



Development of virtual tour media using local history to improve learning outcomes

Aminah Lubis¹, Ichwan Azhari², Samsidar Tanjung³

^{1,2,3}Universitas Negeri Medan, Kota Medan, Indonesia

aminahlubis25@gmail.com¹, ichwana545@gmail.com², samsidar@unimed.ac.id³

ABSTRACT

The research was motivated by the lack of student engagement and minimal visualization in local history learning, which has resulted in a limited understanding. Conventional media limitations have created epistemological and didactic obstacles that hinder effective learning. Therefore, a technology-based solution is needed to present historical objects interactively and contextually. This study aims to develop a 360° *Virtual Tour* learning media based on the local history of Candi Bahal to improve the learning outcomes of fourth-grade elementary school students in Social Studies. This study used a Research and Development (RnD) method with the 4D model (Define, Design, Develop, Disseminate). The research subjects included students and fourth-grade teachers at SD Negeri 0701 Rotan Sogo. Data were collected through observation, interviews, expert validation, and field trials. Results showed that the 360° *Virtual Tour* media was declared feasible by experts, practical for teachers and students, and effective in improving learning outcomes. The practicality scores reached 72.8 percent for students and 76.67 percent for teachers, while the n-Gain score was 0.56 (moderate category). The developed media contribute positively to making local history learning more contextual and engaging.

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ABSTRAK

Latar belakang penelitian ini didasarkan pada rendahnya keterlibatan murid dan minimnya visualisasi dalam pembelajaran Sejarah lokal, yang menyebabkan pemahaman murid menjadi terbatas. Keterbatasan media konvensional menjadi hambatan epistemologis dan didaktik yang mengurangi efektivitas pembelajaran. Oleh karena itu, dibutuhkan solusi berbasis teknologi yang mampu menyajikan objek sejarah secara interaktif dan kontekstual. Penelitian ini bertujuan mengembangkan media pembelajaran *Virtual Tour* 360° berbasis sejarah lokal Candi Bahal untuk meningkatkan hasil belajar murid kelas IV SD dalam mata pelajaran IPS. Penelitian ini menggunakan metode *Research and Development* (RnD) dengan model 4D (*Define, Design, Develop, Disseminate*). Subjek penelitian terdiri dari murid dan guru kelas IV SD Negeri 0701 Rotan Sogo. Data dikumpulkan melalui observasi, wawancara, validasi ahli, dan uji coba lapangan. Hasil penelitian menunjukkan bahwa media *Virtual Tour* 360° dinyatakan layak oleh para ahli, praktis digunakan oleh guru dan murid, serta efektif dalam meningkatkan hasil belajar. Rata-rata skor kepraktisan oleh murid dan guru masing-masing mencapai 72,8 persen dan 76,67 persen, sedangkan skor efektivitas berdasarkan nilai n-Gain sebesar 0,56 (kategori sedang). Media ini memberikan kontribusi positif terhadap pembelajaran Sejarah lokal yang lebih kontekstual dan menarik.

Kata Kunci: hasil belajar; pengembangan media; sejarah lokal; virtual tour

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INTRODUCTION

Local wisdom plays a strategic role in shaping contextual historical understanding at the elementary education level. The integration of local history elements into classroom learning is considered effective in fostering cultural identity, enhancing students' pride in their region of origin, and strengthening the meaningfulness of learning experiences (Prasetyo & Kumalasari, 2021). The introduction of local history in elementary schools is not merely aimed at familiarizing students with historical sites or figures, but also serves as a character education strategy rooted in tangible cultural foundations (Budiarta, 2023). The relevance of this approach lies in the close connection between learning materials and students' daily experiences, which functions as a bridge for constructing deeper meaning and understanding of historical concepts. Learning approaches based on local wisdom have been proven effective in fostering historical awareness and improving students' learning outcomes through the simultaneous activation of affective and cognitive domains (Khasanah *et al.*, 2025).

The limited use of innovative learning media is one of the main factors contributing to the low effectiveness of local history learning in elementary schools. Teachers tend to deliver instructional content primarily through textbooks or verbal explanations, without the support of visual media that are relevant to students' everyday lives (Monika *et al.*, 2023). This condition results in limited meaningful learning experiences and low levels of student engagement in the learning process (Tressyalina *et al.*, 2023). The absence of representative instructional media in history education makes it difficult for students to fully understand historical concepts. The internalization of learning materials is hindered because students lack visual bridges or concrete experiences that can connect new knowledge with their existing cognitive structures. This situation gives rise to two interrelated forms of learning barriers, namely epistemological barriers and didactic barriers.

