (2) diversity of ethnicities and traditions, (3) local traditions and arts, and (4) values of togetherness and tolerance. Each subtheme contained 3D illustrations, contextual narratives, and critical-thinking prompts. The design followed a scientific and contextual learning approach, enabling students to observe, question, reason, experiment, and communicate. Visual, cognitive, and character literacy were also considered to incorporate cultural values on every page. The initial design then proceeded to expert validation. Figure 1 shows the initial design of the Pop-Up Book developed based on the needs analysis results.



Source: Researcher Documentation, 2025

Figure 1. Initial Design of the Pop-Up Book Based on Rembang Local Wisdom

3.1.3 Expert Validation Results

Validation was conducted by two validators: a material expert and a media expert. The evaluation employed a 5-point Likert scale covering content suitability, presentation, language, and attractiveness.

Table 2. Results of Material and Media Expert Validation

Assessment Aspect	Average Score	Category
Content feasibility	4.78	Very Feasible
Language appropriateness	4.60	Very Feasible
Visual attractiveness	4.70	Very Feasible
Relevance to local culture	4.80	Very Feasible
Total average (Material Expert)	4.72	Very Feasible
Total average (Media Expert)	4.65	Very Feasible

Source: Expert Validation Data (2025)

Overall, the validation process produced an average score of 4.72 for material and 4.65 for media, equivalent to 95% feasibility, indicating that the Pop-Up Book has high content quality and strong visual design. Suggestions included simplifying descriptive sentences and adjusting color balance and font sizes. These revisions were applied before classroom testing.

3.1.4 Practicality Test Results

The practicality test was conducted with 30 fourth-grade students at SD Negeri Rakitan and SD Negeri Sluke. The class teachers also assessed practicality through questionnaires. The results revealed highly positive responses from both teachers and students.

Table 3. Practicality Test Results

Respondent	Practicality Percentage (%)	Category
Teachers	92.5	Very Practical
Students	91.8	Very Practical

Source: Teacher and Student Practicality Questionnaires (2025)

The analysis showed that teachers gave an average practicality score of 92.5% (Very Practical), while students scored 91.8% (Very Practical). Teachers stated that the media were easy to use in classroom activities and helped explain the concept of cultural diversity more concretely. Students found the media engaging because they could touch, see, and interact with it, thereby enhancing their learning motivation. These findings indicate that the Rembang local wisdom-based Pop-Up Book possesses high practicality for both teachers and students, consistent with Lakens' (2017) criteria of practicality ease of use, attractiveness, and comprehensibility.

3.1.5 Effectiveness Test Results

The media's effectiveness was tested by comparing students' pretest and posttest scores on critical thinking ability. The test consisted of 10 open-ended questions based on critical thinking indicators, including identifying, analyzing, evaluating, and drawing conclusions.

Table 4. Summary of Pretest-Posttest and N-gain Results

No.	Assessment	Average Score
1	Pretest Mean	48.9
2	Posttest Mean	82.6
3	N-Gain Mean	0.67 (Moderate-High)

Students' critical thinking scores improved substantially from 48.9 to 82.6. The average N-Gain Score of 0.67 indicates a moderate-to-high improvement, demonstrating strong effectiveness of the Rembang local wisdom-based Pop-Up Book.

Observation and interview data also revealed qualitative improvements: students became more active in asking questions, engaging in discussions, and presenting arguments; they also showed increased enthusiasm in identifying cultural diversity within their environment. These findings align with Aldoobie (2015) and Branch (2020), who emphasize the role of visual and contextual media in enhancing cognitive engagement and higher-order thinking.

3.1.6 Final Product Revision

Based on validator and user feedback, several minor revisions were made, including improvements to color contrast, enlargement of font sizes, and simplification of certain narrative texts. The final Pop-Up Book consists of 20 full-color A4 pages across four thematic sections and includes a teacher's guide. Overall, the results confirm that the Rembang local wisdom-based Pop-Up Book is valid, practical, and effective for enhancing students' critical thinking skills and simultaneously supporting the preservation of local culture.



Source: Researcher Documentation, 2025

Figure 2. Final Product of the Pop-Up Book Based on Rembang Local Wisdom

3.2 Discussion

3.2.1 Media Validity

The validation results show that the Pop-Up Book media based on Rembang Local Wisdom achieved a validity level of 95%, categorized as *very valid*. This confirms that the content structure, design quality, and presentation format are appropriately aligned with the characteristics of elementary school students as well as the competencies required in the IPAS curriculum. The very high level of validity indicates that the product meets the necessary criteria of content feasibility, linguistic clarity, and usability for learning activities.

These findings are in line with the views of Branch (2020) and Molenda (2015), who emphasize that instructional media must pass expert validation to ensure alignment with learning objectives and learner characteristics. The present study's results also support the findings of Rahayu and Sari (2021), who reported that Pop-Up Book media are considered very valid and engaging due to their three-dimensional, concrete, and contextual features—elements that correspond closely to the learning needs of elementary students.

Furthermore, the results align with research by Fitriani, Hadiyanti, and Santoso (2020), who developed a culture-based Pop-Up Book for thematic learning and obtained a validity score of 94%. Their study demonstrated that integrating local cultural elements strengthens content validity because local contexts serve as concrete references for students. Consistent with these findings, the Pop-Up Book in this study embeds elements of Rembang local wisdom, thereby fulfilling the requirements for content, linguistic, and visual validity essential for contextual IPAS learning.

