

Qr code-based pop-up book: an innovative learning media for cultural diversity material in elementary schools

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Abstract: *Innovative learning media in primary education remains limited, affecting students' comprehension. Cultural diversity is often taught conventionally, making it less interactive. This study develops a QR Code-based Pop-Up Book as a learning tool combining three-dimensional elements and digital technology. The Research and Development (R&D) method was applied using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Experts validated the content, media, and language, while trials were conducted with fifth-grade students at SDN 160/IV Kota Jambi. Results showed high validity scores (91% content, 89% media, 93% language), with 90% practicality and 91.8% attractiveness. The QR Code-based Pop-Up Book effectively enhances students' understanding and has strong potential for wider use in primary education.*

Keywords: *Learning Media; Pop-Up Book; QR Code, Cultural Diversity; Primary Education.*

Introduction

Learning media play a crucial role in supporting the effectiveness of the teaching and learning process in elementary schools (Dila et al., 2024). As teaching aids, learning media help deliver material in a more engaging and interactive manner, thereby enhancing students' understanding (Fakhriyana & Riayah, 2021). However, in practice, the use of innovative learning media remains limited in many schools. Teaching methods are still dominated by lectures and textbooks, which often fail to capture students' interest, resulting in low motivation and comprehension (Manuain, 2024). Therefore, the development of more innovative learning media that align with current technological advancements is necessary.

One subject that requires more interactive learning media is cultural diversity in Indonesia, particularly the cultural diversity of Jambi Province. This subject encompasses various aspects, such as traditional clothing, signature dances, traditional weapons, local cuisine, traditional houses, regional songs, and traditional musical instruments. Understanding cultural diversity is essential in fostering tolerance and respect for differences from an early age (Zamroni et al., 2024). However, at SDN 160/IV Kota Jambi, cultural diversity material is still taught using an atlas and printed textbooks. The content in these books primarily consists of text and lists of names with few images. This makes it difficult for students to comprehend the real-life forms of cultural diversity in Jambi Province.

Observations conducted in the fifth-grade class at SDN 160/IV Kota Jambi revealed that many students struggle to find additional learning resources relevant to cultural diversity topics. Teachers also face challenges in delivering the material due to the limited media available at the school. To view videos of traditional dances or listen to regional songs, students must search independently on the internet. However, this search process is often

inefficient and time-consuming, causing students to lose focus during learning. Therefore, learning media that present information in a more engaging, comprehensive, and easily accessible manner are needed.

As a solution to these issues, the development of a QR Code-Based Pop-Up Book emerges as an innovation that can enhance students' understanding of cultural diversity. A Pop-Up Book is a book featuring three-dimensional (3D) elements that move or change shape when pages are turned (Ari & Handriyotopo, 2020). This design captures students' attention and makes learning more enjoyable. Meanwhile, QR Codes allow students to access additional information in the form of videos, audio, interactive images, or exercises simply by scanning the code with a digital device such as a smartphone or tablet (Hakim, 2023).

The main advantage of a QR Code-Based Pop-Up Book is its ability to integrate print media with more interactive digital resources (Aransyah, 2023). For instance, when students open a page displaying Jambi's traditional dances, they can scan the QR Code to watch a video of the dance. Similarly, when learning about Jambi's regional songs, they can listen to the songs through the QR Code's audio feature. This allows students to grasp the material in a more concrete manner rather than relying solely on text descriptions in books.

In the digital era, the utilization of technology in education is becoming increasingly essential (Sadriani et al., 2023). Technology-based learning can enhance student engagement, facilitate access to learning resources, and develop digital literacy skills (Naibaho & Rantung, 2024). With the inclusion of QR Codes in the Pop-Up Book, students do not only read and view images but also explore additional materials independently (Sefila, 2024). This provides a more flexible learning experience tailored to each student's learning pace.

However, in its implementation, the use of a QR Code-Based Pop-Up Book also faces several challenges (Kurniawati, 2023). One of the primary challenges is the availability of digital devices in schools. Not all students have access to smartphones or tablets to scan QR Codes. Therefore, schools need to provide supporting facilities to ensure this media can be utilized optimally. Additionally, teachers need training in integrating this media into the learning process to ensure its effective use (Utomo, 2023).