Epistemological barriers occur when students experience difficulty in constructing meaning from abstract historical concepts, while didactic barriers arise when instructional methods fail to optimally accommodate students' ways of thinking (Listiwani & Aramudin, 2024). The absence of media capable of contextualizing local history results in a mechanistic learning process that is less meaningful and primarily focused on memorization. This condition directly affects students' learning outcomes. When learning does not involve imagination, interaction, and multisensory experiences, students' cognitive and affective engagement remains low. Consequently, students' understanding of historical content becomes superficial, easily forgotten, and unable to foster historical awareness, which is the primary objective of history learning (Setiawan, 2022). The utilization of interactive technology in the form of virtual tour-based media offers a concrete solution to the epistemological and didactic barriers experienced by students in history learning.

Virtual tour media provide immersive visual access to historical sites, enabling students to explore environments virtually as if they were experiencing them firsthand (Haswin & Putra, 2024). Digital interactions through 360-degree panoramic displays, integrated narration, and contextual information encourage active student engagement and support the construction of meaningful historical understanding. Such exploration-based learning has been proven effective in strengthening the connection between abstract concepts and students' real-life experiences (Mardainis *et al.*, 2020). The integration of virtual tours into local history materials also fosters cultural awareness and enhances students' understanding of regional heritage (Mustika *et al.*, 2024). The close linkage between learning content and students' socio-cultural environments creates high learning relevance and contributes to more significant improvements in learning outcomes (Karlina & Nugraha, 2022).

Digital representations of historical sites through 360° virtual tours provide more authentic learning experiences compared to text-based instruction alone. Concepts such as geographical location, cultural values, the functions of historical buildings, and accompanying folklore become easier to understand

because they are presented through multimodal forms of representation (Gafar *et al.*, 2022). This approach strengthens the connection between instructional materials and students' lived experiences, while simultaneously fostering a sense of belonging and pride in local identity. However, history learning in Grade IV at SD Negeri 0701 Rotan Sogo remains dominated by conventional instructional methods limited to textbooks and oral explanations. Students have not yet been provided with access to learning media that support the concrete visualization of historical information. These limitations have contributed to students' low ability to identify historical events within their surrounding environment. Preliminary interviews with students indicate that their understanding tends to be general in nature and does not reflect a deep comprehension of local history content.

Furthermore, the instructional material *Daerahku Kebanggaanku* has not been fully internalized because teachers lack media that can effectively connect lesson content with students' cultural and geographical contexts. Students' responses tend to be generic and fail to demonstrate a deep understanding of local historical material. Participation levels in classroom discussions are also low, and learning outcomes indicate that the majority of students have not yet achieved the minimum mastery criteria. These conditions underscore the urgency of developing instructional media capable of providing contextual learning experiences that simultaneously engage students' cognitive and affective dimensions (Kurniawan *et al.*, 2024). This situation highlights a gap between the characteristics of local history content and the instructional approaches currently employed. The absence of media capable of representing information simultaneously in multiple forms, such as visual, textual, and audio, limits students' critical thinking processes in analyzing and reflecting on the meaning of historical events (Baltzer *et al.*, 2025).

Previous studies have demonstrated that the use of interactive media, such as virtual tours or augmented reality, can enhance students' conceptual understanding and critical thinking skills (Firdaus *et al.*, 2021; Siregar, 2023). However, these studies have not specifically emphasized the context of local history or the comprehensive multimodal representation of information within instructional media. This study offers scientific novelty by developing a 360° virtual tour-based learning media grounded in local history that integrates visual, textual, and audio elements simultaneously, and by examining the feasibility, effectiveness, and practicality of the media in improving Social Science learning outcomes through the enhancement of critical thinking skills among Grade IV elementary school students. This research is designed to formulate and address four primary focuses: the process of media development, the feasibility of the resulting product, and the effectiveness and practicality of the media within the context of local history learning.

LITERATURE REVIEW

Learning Media

Learning media are channels for delivering information designed to facilitate educational interaction between teachers and students. The use of learning media plays an important role in bridging the gap between the instructional message delivered and the understanding constructed by students (Khasanah *et al.*, 2025). In the educational context, media encompass all forms of instructional aids, visual, audio, or a combination of both, that help clarify content and support the internalization of knowledge. Learning media should be able to transform abstract concepts into concrete representations, making them more accessible to elementary school students (Maulidina & Darmawati, 2025). The classification of learning media is based on their form and mode of delivery, including visual media, audio media, audiovisual media, and interactive digital-based media (Ifrida *et al.*, 2024). Visual media include images, diagrams, maps, and graphs that function to strengthen learners' perception of the presented information. Audio media emphasize comprehension through sound elements, while audiovisual media simultaneously integrate sound and visual components (Fannandri & Ninawati, 2024).

