Elementary Students' Needs for Interactive Cultural Learning Media: A Needs Analysis for an AR-Based Game

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Abstract: This study analyzes the empirical needs for developing augmented Reality (AR)-based game learning media integrated with local wisdom to support cultural Learning in Integrated Science and Social Studies at the elementary level. Using a qualitative case study within a needs analysis framework, the study involved 28 fifth-grade students and 3 teachers. Data were collected through in-depth interviews, four-point Likert-scale questionnaires, and structured classroom observations, and were analyzed thematically through triangulation. The findings reveal three key gaps. Cultural learning remains dominated by teacher-centered instruction and limited interactive media (M=2.1). Students show strong preferences for visual media (M=3.7) and game-based Learning (M=3.6). Their knowledge of local cultural heritage is still low (M=1.9). Teachers also expressed positive views on integrating game mechanics and AR, though technical readiness remains a constraint. Overall, the findings provide an empirical basis for developing contextual, interactive, and culturally relevant AR Monopoly media to improve literacy, Engagement, and cultural understanding in digital learning environments.

Abstrak: Penelitian ini menganalisis kebutuhan empiris untuk mengembangkan media pembelajaran berbasis augmented reality (AR) yang terintegrasi dengan kearifan lokal guna mendukung pembelajaran budaya pada mata pelajaran Ilmu Pengetahuan Alam dan Sosial di sekolah dasar. Dengan menggunakan desain studi kasus kualitatif dalam kerangka analisis kebutuhan, penelitian ini melibatkan 28 siswa kelas V dan 3 guru. Data dikumpulkan melalui wawancara mendalam, angket skala Likert empat poin, dan observasi kelas terstruktur, kemudian dianalisis secara tematik melalui teknik triangulasi. Hasil penelitian menunjukkan tiga kesenjangan utama. Pembelajaran budaya masih didominasi oleh pembelajaran berpusat pada guru dengan media interaktif yang terbatas (M=2,1). Siswa menunjukkan preferensi yang kuat terhadap media visual (M=3,7) dan pembelajaran berbasis permainan (M=3,6). Pengetahuan mereka tentang warisan budaya lokal juga masih rendah (M=1,9). Guru menilai integrasi mekanisme permainan dan AR secara positif, meskipun kesiapan teknis masih menjadi kendala. Secara keseluruhan, temuan ini menjadi dasar empiris untuk mengembangkan media AR Monopoly yang kontekstual, interaktif, dan relevan secara budaya guna meningkatkan literasi, keterlibatan, dan pemahaman budaya.

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A. Introduction

Rapid technological advances in the era of Society 5.0 have fundamentally transformed educational practices, demanding innovative approaches that integrate digital technology with pedagogical strategies to improve the quality of Learning from the elementary school level (Deguchi et al., 2020; Yaras & Öztürk, 2022). This transformation positions technology as an integral part of society while requiring the education system to continuously adapt and innovate to develop human resources capable of responding to the digital civilization (Dermawan & Sumarni, 2024). Within this context, Integrated Science and Social Studies (IPAS) education plays a crucial role in developing students' understanding of natural phenomena and social dynamics while fostering critical thinking, collaboration, and creativity.

However, Indonesian students' science literacy remains far below international standards. Data from the Programme for International Student Assessment (PISA) 2022 revealed that Indonesian students' science abilities are significantly lower than the OECD average (OECD, 2023a; OECD, 2023b), indicating a serious educational challenge that requires immediate attention. The complexity of learning content does not solely cause this condition but is also closely related to monotonous teaching methods and the limited availability of meaningful and engaging learning media (Nurjaman, 2024).

The problem of low literacy in Integrated Science and Social Studies (IPAS) is concretely manifested in classroom realities. Initial interviews with teachers and fifth-grade students at Singkalan Elementary School revealed that most students were unfamiliar with local cultural elements such as Reog Cemandi, Jetis Batik, and traditional culinary heritage. This knowledge gap indicates that IPAS teaching remains cognitively oriented and has not optimally integrated socio-cultural values as mandated in the Independent Curriculum framework. Teachers acknowledged that limited learning media hinder students' concrete understanding of socio-cultural concepts, leading to rote memorization rather than deep comprehension. Furthermore, several structural and pedagogical issues were identified, namely: teacher-centered instruction dominated by lectures; limited interactive learning media; a lack of integration of local wisdom; and minimal utilization of educational technology in classroom practices.

