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Developing Culturally Responsive Augmented Reality Pop-Up Books for Elementary Social Studies: A Preliminary Needs Analysis

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Abstract
Contemporary Social Studies instruction in elementary schools faces significant challenges in engaging students with cultural heritage content, primarily due to teacher-centered approaches and limited interactive media. This study addresses the need for innovative, culturally responsive instructional media by conducting a preliminary needs analysis for developing Augmented Reality (AR) Pop-Up Book embedded with ethnopedagogical content. A qualitative descriptive approach was employed at SDN Sawunggaling I/382 Surabaya, involving one fifth-grade teacher and ten students. Data were collected through classroom observations, semi-structured interviews, and document analysis, then analyzed using Miles and Huberman's interactive model. Findings revealed persistent lecture-dominated instruction with minimal interactive media utilization, resulting in low student engagement and suboptimal learning outcomes. Both teachers and students expressed strong need for interactive, visual media that contextualizes cultural heritage content. Current instructional resources proved inadequate for facilitating meaningful engagement with abstract cultural concepts. The identified needs strongly support AR Pop-Up Book development as an appropriate pedagogical solution. Integration of AR technology with ethnopedagogical principles can address engagement challenges while strengthening cultural identity. Findings align with research demonstrating AR's effectiveness in improving motivation and learning outcomes, while ethnopedagogy enables authentic connections between academic content and lived cultural experiences.

INTRODUCTION

The rapid advancement of information technology in the digital era necessitates transformative approaches in education to create innovative and engaging learning experiences. Twenty-first century learning emphasizes the development of critical thinking, collaboration, creativity, and technological literacy alongside cultural awareness (Chalkiadaki, 2018; Glaveanu et al., 2021). Social Studies education in elementary schools plays a crucial role in shaping students' understanding of their social environment, cultural heritage, and national values. However, contemporary Social Studies instruction frequently faces challenges in maintaining student engagement and facilitating meaningful learning experiences. Traditional teacher-centered pedagogical approaches often result in passive learning environments where students exhibit limited participation, reduced interest in subject matter, and difficulties comprehending abstract concepts, particularly in the context of cultural heritage materials (Barton & McCully, 2005; Deslauriers et al., 2019).

The persistent reliance on conventional instructional methods, predominantly lecture-based delivery, creates a significant pedagogical gap in Social Studies education (Bradford et al., 2016). Empirical evidence suggests that inadequate utilization of interactive and engaging instructional media

contributes to suboptimal learning outcomes. Students struggle to develop concrete understanding of abstract cultural concepts when instruction relies primarily on textbooks and static visual aids (Çengelci, 2013). This pedagogical challenge is particularly pronounced in cultural heritage education, where learners require multisensory and contextualized learning experiences to develop authentic appreciation and understanding of their cultural identity (Yeh et al., 2022). Furthermore, the absence of technologically-enhanced instructional materials limits opportunities for active student participation and meaningful knowledge construction (Merchant et al., 2014).

Recent developments in educational technology present substantial opportunities for pedagogical innovation through the integration of digital media in instructional design. Augmented Reality (AR) technology represents a particularly promising innovation, offering the potential to merge physical and virtual learning experiences (Akçayır & Akçayır, 2017). When integrated with pop-up books, AR technology creates hybrid learning environments that combine three-dimensional visual elements, digital interactivity, and tangible manipulatives (Billinghurst et al., 2001; Vate-U-Lan, 2012). This technological integration not only enhances visual appeal but also facilitates direct learner interaction with educational content, thereby promoting deeper cognitive processing and meaningful learning experiences. Studies indicate that AR-enhanced instructional materials significantly improve student motivation, engagement, and conceptual understanding compared to traditional instructional approaches (Chang et al., 2023; Garzón & Acevedo, 2019; Liu et al., 2023).