Technological advancements have encouraged the emergence of interactive digital-based media such as educational applications, web-based simulations, virtual reality, and virtual tours that enable exploration-based learning experiences (Maryati *et al.*, 2024). The selection of appropriate media is strongly influenced by the characteristics of the learning material, students' abilities, and the intended learning objectives. The role of learning media extends beyond visual support to include motivational, stimulative, and communicative functions. Properly selected media can stimulate students' interest, maintain their attention, and create active and meaningful learning situations. Media also function as facilitators in developing critical thinking skills, as they allow students to observe, compare, and evaluate information from multiple perspectives (Fadilah *et al.*, 2023). This function becomes increasingly important in thematic learning at the elementary level, particularly when instructional content demands both emotional and cognitive engagement, such as in local history topics.

360° Virtual Tour Media

A 360° virtual tour is a digital technology that presents comprehensive panoramic views of real environments, allowing users to explore spaces as if they were physically present at the location (Drakopoulos & Sioulas, 2021). This technology integrates images, text, and audio narration to enable immersive and contextual learning experiences (Baltzer *et al.*, 2025). A 360° virtual tour displays environments in three-dimensional form, allowing each object within the space to be observed from multiple perspectives (Chrissandy, 2022). The interactivity and spatial navigation features of this media enhance user engagement during information exploration (Javaid *et al.*, 2024). These characteristics indicate that 360° virtual tours provide immersive, interactive, and contextual learning experiences for users. 360° virtual tour media offer access to historical sites through spatial navigation, integrated information, and interactive exploration (Nata, 2023; Rahaman *et al.*, 2023). The theme *Daerahku Kebanggaanku* in Grade IV IPAS emphasizes the recognition of regional identity, the understanding of historical values, and their connection to the formation of national character.

Interactive visual representations increase learning interest while simultaneously promoting critical thinking skills through the analysis of local historical events (Fauziah *et al.*, 2023; Siregar, 2023). These findings indicate that 360° virtual tour media can deliver interactive and informative learning experiences while supporting the development of students' critical thinking skills. The implementation of 360° virtual tours has been shown to improve information retention, stimulate curiosity, and encourage active student participation in learning activities (Gafar *et al.*, 2022; Haswin & Putra, 2024). Well-structured implementation strategies such as virtual observation followed by note-taking and reflective discussion further strengthen students' understanding (Kusdayati & Heryandi, 2024; Sekarsih *et al.*, 2024). These studies demonstrate that 360° virtual tours function as strategic media that bridge local wisdom-based approaches with the demands of modern learning, while simultaneously enhancing the quality of history learning outcomes in elementary schools.

Daerahku Kebanggaanku Learning Material

The theme *Daerahku Kebanggaanku* is part of Grade IV IPAS learning that emphasizes the introduction of cultural, social, and historical identities within students' surrounding environments. The focus of this material is directed toward building students' awareness of regional cultural richness and fostering an understanding of historical values embedded in local community life (Pigai & Yulianto, 2024). Learning within this theme requires a contextual approach that connects instructional content with students' local realities, enabling deeper meaning-making processes. Materials such as historical sites, folklore, traditions, and local cultural heritage need to be presented visually and narratively to facilitate comprehension among elementary school students (Chalimi, 2024). Candi Bahal is one of the historical

heritage sites located in the Portibi District, North Padang Lawas Regency, North Sumatra Province. The site is situated in a rural environment that retains strong traditional characteristics and local cultural values.

The existence of Candi Bahal serves as tangible evidence of Hindu-Buddhist cultural heritage in the southern Tapanuli region (Siswanto *et al.*, 2020). Access to the temple is relatively easy, making it highly suitable as a location-based learning object. Its geographical proximity to students' environments enhances its relevance as a source for local history learning. The construction of Candi Bahal is estimated to have taken place in the 11th century CE and forms part of the Padang Lawas temple complex, which is closely associated with the cultural influence of the Sriwijaya civilization. The temple is believed to have functioned primarily as a center for Vajrayana Buddhist religious activities (Kukuh & Herwindo, 2024). The long history of Candi Bahal reflects not only aspects of ancient architecture but also traces of cultural interaction and belief systems that once developed in the region. Knowledge of the temple's origins and functions is essential to convey to students as a form of appreciation for national cultural heritage (Siregar, 2023).