Addressing these challenges requires innovative learning media that are interactive, contextual, and developmentally appropriate. Research shows that elementary school students need visual and interactive media to understand abstract concepts better (Aulia et al., 2024; Millah et al., 2025). Learning media function as bridges that facilitate information delivery and two-way communication between teachers and students (Damayanti et al., 2023; Wulandari et al., 2017). Systematic reviews confirm that interactive media significantly improve student Engagement and academic achievement (Aryfien et al., 2025; Bond & Bergdahl, 2023). Nevertheless, many elementary school teachers still face technological limitations and lack adequate facilities to develop innovative digital media, resulting in static and less meaningful learning experiences.

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One promising pedagogical innovation is game-based Learning. Meta-analytic evidence indicates that game-based Learning creates enjoyable and challenging environments that significantly enhance motivation and Engagement compared to conventional instruction (Alotaibi, 2024; Partovi & Razavi, 2019). Empirical studies further confirm improvements in cognitive, social, and emotional learning outcomes through game-based interventions (Hung et al., 2015; Lester et al., 2014). Among various game formats, Monopoly has strong educational potential because it integrates competition, strategy, and social interaction while remaining flexible for adaptation to learning objectives (Maryani & Sumiar, 2018; Nurhayati et al., 2022). Modified Monopoly games have been shown to improve knowledge retention and students' social skills (Firmansyah & Indana, 2018; Ender, 2021).

Beyond board-game mechanics, advances in digital technology, particularly Augmented Reality (AR), offer significant opportunities to create immersive and interactive learning environments. Meta-analyses demonstrate that AR positively affects learning performance, motivation, and conceptual understanding (Chang et al., 2022; Sakr & Abdullah, 2024). AR enables realistic 3D visualization that helps students comprehend abstract concepts more concretely (Basumatary et al., 2023; Chen & Tsai, 2012). Recent studies also confirm that AR integration significantly increases elementary students' Engagement (Nurjaman, 2024; Tian & Ironsi, 2025). The Assemblr EDU platform is widely recognized as a user-friendly AR tool equipped with diverse 3D visualization features suitable for classroom use (Putrayasa & Sanjaya, 2025; Kusumawati, 2025). When integrated into Monopoly gameplay, AR can create interactive exploration experiences in which students engage directly with cultural objects, natural phenomena, and social concepts through digital visualization.

In addition to technological and pedagogical aspects, integrating local wisdom is essential to ensure contextual and meaningful Learning. Local wisdom-based education not only enhances instructional quality but also instills character values, cultural pride, and identity awareness (Bulkani et al., 2022; Rahmawati et al., 2020). Studies further indicate that culturally integrated Learning strengthens students' communication and collaboration skills by fostering cultural relevance (Ahmar & Azzajjad, 2025; Sugiyo & Purwastuti, 2017). Therefore, the development of Assemblr EDU-based AR Monopoly media themed "Exploring Indonesian Culture" offers students opportunities to experience cultural Learning in more concrete, contextual, and enjoyable ways.

Despite the growing body of research on educational games, augmented Reality, and local wisdom-based Learning, most previous studies have examined these elements separately. Some focus on AR-based media development without integrating game mechanics, while others explore game-based Learning without technological immersion or cultural contextualization. Studies on local wisdom integration also tend to rely on conventional or non-digital media. Research that simultaneously integrates Monopoly game mechanics, AR technology, and local wisdom content, particularly grounded in empirical needs analysis at the elementary school level, remains limited. This fragmentation creates a

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research gap in the design of holistic, technology-enhanced, and culturally responsive learning media.