Beyond technological considerations, the integration of ethnopedagogical principles in instructional media development represents a critical dimension of culturally responsive education. Ethnopedagogy emphasizes local wisdom and cultural values as fundamental learning resources, enabling students to develop authentic connections between academic content and their lived cultural experiences (Ladson-Billings, 1995; Mulyani et al., 2024). Through ethnopedagogy-based instructional media, learners can explore their regional cultural heritage, develop stronger cultural identity, and cultivate respect for cultural diversity (Lubis et al., 2022). This pedagogical approach aligns with contemporary educational paradigms that emphasize contextualized, culturally relevant learning experiences (Gay, 2010). Preliminary observations conducted in elementary school settings revealed that student learning activity remained significantly low due to limited instructional media variety and insufficient facilitation of active student participation.

Despite growing scholarly interest in AR technology and ethnopedagogy individually, limited research has examined the integration of these approaches in elementary Social Studies education, particularly for cultural heritage instruction. This gap presents both a challenge and an opportunity for educational innovation. Consequently, this study addresses this research gap by conducting a comprehensive needs analysis for developing AR pop-up book instructional media embedded with ethnopedagogical content for elementary Social Studies education. The needs analysis methodology enables systematic identification of instructional challenges faced by teachers and students while determining appropriate media characteristics aligned with authentic classroom needs. The findings from this needs analysis will serve as the essential foundation for the design phase of AR pop-up book media development, ensuring that the final product authentically addresses identified instructional needs and stakeholder expectations.

METHODS

This study employed a qualitative descriptive approach to analyze the preliminary needs for developing Social Studies instructional media based on Augmented Reality Pop-Up Book with ethnopedagogical content. Qualitative research involves investigating phenomena within their natural settings to understand what occurs, why it occurs, and how it occurs through systematic data collection and analysis (Rijal Fadli, 2021). This approach was particularly appropriate for capturing the authentic experiences, perceptions, and expectations of teachers and students regarding instructional media development, thereby enabling comprehensive understanding of the contextual challenges and requirements in real classroom environments.

The research was conducted at SDN Sawunggaling I/382 Surabaya, involving purposively selected participants who were directly engaged in Social Studies instruction. The research subjects comprised one fifth-grade classroom teacher and ten fifth-grade students, chosen based on their direct involvement in teaching and learning Social Studies, particularly cultural heritage materials. This purposive sampling strategy ensured that participants possessed relevant experiences and insights essential for identifying authentic instructional needs and media characteristics required for effective Social Studies learning.

Data collection utilized three complementary techniques to ensure methodological triangulation and comprehensive data gathering. Systematic classroom observations were conducted to examine learning processes, teaching methods, media utilization, and student engagement patterns during Social Studies instruction. These observations provided direct evidence of instructional practices and student behaviors in natural classroom settings. In-depth semi-structured interviews were subsequently conducted with the teacher and selected students to explore their experiences, challenges, and expectations regarding instructional media. The interview protocol addressed topics including current teaching practices, media preferences, perceived learning difficulties, and desired media characteristics. To complement observational and interview data, document analysis examined official instructional documents including lesson plans, syllabi, and student learning outcomes. This documentation review provided insights into curriculum standards, instructional objectives, and actual student achievement levels.

The validity of data collection instruments was established through expert judgment, whereby interview guides and observation protocols were reviewed by educational technology and Social Studies education specialists to ensure content validity and alignment with research objectives. Data reliability was enhanced through methodological triangulation, combining multiple data sources and collection techniques to verify findings and ensure consistency of information across different data types.

Data analysis followed the interactive model proposed by Miles and Huberman (1994), which encompasses three iterative stages. Data reduction involved systematically selecting, focusing, simplifying, and organizing raw data to retain only relevant and meaningful information aligned with research objectives. The reduced data were then presented through matrices, tables, and narrative descriptions to reveal patterns, relationships, and emerging themes systematically. Finally, conclusion drawing involved continuous interpretation and verification processes to ensure that conclusions were accurate, valid, and thoroughly supported by analyzed data. This rigorous analytical approach enabled the identification of specific instructional needs and media characteristics required for AR Pop-Up Book development.

RESULTS AND DISCUSSION

Results

The findings from this preliminary needs analysis reveal critical insights into the current state of Social Studies instruction at SDN Sawunggaling I/382 Surabaya, particularly regarding instructional media utilization, pedagogical approaches, and stakeholder expectations for media development. Data were systematically collected through classroom observations, in-depth interviews with teachers and students, and comprehensive document analysis to provide a holistic understanding of instructional needs.