The main structure of Candi Bahal was constructed using large red bricks arranged with high precision without modern binding materials. The building layout is square-shaped with a towering roof resembling a stupa, while the wall surfaces are adorned with reliefs depicting religious symbols (Napitupulu, 2024). The central area of the temple complex serves as the focal point of ritual activities, marked by the presence of a stone altar surrounded by symmetrical architectural arrangements. The physical design of the temple reflects advanced construction techniques of the past as well as the sacred values upheld by the society of its time. The visual and historical uniqueness of this structure makes it highly suitable to be utilized as a digital learning object through 360° virtual tour media, enabling students to explore architectural details without the need to physically visit the site (Karlina & Nugraha, 2022).

METHODS

This study employed a Research and Development (R&D) approach to produce a learning media product in the form of a 360° virtual tour based on local history. The development model applied referred to the 4D model, which consists of four stages: define, design, develop, and disseminate. The research was conducted during the odd semester of the 2024/2025 academic year at SD Negeri 0701 Rotan Sogo, Huta Raja Tinggi District, Padang Lawas Regency. The research subjects included Grade IV students, classroom teachers, and an expert team consisting of a subject-matter expert, a media expert, and a language expert. The object of the study was the 360° virtual tour media developed to deliver local history content, with a focus on the cultural heritage of Candi Bahal.

The development procedure in this study followed the 4D model (define, design, develop, disseminate) to produce a 360° virtual tour-based learning media that is valid, effective, and practical. The define stage began with a needs analysis through classroom observations, interviews with teachers and students, and curriculum analysis to identify learning problems to be addressed through the media. Analyses of students, concepts, tasks, and learning objectives were conducted systematically to ensure that the developed media aligned with the characteristics and needs of Grade IV students at SD Negeri 0701 Rotan Sogo. The design stage involved preparing learning assessment instruments, selecting appropriate media and formats, and developing the initial media design, which was subsequently revised based on feedback from academic supervisors. The development stage included validation by subject-matter and media experts, as well as a limited trial with students to determine the feasibility and effectiveness of the media in the learning process. The dissemination stage was conducted on a limited scale by introducing the developed product to teachers as an initial step toward broader utilization of the media in local history learning.

Data were collected using several techniques, including observation, interviews, questionnaires, and learning outcome tests. Observation was used to obtain preliminary information regarding instructional conditions and student characteristics. Interviews with teachers and students were conducted to strengthen the identification of media needs. Questionnaires were employed to assess expert and teacher responses regarding the feasibility and practicality of the 360° virtual tour media. Learning outcome tests were administered to students before and after the use of the media to examine its impact on improving students' understanding of the material. The collected data were analyzed using descriptive quantitative analysis based on percentages to interpret expert validation results, media practicality, and learning outcomes. Percentage scores were categorized according to product feasibility and effectiveness criteria to objectively determine the quality of the developed media.

RESULTS AND DISCUSSION

Define Stage

The define stage began with classroom observations conducted over three instructional meetings, interviews with the Grade IV classroom teacher, and an initial analysis of the IPAS learning process at SD Negeri 0701 Rotan Sogo. The observation results indicated that learning activities were still dominated by lecture-based methods with minimal utilization of technology. Local history content, such as Candi Bahal, was delivered solely through verbal explanation. No visual or interactive media were employed, resulting in students experiencing difficulties in developing a deep understanding of the material. Teachers reported limitations in designing engaging and contextual learning media. The impact of these conditions was reflected in low learning achievement, with only 34.7% of students meeting the Minimum Mastery Criteria (*Kriteria Ketuntasan Minimal/KKM*). These findings highlight the urgent need for the development of innovative learning media that align with students' needs, characteristics, and the complexity of local history content.

Student analysis further reinforced the urgency of developing visual- and interactive-based learning media. Grade IV students are at the concrete operational stage of cognitive development, which requires learning experiences grounded in concrete activities and visual representations. Information is more easily understood when presented through images, animations, or simulations that allow for independent exploration. Students' tendency to experience boredom during lessons indicates that conventional instructional approaches are insufficient in meeting their learning style preferences. Moreover, students' interest in technological devices such as computers, tablets, and smartphones suggests strong potential for increasing learning motivation when digital media are optimally integrated into the instructional process. Concept analysis was conducted to determine the structure of local history material to be delivered through the learning media. The primary focus was placed on the theme "*Cerita tentang Daerahku*" within the Kurikulum Merdeka, with Candi Bahal as the main learning object. The developed concepts included historical understanding, architectural structure, cultural values, and the relationship between historical sites and community life. The limited availability of learning resources related to local history further emphasized the importance of presenting content through visual narrative-based media.