This study offers several novelties. First, it integrates three core elements simultaneously, namely AR technology, Monopoly-based game learning, and local wisdom content. Second, it is grounded in empirical needs analysis involving teachers, students, and classroom observations. Third, it focuses specifically on Integrated Science and Social Studies cultural literacy at the elementary school level. Fourth, it utilizes the Assemblr EDU platform as a practical AR implementation tool suitable for school contexts.

Based on the identified gaps, this study aims to analyze the empirical needs for developing augmented-reality-based game-learning media integrated with local wisdom. Three explicit research questions guide this research. The first question examines what challenges are faced in teaching cultural diversity in Integrated Science and Social Studies at the elementary school level. The second question investigates what types of learning media are needed by teachers and students to support cultural Learning. The third question explores how students perceive game-based and augmented Reality-supported cultural Learning. The findings of this needs analysis are expected to provide an empirical and methodological foundation for developing interactive, contextual, and culturally relevant Assemblr EDU-based AR Monopoly learning media to improve elementary school students' literacy and cultural understanding in the digital era.

B. Method

This study employed a qualitative case study design using a needs analysis approach to comprehensively explore learning challenges and identify requirements for innovative learning media in Integrated Science and Social Studies instruction at the elementary school level, particularly regarding Indonesian cultural diversity content. The case study design was selected because it facilitates an in-depth examination of real classroom phenomena within a bounded context, enabling researchers to understand complex educational processes without neglecting contextual realities (Creswell, 2014). This research represents a preliminary stage of educational media development, focusing on identifying pedagogical needs, learner characteristics, and instructional constraints prior to the design and production of technology-enhanced learning media. By systematically mapping gaps between ideal and actual classroom conditions, this approach provides a strong methodological foundation for developing effective, relevant, and contextually appropriate learning innovations.

The research was conducted at Singkalan Elementary School, involving fifth-grade students and teachers as primary participants. Fifth-grade students were selected because they are at the concrete operational developmental stage, where learners begin to analyze simple social phenomena but still require visual representations and concrete contexts to understand abstract concepts. Student participants were selected through random sampling to ensure representation across diverse academic, socioeconomic, and experiential backgrounds. Teacher participants were selected purposively based on at least 3 years of

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teaching experience and direct involvement in delivering Indonesian cultural diversity content within Integrated Science and Social Studies Learning. This purposive selection ensured that participating teachers possessed comprehensive insights regarding pedagogical challenges, media limitations, and student interaction patterns during classroom instruction.

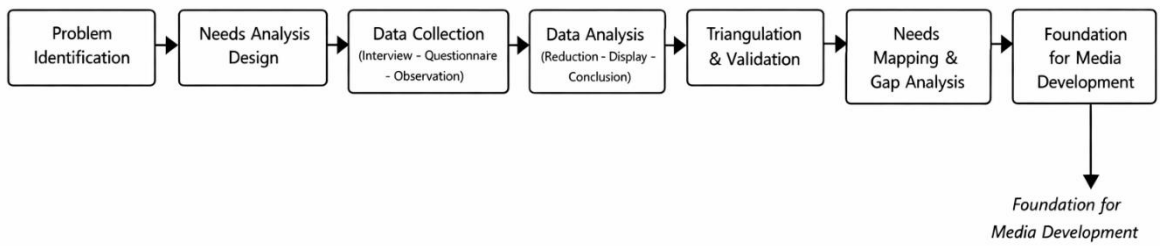

Figure 1. Research Flow of Needs Analysis for AR-Based Monopoly Learning Media Development

To illustrate the systematic stages of the research process, a research flow diagram is presented after this methodological description. The diagram outlines the sequential stages of problem identification, needs analysis and design, data collection, data analysis, and media specification formulation, thereby clarifying the procedural framework of the study as a preliminary needs assessment prior to media development.