Another crucial aspect in developing a QR Code-Based Pop-Up Book is the quality of the content provided through QR Codes (Loreti et al., 2023). The displayed content must be relevant, accurate, and suitable for students' comprehension levels. Thus, the development process requires collaboration among educators, media designers, and technology developers to ensure the learning media's optimal use in classrooms.

Beyond improving learning effectiveness, the use of a QR Code-Based Pop-Up Book can also support students in mastering digital literacy (Fitri, 2024). By frequently using QR Codes to access additional materials, students become more adept at utilizing technology positively. This skill is crucial in addressing the challenges of the increasingly digital world. Within the context of the elementary education curriculum, the use of a QR Code-Based Pop-Up Book also aligns with the Project-Based Learning (PBL) approach. Students can be assigned tasks to further explore Jambi's culture using the information available in QR Codes, then present their findings through reports, presentations, or other creative projects. This way, learning becomes not only more engaging but also more meaningful for students.

Previous research has also indicated that using a QR Code-Based Pop-Up Book receives highly positive responses from both students and teachers (Anggraeni et al., 2024). Studies conducted in several elementary schools have shown that this media increases students' learning interest, makes them more active in class, and helps them better understand the material. Additionally, validation results from media and subject matter experts have demonstrated that this media possesses a high level of practicality and can be widely implemented in elementary school learning (Rachmawati et al., 2023).

Based on these findings, it can be concluded that a QR Code-Based Pop-Up Book holds great potential as an effective learning medium for teaching cultural diversity material at SDN 160/IV Kota Jambi. By combining three-dimensional visualization with digital technology, this media can help students grasp complex concepts in a more engaging and enjoyable manner.

Therefore, this study aims to develop and evaluate a QR Code-Based Pop-Up Book as a learning medium for cultural diversity material at SDN 160/IV Kota Jambi. The main focus of this research is to assess the validity, practicality, and effectiveness of this media in enhancing students' understanding of cultural diversity. Through this study, it is expected that a significant contribution can be made toward the development of more effective, technology-based learning media that meet current educational needs.

Method

This study employs the Research and Development (R&D) method using the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). This model was chosen because it provides a systematic approach to developing learning media, from needs analysis to product evaluation. The development model used in this study consists of five main stages:

The study involves developing a QR Code-based Pop-Up Book for teaching cultural diversity to fifth-grade students at SDN 160/IV Kota Jambi. It follows five stages: (1) Analysis—identifying media limitations, curriculum relevance, and student characteristics; (2) Design—creating an interactive pop-up book with QR codes linking to multimedia content; (3) Development—prototyping, expert validation, and revision; (4) Implementation—testing in small and large groups with student and teacher feedback; and (5) Evaluation—analyzing effectiveness and refining the media.

The data analysis involved both quantitative and qualitative methods. Quantitative analysis used percentage score techniques to evaluate media validity and practicality based on expert validation and student-teacher responses, measured using a Likert scale (very good to very poor). Qualitative analysis involved descriptive evaluation of interview and observation data, providing insights into user experiences and serving as a basis for media refinement.

The success of the QR Code-based Pop-Up Book is assessed through three key aspects: validity, practicality, and effectiveness. Each aspect is evaluated using specific criteria and percentage thresholds to determine the quality and impact of the learning media. The following table summarizes these success indicators:

Table 1. Success Indicators of QR Code-Based Pop-Up Book

Aspect	Criteria	Success Indicator
Validity	Expert validation by subject matter, media, and language experts	Achieves a score of $\geq 80\%$
Practicality	Student and teacher responses on usability and attractiveness	Achieves a score of $\geq 80\%$
Effectiveness	Improvement in students' understanding after using the media	Shows a measurable increase in comprehension

A learning media is considered successful if it meets the minimum threshold of 80% for validity and practicality and demonstrates effectiveness in improving students' understanding. These indicators ensure that the developed media is both high-quality and beneficial for classroom use.