Task analysis was also carried out to design learning activities that promote exploration, such as virtual exploration, information recording, discussion, and report writing. This approach was selected to develop students' observational, reflective, and critical thinking skills. The formulation of learning objectives constituted the final component of the define stage and served as the foundation for media development. The objectives focused on students' ability to identify local historical information, understand cultural values, and connect IPAS concepts with everyday life. These objectives were designed to integratively develop cognitive, affective, and psychomotor domains. Achievement indicators were formulated to enable

students to identify key parts of Candi Bahal, explain its brief historical background, and relate it to its social context. The 360° virtual tour media was selected as a solution due to its capacity to provide exploratory and immersive learning experiences. Overall, the definition stage established a strong foundation for the development of learning media that are relevant, contextual, and aligned with the characteristics of elementary school students.

Design Stage

The design stage focused on the development of evaluation instruments and the design of digital-based learning media. Test instruments were constructed based on local history learning indicators that refer to the learning outcomes of the Kurikulum Merdeka. The test items were designed using Bloom's taxonomy to measure students' thinking skills from basic to higher-order levels, including remembering, understanding, analyzing, and creating. The question formats consisted of multiple-choice and short-answer items to align with the cognitive characteristics of elementary school students. This adjustment was intended to produce an evaluation that is both comprehensive and aligned with the established learning objectives. The selected learning media was a 360° virtual tour that enables students to explore the Candi Bahal site interactively. The media was developed through a digital platform that presents a comprehensive visualization of the temple, complemented by audio narration at key points of the building. Interactive features allow students to conduct virtual exploration as if they were visiting the site directly. The utilization of this media is expected to enhance student learning engagement and foster interest in local history, which has been difficult to achieve through conventional instructional methods.

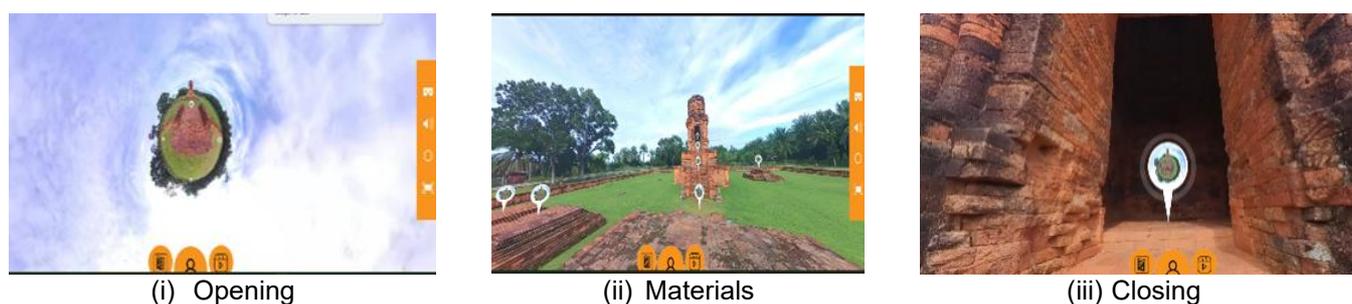


Figure 1. Initial interface of the 360° virtual tour–based learning media
Source: Research Data, 2025

The media design consists of three main components: an opening section, core content, and a closing section. This design is intended to encourage students to identify connections between newly acquired information and the realities of their daily lives. The primary objective of this design is to create learning experiences that are contextual, interactive, and capable of enhancing cultural awareness. Overall, the design stage provides a strong foundation for the subsequent phase of media development. The initial display of the 360° virtual tour–based learning media developed in this study is presented in **Figure 1**.

Development Stage

The opening section guides students in familiarizing themselves with the initial interface, while the main content presents historical information, architectural structures, and the cultural values of Candi Bahal. Visual and audio narratives are employed to strengthen students' comprehension of the material. The closing section provides a summary of the content and invites students to engage in reflective learning. The navigation design is linear and intuitive, making it easy to understand and use by students, including those who are not yet accustomed to digital learning media. Validation was conducted by involving

classroom teachers and media experts to assess content feasibility, visual quality, and the alignment of the material with the local context. Feedback obtained from the validation process was used to refine the design before the product was implemented in a trial phase. The validation aimed to ensure that the 360° virtual tour media met feasibility standards in terms of visual presentation, content accuracy, language use, and evaluation instruments. This process involved four independent validators who systematically evaluated critical aspects of the learning media. The results of these assessments served as the basis for determining whether the media were suitable for limited trials with students.