Data collection employed three complementary techniques to achieve methodological triangulation and enhance data validity. First, in-depth semi-structured interviews were conducted with teachers, lasting approximately 30 to 45 minutes each. The interviews explored challenges in teaching cultural diversity, current media use and constraints, needs for interactive and visual media, readiness to adopt augmented reality technology, perceptions regarding game-based Learning, and expectations for ideal instructional media for elementary students. All interviews were audio recorded and transcribed verbatim for systematic analysis. Second, student questionnaires included closed-ended items on a four-point Likert scale and open-ended questions designed to capture students' learning preferences, experiences with cultural content, and interest in game-based media. Third, structured classroom observations were conducted to document instructional practices, levels of student Engagement, types of media used, student responses, and technical and non-technical learning constraints. Field notes were used to complement structured observation sheets in capturing contextual classroom nuances.

Data analysis followed the qualitative framework proposed by Miles & Huberman (1994), which involved data reduction, data display, and conclusion drawing. Interview transcripts and open-ended responses were coded and categorized thematically, while questionnaire data were analyzed descriptively to generate mean scores representing students' perceptions and media preferences. The integration of qualitative and descriptive quantitative findings enabled a comprehensive interpretation of identified learning needs.

To ensure trustworthiness, multiple validation strategies were employed. Source triangulation involved cross-verifying data obtained from teachers, students, and classroom

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observations. Method triangulation integrated interviews, questionnaires, and observations to confirm data consistency. Member checking was conducted to validate participants' interpretations and responses, while reliability was supported through consistent data collection procedures, pre-tested instruments, and systematic documentation of all research processes. This comprehensive methodological approach enabled the identification of authentic field needs and contextual instructional gaps, providing a strong empirical foundation for designing interactive, culturally relevant, and pedagogically appropriate Assemblr EDU-based augmented-reality Monopoly learning media to improve elementary school students' literacy and cultural understanding.

C. Result

Overview of Findings

The results of this needs analysis were obtained through triangulation of three primary data sources, namely in-depth teacher interviews, student questionnaires, and structured classroom observations. This triangulated approach enabled a comprehensive exploration of instructional realities, learner preferences, and pedagogical constraints in teaching Indonesian cultural diversity within Integrated Science and Social Studies at the elementary school level.

Overall findings reveal a substantial discrepancy between existing instructional practices and the ideal learning conditions required to support meaningful cultural literacy development. Cultural learning remains dominated by teacher-centered instructional approaches characterized by lectures, reliance on textbooks, and static presentation media. Opportunities for interactive, exploratory, and experiential Learning remain minimal, resulting in relatively low student Engagement and limited understanding of local cultural heritage. These findings provide a strong empirical basis for the development of innovative, technology-enhanced, and culturally contextualized learning media.

Student Questionnaire Results

Student perceptions of cultural Learning and instructional media were measured using a 4-point Likert-scale questionnaire administered to 28 fifth-grade students. The questionnaire examined students' interest in cultural topics, perceptions of current media effectiveness, learning preferences, and levels of cultural knowledge.

Table 1. Student Perceptions and Media Preferences

No	Statement	Mean Score	Category
1	The cultural diversity topic is interesting	2.8	Moderate
2	Current media helps understanding	2.1	Low
3	Prefer visual interactive media	3.7	High
4	Interested in game-based Learning	3.6	High
5	Knowledge of local culture	1.9	Low

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The data indicate that students demonstrate moderate interest in cultural diversity topics (M = 2.8). However, they perceive current instructional media as insufficient in facilitating conceptual understanding (M = 2.1). This suggests that while content relevance exists, delivery methods remain ineffective.

Students show very strong preferences for visual interactive media (M = 3.7) and game-based Learning (M = 3.6), indicating a dominant inclination toward participatory, image-rich, and exploratory learning environments. The lowest score is for students' knowledge of local cultural heritage (M = 1.9), highlighting a critical cultural literacy gap that warrants pedagogical intervention.

Response Distribution Analysis

While mean scores indicate general trends, they do not fully capture the intensity of students' agreement. Therefore, a response distribution analysis was undertaken to identify the proportion of students selecting each Likert category. This analysis provides a clearer understanding of learners' readiness for innovative instructional media, as shown in Table 2.

Table 2. Distribution of Student Responses

Response Category	Visual Interactive Media	Game-Based Learning
Strongly Agree	64%	61%
Agree	29%	32%
Disagree	7%	7%
Strongly Disagree	0%	0%

More than 90% of students agreed on the need for visual and game-based learning media, reinforcing quantitative mean findings and indicating strong learner readiness for innovative instructional approaches.