Current Instructional Practices and Challenges

Classroom observations conducted over multiple Social Studies lessons revealed persistent patterns of traditional, teacher-centered instruction. The teaching process was predominantly lecture-based, with minimal utilization of interactive or technologically-enhanced instructional media. Throughout observed lessons, the teacher primarily relied on oral explanations supplemented by static textbook images and occasional use of printed visual aids. Student engagement during these lessons remained notably low, with only a small fraction of students actively participating in question-and-

answer exchanges initiated by the teacher. The majority of students exhibited passive learning behaviors, demonstrating limited initiative in asking questions or contributing to classroom discussions. This observation aligns with the broader critique that teacher-centered approaches often result in passive learning environments where students become mere recipients of information rather than active constructors of knowledge.

The limited variety of instructional media available in the classroom emerged as a significant constraint. Beyond standard textbooks and occasional printed images, no interactive, digital, or culturally contextualized learning materials were evident during observations. This absence of engaging media contributed directly to reduced student motivation and participation. Furthermore, the instructional time was not optimally utilized for active, exploratory learning activities that could enhance student engagement with cultural heritage content. These observational findings underscore the critical need for innovative instructional media that can transform passive learning environments into more interactive and engaging educational experiences.

Stakeholder Perspectives on Instructional Needs

In-depth interviews with the fifth-grade teacher and selected students provided valuable insights into current challenges and expectations regarding Social Studies instruction. Table 1 summarizes the key findings from these interviews, revealing consistent patterns of instructional limitations and stakeholder aspirations for enhanced learning experiences.

Table 1. Interview Findings with Teacher and Students

No	Aspect Examined	Interview Findings
Teacher Interview		
1	Social Studies Lesson Planning	Teacher develops lesson plans aligned with curriculum requirements but has not integrated innovative or interactive media into instructional design
2	Instructional Media Utilization	Media usage remains limited to textbooks and simple images, insufficient for optimally engaging student attention and facilitating deep understanding
3	Student Activity and Engagement	Student activity tends toward passivity, evidenced by low participation in discussions and question-answer sessions
4	Student Comprehension of Content	Student comprehension remains low, demonstrated by difficulties in explaining previously learned material
5	Assessment and Learning Outcomes	Student learning outcomes have not achieved mastery standards; teacher identifies media limitations as a primary contributing factor
Student Interview		
1	Interest in Social Studies Learning	Several students express limited interest due to monotonous instruction lacking engaging activities
2	Experience with Learning Media	Students report only textbooks and images are used; these media provide insufficient support for deep content understanding
3	Participation in Learning Process	Most students acknowledge infrequent active participation because content is delivered through lectures without motivating media
4	Content Comprehension	Students experience difficulty understanding material, particularly due to unengaging and decontextualized presentations
5	Learning Barriers	Students report feeling quickly bored and struggling to visualize examples of local cultural heritage due to absence of interactive visual media

The teacher interview data revealed a critical disconnect between curriculum intentions and actual instructional implementation. While lesson planning adhered to official curriculum standards, the integration of innovative media remained minimal. The teacher explicitly acknowledged that

existing instructional media—primarily textbooks and static images—proved inadequate for capturing student attention or facilitating meaningful engagement with cultural heritage content. This limitation directly impacted student learning outcomes, with assessment results consistently falling below mastery standards. The teacher identified this media gap as a primary obstacle to achieving instructional objectives, particularly for abstract cultural concepts requiring concrete, contextualized representations.

Student interview responses corroborated the teacher's observations while providing additional perspectives on learning experiences. Students consistently reported low interest in Social Studies lessons, attributing their disengagement to monotonous, lecture-dominated instruction. The absence of interactive or visually engaging media left students unable to connect abstract cultural heritage concepts with tangible, relatable examples. Multiple students expressed difficulty visualizing local cultural heritage examples when instruction relied solely on verbal descriptions and static images. This comprehension challenge manifested in reduced motivation to participate actively in learning activities. Students articulated clear preferences for more interactive, visually stimulating learning experiences that would enable them to explore cultural content in engaging, meaningful ways.