The validation results from the four experts are presented in **Table 1**.

Table 1. Expert Validation Results

No	Validator	Score	Category
1	Language Expert	4,6	Very Feasible
2	Media Expert	4,39	Very Feasible
3	Subject Matter Expert	3,33	Feasible
4	Test Instrument Expert	4,7	Very Feasible

Source: Research Data, 2025

The evaluation conducted by the media expert indicates that the 360° virtual tour learning media obtained an average score of 4.39, classified as “very feasible.” The assessed components included visual aesthetics, interactive navigation, text readability, and the integration of audiovisual elements with the content structure. These results demonstrate that the media meets the standards of adaptive digital instructional design and is easy to use for elementary school students. Overall, the visual aspects were considered sufficiently informative and did not require further revision. The language expert’s assessment shows that the language used in the media is appropriate for the cognitive development level of elementary school students. The average score obtained was 4.6, categorized as “very feasible.” The narration was deemed communicative, unambiguous, and effective in conveying instructional messages. Validation by the subject matter expert resulted in an average score of 3.33, which falls under the “feasible” category. Several aspects were identified as requiring improvement, particularly the systematic organization of the material, the completeness of the illustrations, and the accuracy of spelling and grammar. The evaluation also examined the alignment of the content with learning objectives and its relevance to the local context.

The final validation was conducted by the test instrument expert, who awarded an average score of 4.7. The assessment instruments were considered well aligned with the learning indicators and capable of measuring various cognitive levels in accordance with Bloom’s taxonomy. The test items reflected the achievement of learning objectives comprehensively and were deemed usable without revision. Based on the overall validation results, the 360° virtual tour media was declared feasible and ready for implementation in a limited trial.

The next stage involved a practicality test aimed at assessing the extent to which the 360° virtual tour media could be used efficiently in IPAS learning activities. This evaluation was conducted after the media was implemented on a limited basis with five fourth-grade students at SD Negeri 0701 Rotan Sogo. Each student participated in the learning process using the developed media. The evaluation instrument consisted of a practicality questionnaire covering indicators such as ease of navigation, clarity of display, visual appeal, and the usefulness of the media in facilitating understanding of local history material. The results of the student practicality test are presented in **Table 2**.

Table 2. Results of the Student Practicality Test

No	Respondents	Score Percentage
1	Student-01	71%
2	Student-02	73%
3	Student-03	70%
4	Student-04	67%
5	Student-05	83%
Average		72,8%

Source: Research Data, 2025

The analysis results indicate that the average percentage score of students' responses reached 72.8%. Based on the assessment criteria, this percentage falls into the "practical" category, indicating that the media is feasible for use in IPS learning.

The next stage involved conducting a practicality test by teachers. The results of the teacher practicality test are presented in Table 3 below.

Table 3. Results of the Teacher Practicality Test

No	Respondents	Score Percentage
1	Teacher-01	77%
2	Teacher-02	76%
Average		72,8%

Source: Research Data, 2025

The evaluation of the practicality of the learning media was conducted not only with students but also involved two fourth-grade teachers who served as respondents. The assessment focused on aspects of ease of access to the media, alignment of content with the curriculum, and the effectiveness of the media in supporting teaching and learning activities. The first teacher provided a practicality score of **77%**, while the second teacher gave a score of 76%. The overall average score from both respondents reached 76.67%, which is categorized as "very practical" based on the data interpretation guidelines used. These findings provide empirical support that the 360° virtual tour media is considered highly supportive of the learning process by teachers.

The results of the practicality tests from both students and teachers indicate that the 360° virtual tour media have met the criteria of functionality and ease of use in learning activities. The practicality score from students was 72.8%, while the two teachers' assessments averaged 76.67%, placing in the very practical category. These findings suggest that the media is feasible for use without requiring significant modifications and can be directly implemented in the learning process. This validation is further strengthened by the evaluation of the learning assessment instrument, which was declared valid and reliable by experts.

Empirical testing results indicate that the instrument demonstrated a reliability coefficient of 0.855, proportional variation in item difficulty levels, and high discriminating power. The instrument was used in a field trial at SDN 0701 Rotan Sogo involving two classes with 30 and 25 students, respectively, through the administration of pretests and posttests. The visualization of the comparison between pretest and posttest results is presented in **Figure 2**.