Result and Discussion

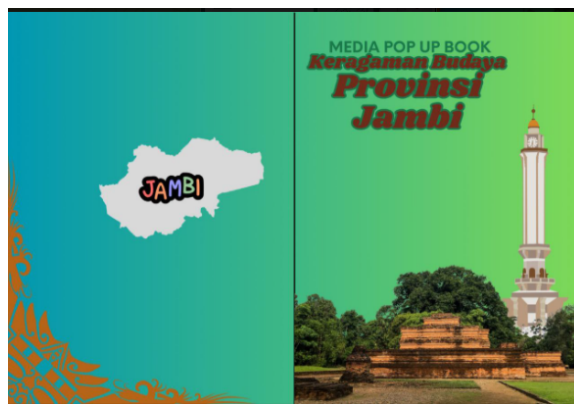


Figure 1. Pop-Up Book Cover Page

At the beginning, students are presented with a characteristic image of Jambi Province. The cover features a 3D format depiction of traditional houses, traditional clothing, and Jambi's signature musical instruments



Figure 2. Media Usage Guide

The next page provides students with instructions on how to use the QR Code-based Pop-Up Book.



Figure 3. QR Code-Embedded Learning Content

Each page contains embedded QR Codes, which can be scanned using a smartphone or tablet to access videos, interactive images, and further explanatory texts.



Figure 4. Student Worksheet

The digital-based student worksheet (LKS) is presented in Live Worksheet format, allowing students to complete exercises interactively.

Validation and Practicality Test Results

Before implementation, the QR Code-based Pop-Up Book underwent validation by subject matter experts, media experts, and language experts. Additionally, practicality tests were conducted with teachers and students. The summarized results presented in the following table:

Table 2. Summary of Validation and Practicality Test Results

Aspect	Average Score (%)	Category
Material Validity	91%	Very Valid
Media Validity	89%	Very Valid
Language Validity	93%	Very Valid
Practicality (Teachers)	90%	Highly Practical
Practicality (Students)	91.8%	Highly Practical

The validation process conducted by subject matter experts showed that the QR Code-based Pop-Up Book achieved an impressive validity score of 91%. This high rating indicates that the material presented in the book is highly relevant and aligned with the curriculum. The structured content ensures that students can grasp essential concepts about cultural diversity accurately and comprehensively. Additionally, the 95% score for concept accuracy highlights the reliability of the book's information, confirming that it has undergone a rigorous review process before implementation in the classroom. Further analysis of content validity reveals that the QR Code-based Pop-Up Book successfully integrates key cultural themes in a structured manner. The book provides students with clear explanations of traditional customs, attire, dances, and artifacts. The QR Code feature enriches this learning experience by allowing access to multimedia resources, ensuring that students can visualize cultural elements rather than relying solely on textual descriptions. This high validation score suggests that the book can serve as a reliable tool for fostering cultural awareness among elementary school students.

In terms of media validation, the QR Code-based Pop-Up Book received an average score of 89%, which signifies a strong level of effectiveness in terms of design and presentation. The 3D elements incorporated into the book make it visually appealing and engaging for young learners. By including interactive features, such as pop-up illustrations and foldable components, the book successfully captures students' attention and increases their motivation to learn. The structured layout and well-organized pages ensure that the content is accessible and easy to navigate. Beyond the physical design, the QR Code integration within the book enhances its overall functionality. With a QR Code score of 92%, it is evident that this feature significantly contributes to the book's effectiveness as a learning tool. Students can scan the codes using smartphones or tablets to access interactive content such as traditional music, dance videos, and detailed explanations of cultural artifacts. This innovative approach bridges the gap between traditional print materials and digital learning, offering students a dynamic and immersive educational experience.

The language validation aspect of the book also received a high score of 93%, indicating that the wording and sentence structures are appropriate for fifth-grade students. The readability score of 94% further supports this, showing that students can easily comprehend the material without unnecessary complexity. The book employs clear and concise language, ensuring that young learners can follow along with ease while developing their cultural literacy. Additionally, language experts highlighted that the book's instructional tone is engaging and suitable for elementary students. The combination of simple sentence structures and descriptive explanations allows for a smooth reading experience. This aspect is crucial, as younger students often struggle with complex wording, which can hinder comprehension. The strong validation score in this category suggests that the book successfully conveys cultural concepts in a way that is both accessible and enjoyable for its target audience.