Document Analysis Findings

Systematic analysis of official instructional documents, including lesson plans (RPP), syllabi, and student learning outcome records, provided complementary evidence supporting observational and interview findings. The curriculum documents demonstrated that Social Studies instruction at this school followed prescribed national curriculum standards, with clearly articulated learning objectives and competency targets. Lesson plans specified appropriate pedagogical activities including observation, questioning, and discussion strategies designed to promote active learning. However, a critical limitation emerged in the instructional media sections of these documents, which predominantly listed conventional resources: textbooks, worksheets, and printed images.

Further examination of student learning outcome data revealed that a substantial proportion of students had not achieved mastery levels in Social Studies assessments, particularly on content requiring visual understanding and cultural contextualization. This pattern of suboptimal achievement corresponded directly with topics where abstract concepts predominated and where concrete, interactive media could have enhanced comprehension. The document analysis thus confirmed that existing instructional resources, as reflected in planning documents and outcome assessments, remained insufficient to support effective teaching and learning of cultural heritage content. These findings collectively validate the urgent need for innovative, technology-enhanced instructional media that can bridge the gap between curriculum intentions and actual learning outcomes.

Discussion

This preliminary needs analysis has identified critical gaps in current Social Studies instruction at the elementary level, particularly regarding media utilization, pedagogical approaches, and student engagement with cultural heritage content. The convergence of evidence from observations, interviews, and document analysis reveals a persistent pattern of teacher-centered, lecture-dominated instruction that relies heavily on conventional media while producing suboptimal learning outcomes. Students demonstrate low engagement, limited comprehension, and reduced motivation when learning about cultural heritage through traditional approaches. These findings align with extensive research demonstrating that passive, teacher-centered pedagogical approaches often fail to promote meaningful learning, particularly for abstract or culturally contextualized content.

The observed predominance of teacher-centered instruction at SDN Sawunggaling I/382 reflects broader challenges documented in educational research. As noted by Mladenovici et al. (2022) and Woods and Copur-Gencturk (2024), traditional teacher-centered approaches position teachers as primary knowledge sources while students remain passive information recipients. This pedagogical model, while efficient for content coverage, frequently fails to develop critical thinking, problem-solving capabilities, and deep conceptual understanding essential for meaningful learning. The present

findings corroborate these concerns, demonstrating that lecture-based instruction with minimal interactive media correlates with reduced student engagement and suboptimal learning outcomes. Research by Deslauriers et al. (2019) further validates that passive learning environments significantly limit students' ability to construct meaningful knowledge, particularly when dealing with abstract concepts such as cultural heritage values and historical significance.

The identified media limitations present particularly significant implications for cultural heritage education. Students' difficulty visualizing and understanding local cultural concepts when instruction relies on static, decontextualized materials aligns with Yeh et al. (2022), who emphasized that cultural heritage education requires multisensory, contextualized learning experiences to foster authentic appreciation and understanding. The absence of interactive, culturally responsive media at the research site represents a critical barrier to achieving Social Studies learning objectives. This finding resonates with Çengelci's (2013) assertion that effective Social Studies instruction necessitates diverse, engaging media that can bridge abstract concepts with students' lived experiences.

The identified needs strongly support the development of Augmented Reality Pop-Up Book media as an appropriate intervention. AR technology's capacity to merge physical and virtual learning experiences addresses multiple challenges identified in this study. Research demonstrates that AR-enhanced instructional materials significantly improve student motivation, engagement, and conceptual understanding compared to traditional approaches (Chang et al., 2023; Garzón & Acevedo, 2019). A meta-analysis by Liu et al. (2023) specifically examining AR in elementary education confirmed substantial positive effects on learning outcomes, corroborating AR's potential to address the engagement and comprehension challenges documented at the research site.

The integration of pop-up book elements with AR technology creates particularly promising opportunities for elementary Social Studies instruction. Physical pop-up books provide tangible, manipulable learning materials that elementary students find intrinsically engaging, while AR overlays introduce interactive digital content that can animate cultural heritage concepts in ways static images cannot. Studies by Vate-U-Lan (2012) and Billinghurst et al. (2001) demonstrated that AR pop-up books successfully combine three-dimensional visual elements with digital interactivity, creating hybrid learning environments that facilitate deeper cognitive processing. This technological integration directly addresses students' expressed need for more visual, interactive media that can help them visualize and understand cultural heritage concepts more concretely.