Teacher Interview Themes

Thematic coding of semi-structured interviews with three teachers generated four dominant themes reflecting instructional realities, pedagogical constraints, and expectations toward innovative learning media in cultural Learning within Integrated Science and Social Studies. The themes encompass the dominance of conventional instruction, the limited availability of interactive media, the difficulty in explaining abstract cultural concepts, and positive perceptions of technology-enhanced game-based Learning.

1. Dominance of Conventional Teaching Practices

Findings indicate that cultural Learning is still predominantly delivered through teacher-centered instructional approaches. Teachers rely heavily on lecture methods, supported by textbooks and PowerPoint presentations, as their primary teaching tools.

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Instructional delivery tends to focus on verbal explanation and memorization of cultural facts rather than experiential exploration.
One teacher stated:

> *"I usually teach cultural diversity using textbooks and PowerPoint slides, but students often seem less interested when the material is explained this way."*

This pattern suggests that instructional practices prioritize content transmission over interactive Engagement. Although such approaches enable curriculum coverage, they are perceived as less effective in fostering meaningful cultural understanding among elementary learners.

2. Limited Availability of Interactive Learning Media

Another dominant theme emerging from the interviews concerns the scarcity of interactive, culturally contextualized learning media. Teachers acknowledged that available instructional resources are largely static, text-based, and visually limited. As a result, opportunities to create engaging and participatory cultural learning experiences remain constrained.
A teacher explained:

> *"We do not have interactive media that can show cultural objects clearly. Most of the time we only rely on pictures in books or slides."*

This limitation not only affects instructional delivery but also reduces students' opportunities to interact with cultural content in meaningful ways. Teachers emphasized the need for media that can present cultural diversity through dynamic visualization and exploratory features.

3. Difficulty in Explaining Abstract Cultural Concepts

Teachers also reported pedagogical challenges in explaining abstract cultural material, particularly when addressing traditional houses, clothing, dances, and regional heritage spread across Indonesia's diverse geographical landscape. Without concrete visual aids or experiential media, students often struggle to imagine cultural artifacts beyond textual descriptions.
One participant noted:

> *"It is difficult to explain traditional houses or cultural heritage without concrete visuals. Students find it hard to imagine objects they have never seen."*

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This finding highlights the mismatch between the abstract nature of cultural content and the developmental characteristics of elementary school learners, who require concrete representations to support conceptual understanding.

4. Positive Perceptions Toward Innovative Media Integration

Despite existing constraints, all interviewed teachers demonstrated strong openness to adopting innovative instructional media. Game-based Learning and augmented Reality were consistently perceived as promising pedagogical approaches capable of increasing student motivation, Engagement, and cultural exploration.
One teacher expressed:

> "*Game-based Learning would be very helpful, especially if combined with technology. Students would be more enthusiastic.*"

However, teachers also acknowledged potential implementation challenges, including limited technological infrastructure, varying levels of digital literacy, and the need for training in using augmented reality platforms.

Collectively, these four themes illustrate a pedagogical landscape characterized by conventional instructional dominance, limited media innovation, and emerging readiness for technological integration. While current teaching practices face structural and resource constraints, teachers demonstrate positive attitudes toward adopting interactive, game-based, and augmented Reality–supported cultural learning media. These findings reinforce the urgency of developing instructional media that are not only technologically advanced but also pedagogically aligned with classroom realities and teacher capacities.

Classroom Observation Results

To obtain empirical evidence of classroom practices, structured observations were conducted during cultural learning activities. This process focused on documenting teaching approaches, levels of student Engagement, and the types of instructional media employed. The observation findings, which serve to corroborate interview and questionnaire data, are summarized in Table 3.