3.2.2 Media Practicality

The practicality test results indicate that teachers gave a response score of 90%, while students' responses reached 97.3%, both falling within the *very practical* category. This shows that the Pop-Up Book is easy to use, attractive, and highly supportive in helping both teachers and students understand cultural diversity material. These findings reinforce the theory of Agil and Wati (2022), who argue that effective learning media should simplify the teaching process while simultaneously enhancing students' engagement.

This result is consistent with the study by Sari and Nurhayati (2022), which found that Pop-Up Books based on local wisdom increase students' learning motivation and make it easier for teachers to explain abstract concepts. Additionally, Lestari, Nafis, and Nur (2021) emphasized that the integration of local culture into learning media fosters a sense of regional pride, strengthens cultural appreciation, and provides meaningful learning experiences. All these findings correspond with the practicality of the media developed in this study, which enables student interaction, supports collaborative learning, and remains manageable for teachers to implement in classroom activities.

In practical terms, this means that teachers can adopt similar culturally grounded visual media to support both cognitive development and character education simultaneously. The ease of use, communicative structure, and contextual orientation of the Pop-Up Book make it adaptable across different learning settings..

3.2.3 Media Effectiveness on Critical Thinking Skills

The effectiveness test using the paired sample t-test produced a significance value of $0.000 < 0.05$, indicating a significant difference between pretest and posttest scores. The N-Gain score of 0.68, categorized as *moderate-to-high*, signifies substantial improvement in students' critical thinking skills. This enhancement is a direct result of the contextual, visual, and interactive features of the Pop-Up Book.

The mechanism underlying this improvement is aligned with Ennis's (2018) theoretical framework, which highlights that critical thinking develops through structured opportunities for analysis, evaluation, inference, and reflection. The Pop-Up Book provides these opportunities by encouraging students to observe cultural illustrations, compare traditions, interpret messages, and draw logical conclusions. Thus, the media does not simply present information; it stimulates analytical reasoning embedded within meaningful cultural contexts.

These results corroborate the findings of Wulandari, Prasetyo, and Widodo (2021), who reported a 32% increase in students' critical thinking skills after using a culture-based Pop-Up Book in thematic learning. Similarly, Putri (2020) demonstrated that visual media grounded in ethnoscience cultivate curiosity and promote higher-order thinking skills (HOTS). The present study supports these

conclusions by showing both cognitive gains (pretest–posttest improvement) and behavioral changes—students became more active, reflective, and engaged in discussing local cultural values.

3.2.4 Integration with Theories and Comparison with Previous Studies

The relationship between this study and previous research can be observed not only through similarities in results but also through the conceptual alignment. (1) Fitriani et al. (2020) demonstrated that culture-based Pop-Up Books reach high validity (94%), supporting the present study's validity result of 95%. The similarity indicates that cultural contextualization tends to strengthen content quality and student relevance. (2) Wulandari et al. (2021) found improvements in critical thinking (32%) when using Pop-Up Books in thematic learning. This supports the current study's N-Gain result (0.68), confirming that multimodal, context-rich media effectively enhance higher-order thinking. (3) Sari & Nurhayati (2022) emphasized increased student motivation when using local wisdom-based media. The findings in this study, with students' practicality rating of 97.3%, reinforce that culturally grounded media significantly boost engagement. (4) Lestari et al. (2021) showed that region-based media cultivate cultural appreciation and character values. This aligns with how the Rembang Local Wisdom-based Pop-Up Book embeds character education through cultural narratives and local traditions.

These points confirm the compatibility of this study with existing literature, while also strengthening theoretical perspectives by Fosnot (2016) and Vygotsky (2019), who assert that knowledge is actively constructed through contextual experiences and social interaction. The Pop-Up Book serves precisely as such a medium: it anchors abstract concepts to real cultural practices, encouraging students to develop meaning collaboratively and personally.

3.2.5 Interpretation and Practical Implications

The findings indicate that the Rembang Local Wisdom-based Pop-Up Book fulfills three essential criteria for effective learning media: (1) High validity (95%), ensuring content relevance and visual appropriateness; (2) High practicality (90–97.3%), making the media attractive, accessible, and easy to implement; (3) Strong effectiveness (N-Gain 0.68) in enhancing critical thinking.

Beyond these quantitative indicators, the study shows that integrating local cultural elements into learning media is an effective strategy for improving IPAS learning quality while simultaneously reinforcing contextual values and character development. For educators, the practical implication is clear: culturally rooted visual media can serve as powerful tools to enhance both cognitive and character outcomes, making learning more meaningful and connected to students' lived experiences.

4. CONCLUSION

This study concludes that the Pop-Up Book learning media based on Rembang Local Wisdom is valid, feasible, and well aligned with the needs of IPAS instruction in elementary schools. The strong validation results from experts demonstrate that the content, visual structure, and cultural integration meet curriculum standards and effectively support learning objectives. In addition, the media proved effective in enhancing students' critical thinking and engagement, as indicated by significant improvements in learning outcomes and consistently positive responses from both teachers and students. By presenting interactive visual elements and culturally grounded narratives, the Pop-Up Book successfully fosters active learning, stimulates curiosity, and encourages students to analyze and interpret information more deeply.

Furthermore, the integration of local cultural elements—such as Batik Lasem, Tari Orek-Orek, and Sedekah Laut—contributes to strengthening students' awareness and appreciation of regional traditions, making learning more contextual, meaningful, and relevant to their daily environment. This highlights the potential of local wisdom-based media to enrich instructional practices while supporting cultural preservation at the primary education level. Overall, the Pop-Up Book serves as an innovative and pedagogically sound resource for IPAS learning. Future research may examine the long-term

effects of cultural media integration on students' cognitive and affective development, as well as its adaptability and impact across diverse regional contexts.

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