The practicality test conducted with teachers yielded a strong result, with an overall score of 90%. Teachers found the QR Code-based Pop-Up Book highly practical in classroom

settings due to its ease of use and adaptability. The structured design allows educators to seamlessly integrate it into existing lesson plans without requiring extensive modifications. Additionally, the multimedia components help teachers enhance their lessons by providing visual and auditory stimuli that engage students more effectively than traditional textbooks. Teachers also appreciated the QR Code feature, which allows them to introduce supplementary learning materials effortlessly. Instead of searching for external resources, they can simply direct students to scan the provided codes, leading them to relevant videos and images. This minimizes preparation time and ensures that lessons remain interactive and engaging. The practicality score suggests that teachers view this learning tool as a valuable addition to their instructional methods, particularly in subjects related to cultural diversity.

The student practicality test results further reinforced the book's effectiveness, with an average score of 91.8%. Students responded positively to the interactive elements, expressing enthusiasm for the pop-up illustrations and multimedia content. The combination of hands-on engagement and digital exploration allowed students to experience cultural learning in a more immersive manner. Unlike conventional textbooks, which often rely heavily on text, this book provides an active learning experience that aligns with modern pedagogical approaches. Moreover, student feedback indicated that the QR Code-based Pop-Up Book helped improve their understanding of cultural diversity. Many students reported that being able to see and hear cultural elements—such as traditional dances and music—made the learning process more relatable and enjoyable. The ability to scan QR Codes and explore additional content at their own pace also allowed for greater autonomy in learning. This aspect highlights the book's potential to enhance student motivation and foster a deeper appreciation for cultural heritage.

The use of the QR Code-based Pop-Up Book as an innovative learning medium has proven to have high validity in terms of content, media, and language. The content validation score of 91% indicates that the material in this book meets academic standards and aligns with the curriculum. The high concept accuracy score of 95% serves as an indicator that the information presented in this medium is reliable and does not mislead students. This is crucial because, in elementary education, the material must not only be engaging but also conceptually accurate. If students receive inaccurate information, misconceptions may arise, affecting their understanding in future learning stages (Gilbert & Watts, 1983). Therefore, implementing this book in elementary schools ensures that the delivered content has undergone expert review, providing students with a structured and credible understanding of cultural diversity.

From a media perspective, the validation score of 89% demonstrates that the QR Code-based Pop-Up Book meets the criteria for an effective learning medium. The visual design, incorporating three-dimensional (3D) elements, offers a more engaging learning experience than conventional textbooks. Direct interaction with pop-up elements increases student engagement in the learning process, which, according to constructivist learning theory, is crucial for developing deeper comprehension (Jayaraman & Aane). Furthermore, the QR Code feature, which received a score of 92%, enriches this medium by providing access to additional learning resources. In today's digital era, technology-integrated learning is more

easily accepted by students, as they are already familiar with digital devices. Therefore, the combination of visual and digital elements in this learning medium offers a dual advantage in improving learning effectiveness in elementary schools (Abdulrahman et al., 2020).

From a language standpoint, the validation score of 93% indicates that the QR Code-based Pop-Up Book uses language appropriate for fifth-grade students. Children's ability to comprehend text highly depends on the structure of the language used, and the readability score of 94% confirms that this book is designed to be easily understood by students. In elementary education, word choice and sentence structure are key factors in determining learning effectiveness, as overly complex language can hinder students' understanding (Stahl & Nagy, 2007). Additionally, clear and simple language helps students associate new concepts with their existing knowledge, making the learning process more meaningful. Therefore, the high language validation score proves that this book is not only visually appealing but also effective in communicating the subject matter.

In terms of practicality for teachers, the score of 90% indicates that the QR Code-based Pop-Up Book is easy to implement in the teaching process. One of the biggest challenges in adopting new learning media is how well teachers can integrate it into their existing teaching methods without difficulty (Buabeng, 2012). The high practicality score suggests that this book has been designed in a way that allows seamless use without requiring extensive training for teachers. The QR Code feature also provides an added advantage, as teachers do not need to manually search for external sources to supplement the lesson (Gilbertson et al., 2022). With just a simple scan, students can instantly access additional materials such as traditional dance videos, regional songs, and interactive images. This not only saves teachers time but also ensures that the learning resources used are relevant and of high quality.

Student practicality is another key strength of this medium, as evidenced by the high score of 91.8%. Students showed great enthusiasm in using the QR Code-based Pop-Up Book due to its interactive and engaging nature. Visual and digital-based learning significantly impacts students' motivation, especially in subjects that require exploring abstract concepts such as cultural diversity. Students who previously learned about cultural topics only through static text and images can now see, hear, and even interact with the learning materials through the QR Code feature. According to multimodal learning theory, combining text, images, and audio increases students' cognitive engagement and strengthens their understanding of the concepts being taught (Ruck, 2022). Therefore, the high practicality score from students proves that this medium can create a more effective learning experience compared to conventional methods.