Table 3. Classroom Observation Summary

Aspect Observed	Findings	Category
Teaching approach	Lecture-dominated	High
Media used	Textbooks & PowerPoint	Limited
Student Engagement	Moderate–Low	Low
Cultural discussion	Minimal	Low
Interactive activities	Not observed	Very Low

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Observational data revealed that instruction was largely one-directional. Approximately 40% of students appeared passive during learning sessions, demonstrating limited attentiveness and participation. When teachers posed questions about local cultural heritage, only about 25% of students responded accurately. These findings validate questionnaire data indicating low cultural literacy.

Student Qualitative Responses

Open-ended questionnaire responses provided deeper insight into students' lived learning experiences, particularly regarding how they perceive current cultural learning practices and instructional media. Qualitative data reveal that many students struggle to understand material on cultural diversity presented through static visual slides and text-based explanations. Although PowerPoint presentations occasionally include images, students reported that such visuals are often limited, unclear, or displayed too quickly to support meaningful comprehension.
Representative verbatim excerpts illustrate these challenges:

"The slides have pictures, but they change too fast. I do not really understand."
"It is hard to imagine traditional houses if we only read from books."

These responses indicate that existing media fail to provide sufficient visual depth and cognitive support for elementary learners, who require concrete representations to grasp abstract cultural concepts. Students' difficulties are not solely related to content complexity but also to the instructional delivery mode, which lacks sustained visualization and exploratory Engagement.

In contrast, students expressed strong enthusiasm toward game-based and technology-supported learning environments. Many articulated a preference for learning experiences that integrate play, exploration, and interactive visualization. Students showed particular interest in board-game mechanics combined with digital visualization features.
Several students stated:

"I want a game where we can roll dice and see culture in 3D."
"Learning while playing would be more fun and easier to remember."

These responses suggest that students associate gameplay with reduced learning pressure, increased enjoyment, and improved memory retention. The desire to "see culture in 3D" further indicates readiness for immersive technologies such as augmented Reality, which can transform abstract cultural knowledge into tangible learning experiences.

Overall, qualitative findings reinforce the quantitative questionnaire results, confirming students' strong preference for visually rich, interactive, and game-based instructional media. The convergence of these insights highlights the need for immersive

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cultural learning environments capable of integrating visualization, exploration, and participatory Engagement within elementary classroom contexts.

Triangulation Synthesis

To enhance the trustworthiness of the needs analysis, findings derived from multiple data sources were systematically triangulated. The integration of qualitative and quantitative evidence enabled the identification of consistent patterns regarding instructional practices, learner needs, and media limitations. The triangulated synthesis is summarized in Table 4.

Table 4. Triangulated Needs Identification

Data Source	Key Evidence	Interpretation	Identified Needs
Teacher interviews	Limited media, teaching constraints	Instructional barriers	Interactive media
Student questionnaires	High visual & game preference	Learning motivation	Game-based Learning
Classroom observations	Passive Engagement	Experiential gap	Immersive Learning
Cross-source synthesis	Low cultural literacy	Knowledge gap	Cultural integration

Table 4 presents the triangulated synthesis of findings derived from teacher interviews, student questionnaires, and classroom observations. The table integrates evidence from multiple data sources to identify convergent instructional patterns, learner needs, and pedagogical gaps in cultural learning practices.

Findings from teacher interviews indicate significant instructional constraints, particularly the limited availability of interactive and culturally contextualized learning media. Teachers also reported reliance on lecture-based methods and expressed challenges in visualizing abstract cultural concepts. These constraints highlight the need for more dynamic instructional tools capable of supporting experiential Learning.

Student questionnaire data reveal strong preferences for visual interactive media and game-based learning environments. High mean scores and response distribution patterns indicate that students are highly motivated by participatory and exploratory learning formats. However, students' self-reported knowledge of local cultural heritage remains low, indicating gaps in cultural literacy.

Classroom observation findings further corroborate these patterns. Instructional delivery was predominantly teacher-centered, with minimal interactive activities observed. Student Engagement levels were moderate to low, and cultural discussions were limited in depth and frequency. The absence of immersive learning experiences reinforces the instructional limitations reported by both teachers and students. Overall, the triangulation matrix demonstrates strong convergence across all data sources, validating the authenticity and consistency of the identified instructional needs.