Georgiou and Kyza (2018) found that immersion in AR settings positively predicted conceptual learning gains, suggesting that AR's immersive qualities can enhance students' ability to construct meaningful understanding of abstract content. Furthermore, research by Khan et al. (2019) and Lai and Chang (2021) demonstrated that AR applications significantly increased students' intrinsic motivation and learning performance, addressing the motivation challenges identified in the present study. The novelty of AR stimulates students' curiosity and drives sustained engagement, making learning more appealing and effective—precisely the qualities teacher and student participants identified as lacking in current instruction.

Beyond technological considerations, the integration of ethnopedagogical principles represents a critical dimension of the proposed media development. Interview findings revealed that students struggle to connect cultural heritage content with their lived experiences, suggesting a need for more culturally responsive instructional approaches. Ethnopedagogy, which emphasizes local wisdom and cultural values as fundamental learning resources, enables students to develop authentic connections between academic content and their cultural identities (Ladson-Billings, 1995; Mulyani et al., 2024). Recent research by Patras et al. (2025) demonstrated that integrating culturally responsive teaching with local wisdom significantly enhances students' multicultural competence and cultural awareness.

The potential of ethnopedagogy-based media to strengthen cultural identity while improving learning outcomes has been documented across multiple contexts. A systematic review by Syafiulia et al. (2025) found that indigenous learning through ethnopedagogical perspectives promotes social learning, community participation, and inclusive educational practices that enhance academic

outcomes while preserving cultural authenticity. Similarly, Erfan et al. (2025) reported that ethnopedagogy-based e-learning tools proved highly practical and effective in supporting culturally responsive education at the elementary level. These findings suggest that embedding local cultural content within AR pop-up book media can simultaneously address comprehension challenges and strengthen students' cultural identity and appreciation for heritage.

The culturally responsive approach aligns with contemporary educational paradigms emphasizing contextualized, meaningful learning experiences. As demonstrated by research in various Indonesian contexts (Lubis et al., 2022; Supriatna, 2016), ethnopedagogical approaches that integrate local wisdom into curriculum and instruction enable students to construct ecological intelligence and develop stronger connections to their cultural heritage. For the present study's context, this implies that AR pop-up book media incorporating Surabaya's local cultural heritage will likely prove more engaging and educationally meaningful than generic, decontextualized materials.

The findings from this needs analysis establish clear design parameters for the subsequent AR pop-up book development phase. The media must address multiple identified needs: (1) transforming passive learning environments into interactive, engaging experiences; (2) providing visual, concrete representations of abstract cultural heritage concepts; (3) integrating local cultural content in ways that are meaningful and relatable to students; (4) facilitating active student participation and exploration rather than passive reception of information; and (5) supporting teachers in achieving curriculum objectives while accommodating diverse student learning needs.

Research on successful AR implementation suggests several critical design considerations. Merchant et al. (2014) emphasized that technologically-enhanced materials must be carefully designed to enhance rather than obstruct learning processes, with appropriate scaffolding and user-friendly interfaces. Studies examining AR's impact on student motivation (Astuti et al., 2019; Georgiou & Kyza, 2018) identified key factors including real-time feedback, degree of success, and time-on-task as positively correlating with motivation dimensions. These insights should inform the AR pop-up book design to ensure that technological features genuinely support learning rather than creating cognitive overload or technical difficulties.

The ethnopedagogical integration requires equally careful consideration. As noted in research on culturally responsive teaching (Bishop, 2021; Patras et al., 2024), effective cultural integration demands collaboration with local communities, authentic representation of cultural values, and alignment with both cultural contexts and educational standards. The AR pop-up book must therefore incorporate carefully selected local wisdom elements—such as traditional stories, cultural practices, and heritage sites from Surabaya and surrounding regions—in ways that respect cultural authenticity while supporting curriculum objectives.