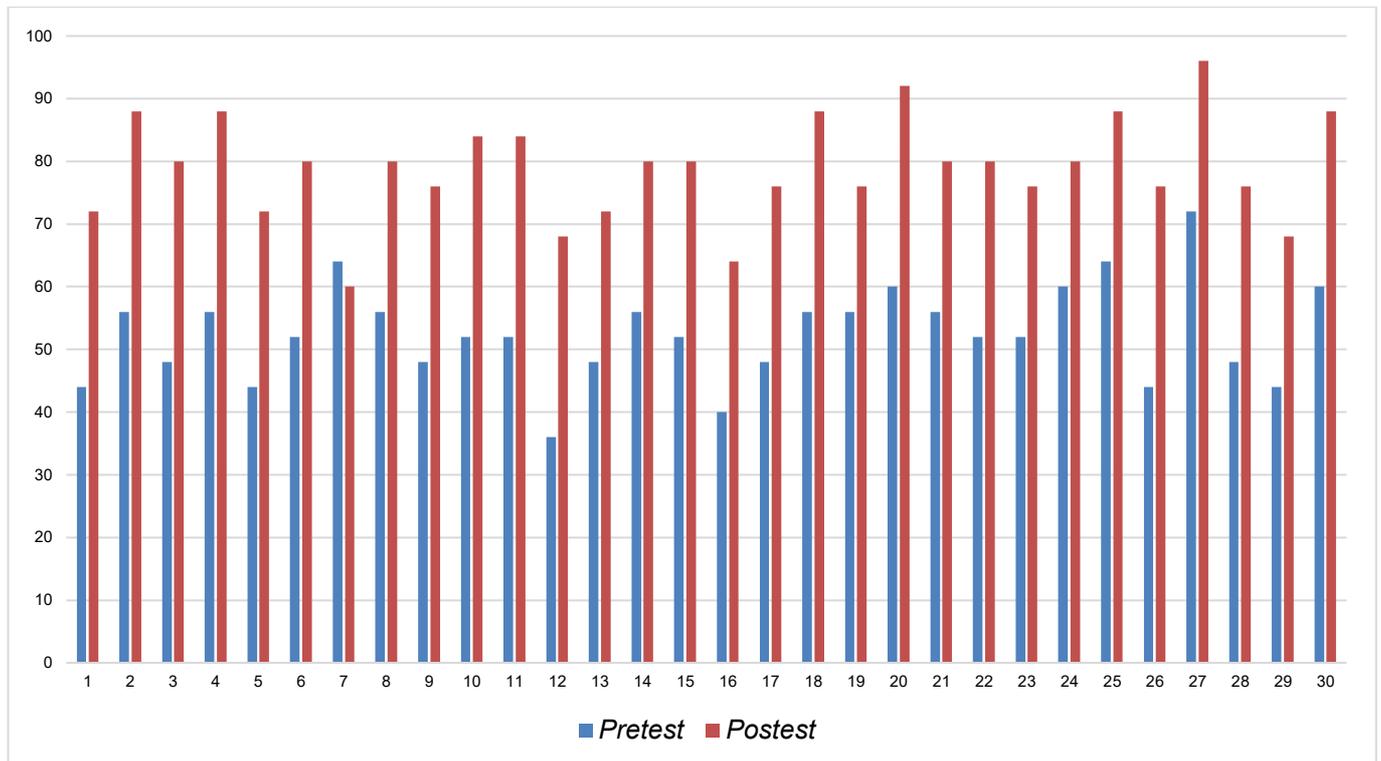


Figure 2. Pretest and Posttest Results
Source: Research Data, 2025

Normality and homogeneity tests were conducted to ensure the validity of the data. The analysis results indicate that both pretest and posttest data were normally distributed and that the variances between classes were homogeneous. These findings strengthen the conclusion that the differences in learning outcomes were attributable to the media intervention rather than extraneous factors. The effectiveness of the media was measured using the n-Gain analysis. The results showed that the average pretest score was 53, which increased to 79 in the posttest, yielding an n-Gain score of 0.56, categorized as moderate. This improvement indicates a positive contribution of the media to students' learning outcomes in local history material. The 360° virtual tour media was proven to provide a contextual, interactive, and meaningful learning experience. These results serve as empirical evidence that the media is feasible and effective for use as an alternative learning resource in Social Science instruction at the elementary school level.

Dissemination Stage

The product was disseminated through a discussion forum for classroom teachers, accompanied by an explanation of the background of media development, usage guidelines, and the advantages of the available interactive features. The dissemination process was further complemented by a live demonstration of the media, including the exploration of visual and audio elements embedded in the virtual tour. During the activity, teachers actively participated in understanding and evaluating the potential use of the media in locally based IPAS learning. Furthermore, teachers expressed enthusiasm for the use of digital-based media, as they perceived it to be capable of increasing students' interest in local history learning. The integration of virtual tour media into history instruction aligns with the principles of the Kurikulum Merdeka.