Although this medium has many advantages, several challenges must be considered in its implementation. One of the main concerns is the availability of digital devices in schools. Not all students have access to smartphones or tablets, meaning that the use of QR Codes may not be feasible for every student. To address this issue, schools can provide shared devices that students can use in turns during learning sessions. Additionally, a blended learning model can be adopted, where students use the QR Code feature at home under parental guidance, while in the classroom, they continue using the printed version of the book

(Tucker et al., 2016). This approach ensures that limited digital access does not become a major obstacle in the adoption of this learning medium.

Besides technical challenges, teacher readiness in adopting technology is another important factor. Some teachers may struggle to integrate digital-based media if they are not familiar with educational technology. Therefore, teacher training is essential to maximize the benefits of the QR Code-based Pop-Up Book. Training programs can cover how to optimize QR Codes in lessons, integrate them into lesson plans, and address potential technical issues (Ardika et al., 2022). With support from various stakeholders, including schools and policymakers, this medium can become a sustainable educational innovation that not only enhances students' understanding but also builds their digital literacy skills, which will be valuable for their future.

Besides improving students' understanding, using the QR Code-based Pop-Up Book has also been proven to increase students' interest in learning. In the educational field, learning motivation is one of the primary factors determining students' success in absorbing educational materials (Maesaroh, 2013). If students are interested and motivated to learn, they will be more active in exploring the material, ultimately improving their learning outcomes (Putri et al., 2017). Therefore, using engaging learning media like this can be a solution to overcoming low learning interest, which often becomes a challenge in conventional education systems.

Although this study's results show highly promising success, several challenges must still be considered in implementing the QR Code-based Pop-Up Book. One major challenge is the availability of digital devices in schools. Not all students have access to smartphones or tablets to scan QR Codes, requiring solutions from the school to ensure that all students can optimally use this media. One possible solution is to provide a limited number of digital devices at school that students can use interchangeably during the learning process.

Moreover, teachers' readiness to use technology is another crucial factor in successfully implementing this media. Teachers need specialized training to maximize the use of the QR Code-based Pop-Up Book in education. If teachers are unfamiliar with this technology, there is a possibility that this media will not be utilized optimally and will only become an additional tool that is underutilized (Ahmadi, 2017). Therefore, training teachers on utilizing technology in education should be part of the strategy for implementing the QR Code-based Pop-Up Book in schools.

Another aspect that must be considered is the quality of the content displayed in the QR Codes. Multimedia content must be continuously updated to remain relevant and engaging for students (Sugihartono, 2024). With rapidly advancing technology, the format or type of media used in QR Codes today may become obsolete in the coming years. Therefore, collaboration between educators, media designers, and technology developers is necessary to ensure that this Pop-Up Book continues to evolve and does not lose its appeal in the future.

Overall, the results of this study prove that the QR Code-based Pop-Up Book has great potential in enhancing the effectiveness of learning cultural diversity in elementary schools. This media not only helps students understand the material better but also increases their motivation to learn. Although some challenges remain in its implementation, the right

solutions can ensure that this media becomes part of sustainable educational innovation. With support from various parties, including schools, the government, and academics, the QR Code-based Pop-Up Book can be more widely implemented and positively impact the education sector.

Conclusion

Based on the research findings, the development of the QR Code-based Pop-Up Book has proven to be an innovative and effective learning medium for enhancing students' understanding of cultural diversity at SDN 160/IV Kota Jambi. Validation by experts indicates that this medium is highly valid in terms of content, visual design, and language, while trials conducted with teachers and students demonstrate that the Pop-Up Book is both highly practical and engaging for use in learning. The integration of three-dimensional elements with QR Code technology allows students to access additional materials in the form of videos, audio, and interactive exercises, making learning more dynamic and in-depth. Despite challenges such as limited digital devices and teachers' readiness to adapt to technology, appropriate solutions can ensure the optimal implementation of this medium. Therefore, the QR Code-based Pop-Up Book has great potential for broader application as an innovative learning tool that not only enhances students' understanding but also promotes digital literacy in elementary education.

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