The present findings align with and extend previous research on instructional media needs in Indonesian elementary education. Ayurachmawati et al. (2022) similarly identified the need for local wisdom-based multimedia in Social Studies instruction, finding that such media enhanced student engagement and cultural understanding. The current study's emphasis on AR technology represents an advancement beyond conventional multimedia approaches, leveraging emerging technologies to create more immersive, interactive learning experiences. Paramita and Nurharini (2025) recently demonstrated that AR pop-up books successfully improved learning outcomes for traditional dance instruction among fifth-grade students, providing empirical support for the media format proposed in this study.

This research also contributes to growing evidence regarding the importance of culturally responsive media in Indonesian education. Asnimawati et al. (2025) argued that ethnopedagogical approaches are essential for developing Social Studies materials that resonate with students' cultural contexts. The present study validates this argument while proposing a specific technological solution—AR pop-up books—that can operationalize ethnopedagogical principles in engaging, accessible formats. By combining technological innovation with cultural responsiveness, this research addresses

a critical gap identified by Hidayah and Rachmadtullah (2025), who emphasized that ethnopedagogy in elementary education requires practical implementation strategies that teachers can readily adopt.

The identified challenges regarding media limitations and passive learning environments are consistent with broader critiques of Indonesian elementary education. Baharudin et al. (2025) noted that many elementary schools still lack media that facilitate 21st-century skills development, including critical thinking and creativity. The proposed AR pop-up book media directly addresses this limitation by providing interactive, technology-enhanced learning experiences that can promote higher-order thinking skills alongside cultural knowledge. This aligns with calls from educational researchers for innovative media that simultaneously address technological literacy, cultural awareness, and academic achievement goals.

While this needs analysis provides robust evidence supporting AR pop-up book development, certain limitations warrant acknowledgment. The study was conducted in a single elementary school with a relatively small sample of participants, potentially limiting generalizability to other contexts. Future research should expand to multiple schools across diverse geographic and socioeconomic settings to validate and refine these findings. Additionally, this preliminary analysis focused on needs identification rather than media development and testing. Subsequent research phases must systematically design, develop, and empirically evaluate the AR pop-up book media to determine actual effectiveness in addressing identified needs.

The integration of ethnopedagogical content requires ongoing collaboration with cultural experts, educators, and community members to ensure authentic, appropriate cultural representations. Future development work must establish mechanisms for this collaboration while addressing potential challenges such as technological accessibility, teacher training needs, and sustainability of AR media implementation in resource-constrained settings. Despite these considerations, the present findings provide a solid foundation for developing innovative, culturally responsive instructional media that can meaningfully enhance elementary Social Studies education while preserving and promoting local cultural heritage.

CONCLUSION

This preliminary needs analysis has systematically identified critical gaps in elementary Social Studies instruction, revealing that traditional teacher-centered approaches with limited media utilization significantly constrain student engagement, motivation, and comprehension of cultural heritage content. The convergence of evidence from classroom observations, stakeholder interviews, and document analysis demonstrates that both teachers and students require innovative, interactive, and culturally responsive instructional media to enhance learning effectiveness. The findings establish that Augmented Reality Pop-Up Book media embedded with ethnopedagogical content represents a theoretically sound and contextually appropriate solution to address identified instructional challenges.

This research contributes to the growing body of knowledge on technology-enhanced, culturally responsive education by providing empirical evidence supporting the integration of AR technology with ethnopedagogical principles in elementary Social Studies instruction. The study extends existing literature on AR applications in education while offering practical insights into stakeholder needs and expectations that can inform effective media design. Practically, these findings provide essential design parameters for developing AR pop-up book media that can transform passive learning environments into engaging, culturally meaningful educational experiences while supporting teachers in achieving curriculum objectives.

However, certain limitations warrant acknowledgment. The study's single-site design and small sample size may limit generalizability across diverse educational contexts. The research focused exclusively on needs identification without actual media development or effectiveness testing. Future research should expand to multiple schools across varied settings to validate findings and examine the actual impact of developed AR pop-up book media on student learning outcomes, cultural awareness, and engagement levels. Additionally, longitudinal studies investigating the sustained effects of

ethnopedagogy-based AR media and exploring optimal implementation strategies in resource-constrained environments would provide valuable insights for scalable, sustainable educational innovation.

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