Teachers also provided recommendations regarding the developed 360° virtual tour. These recommendations included improving the clarity of audio narration, adding visual elements that display more detailed structures of Candi Bahal, and providing simpler usage instructions for students. The feedback served as a basis for further development to enhance accessibility and improve students' learning experiences through the media. In addition, the recommendations were used as a reference for implementing the media in other schools with similar characteristics, particularly those with limited resources for teaching local history. These findings confirm that the dissemination stage functions not only as a means of introducing the product but also as a source of constructive feedback for refinement and broader implementation of the learning media.

Discussion

The locally based 360° virtual tour learning media focusing on the historical site of Candi Bahal was declared feasible based on validation results from expert reviewers. The feasibility of the media is reflected in the high average scores awarded by media experts, language experts, and evaluation instrument experts. The visual aspects, narration, and material structure met the criteria appropriate to the cognitive developmental level of elementary school students. Interface clarity, the use of age-appropriate terminology, and the systematic organization of content based on concept mapping further support the feasibility of the media as an instructional tool. Previous studies have also indicated that digital learning media grounded in local culture significantly contribute to content validity and structural presentation (Khasanah *et al.*, 2025). Validation from multiple experts confirms that the developed media meets quality standards and is suitable for use in fourth-grade social studies (IPS) learning (Kusdayati & Heryandi, 2024).

The effectiveness of the learning media is demonstrated by the improvement in students' learning outcomes after using the 360° virtual tour. Pretest and posttest data reveal a significant increase, with an average n-Gain score of 0.56, which falls into the moderate category. This finding indicates that the media effectively facilitates students' meaningful understanding of local historical concepts. Interactive visual media enable students to construct knowledge through independent exploration and context-based learning experiences. Previous research has similarly shown that virtual tour media can enhance learning achievement in history-related topics by fostering emotional and narrative engagement among students (Haswin & Putra, 2024). The effectiveness of experience-based digital learning media has also been proven to strengthen the understanding of abstract concepts through contextual visualization (Handayani *et al.*, 2021). The practicality of the learning media is reflected in the results of limited trials involving both students and classroom teachers. Student practicality scores reached 72.8%, categorized as practical, while teachers provided an average score of 76.67%, indicating that the media is very practical for classroom use.

These assessments were based on ease of access, attractive visual presentation, and the effectiveness of the media in supporting teaching and learning processes. Recent studies have found that locally based virtual tours are highly practical because they require minimal additional training and are easily accessible for elementary school students (Karlina & Nugraha, 2022). However, attention must also be given to the medium used to deliver the virtual tour, such as websites or other digital platforms that serve as access points for the media (Hadiapurwa *et al.*, 2024). Despite these positive findings, this study has several limitations. The scope of the trial was restricted to a single elementary school, SD Negeri 0701 Rotan Sogo, with a relatively small number of participants. Consequently, the generalisation of the findings to other elementary school contexts with different characteristics remains limited. In addition, the effectiveness of the media was examined only within the context of the local history topic of Candi Bahal; therefore, its application to other Social Science themes cannot yet be generalized. Limitations in schools' technological infrastructure may also affect the sustainability and broader implementation of media.

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CONCLUSION

The 360° virtual tour-based learning media developed for the local history material on Candi Bahal have been validated by experts, shown to improve student learning outcomes, and practical for use in fourth-grade IPS learning at the elementary school level. The development of this media offers a viable solution to address student boredom in history learning. Interactive visualization and contextual narration embedded in the media successfully enhanced student engagement and supported a meaningful understanding of local historical concepts. The effectiveness testing demonstrated a significant improvement in students' learning achievement after the implementation of the media, while the practicality test indicated that the media could be used smoothly by both teachers and students without technical difficulties. Furthermore, the dissemination stage revealed positive responses from teachers, leading to the conclusion that the media is feasible for classroom implementation. This development strengthens the role of technology in locality-based learning and provides an alternative solution to the limited availability of local history learning resources in elementary schools. Future research is recommended to develop similar media featuring other cultural heritage sites across Indonesia and to expand coverage of digital platforms to support equitable access to locally wisdom-based learning at the national level.

AUTHOR'S NOTE

The authors declare that there is no conflict of interest related to the publication of this article. The authors also affirm that the data and content of this article are free from plagiarism.

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