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Identified Media Needs

Based on the integrated needs analysis derived from questionnaires, interviews, and classroom observations, three primary instructional media needs were identified. First, there is a critical need for interactive visual media that can transform abstract cultural concepts into concrete, explorable representations. This need emerges from students' reported difficulty in imagining cultural artifacts through static slides and textual explanations, as well as teachers' challenges in visualizing diverse cultural objects during instruction. The absence of immersive visualization has limited students' conceptual understanding of Indonesia's cultural diversity.

Second, game-based learning environments are required to enhance student motivation, participation, and experiential Engagement. Quantitative findings revealed high levels of student interest in game-supported Learning, while qualitative responses indicated strong enthusiasm toward exploratory and play-based instructional formats. Observational data further confirmed low Engagement in conventional lecture settings, reinforcing the need for participatory pedagogical approaches.

Third, systematic integration of local wisdom content is essential to strengthen students' cultural literacy and contextual understanding. Both questionnaire data and classroom observations revealed limited student knowledge of local cultural heritage, indicating insufficient exposure to culturally grounded instructional material. Integrating local wisdom into learning media is, therefore, necessary to ensure contextual relevance and foster cultural identity.

Table 4. Identified Instructional Media Needs

Needs Category	Empirical Basis	Media Implication
Interactive visual media	Low media effectiveness; visualization difficulty	AR 3D cultural objects
Game-based Learning	High motivation & preference scores	Monopoly gameplay
Local wisdom integration	Low cultural literacy	Cultural content embedding

Collectively, these empirically grounded needs form the pedagogical and technological foundation for developing augmented Reality–based Monopoly learning media designed to support cultural Learning in elementary Integrated Science and Social Studies instruction.

D. Discussion

The findings of this needs analysis provide important insights into instructional challenges and opportunities in teaching Indonesian cultural diversity at the elementary school level. By integrating questionnaire data, interview findings, and classroom observations, the study reveals interconnected gaps in pedagogy, media utilization, student Engagement, and cultural literacy. These findings not only answer the research questions

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but also align closely with established theories of elementary education and contemporary research on instructional media effectiveness.

The predominance of teacher-centered, lecture-based instruction observed in this study reinforces extensive research demonstrating the inadequacy of passive learning approaches for elementary school students (Aulia et al., 2024; Bond & Bergdahl, 2023). Cultural diversity content, which is rich in symbolism, artifacts, and contextual meaning, requires experiential and representational learning modes that extend beyond verbal explanation. Piaget's developmental theory provides a strong theoretical explanation for students' documented difficulties in understanding abstract cultural concepts. Fifth-grade students typically operate at the concrete operational stage, where Learning is most effective when supported by tangible representations and direct experiences (Plass et al., 2015). The low mean score for current media effectiveness (M = 2.1) empirically validates this theoretical position, indicating that static, text-heavy resources fail to provide the concrete references necessary for conceptual understanding at this developmental level. Instructional challenges identified in this study, therefore, reflect not only pedagogical limitations but also developmental misalignment between instructional delivery and learners' cognitive readiness.

Students' strong preference for interactive and visual learning materials (M = 3.7) further supports the need for pedagogical transformation. This finding aligns with multimedia learning theory and a growing body of empirical research confirming that interactive media significantly enhance student Engagement, comprehension, and retention compared to conventional instructional resources (Aryfien et al., 2025; Damayanti et al., 2023; Millah et al., 2025). The effectiveness of visual media lies in its ability to reduce cognitive load by distributing information across multiple representational channels, thereby facilitating deeper processing and stronger memory encoding (Chen & Tsai, 2012). Within the context of cultural education, visual media are particularly essential because they provide access to cultural artifacts, performances, and environments that students cannot directly encounter. Through immersive visualization, distant cultural phenomena become cognitively accessible, enabling students to construct meaningful cultural understanding rather than relying on rote memorization.

Students' strong interest in game-based Learning (M = 3.6) reflects the well-documented motivational and Engagement benefits of game-based pedagogies. Meta-analytic research demonstrates that game-based Learning significantly enhances student motivation, Engagement, and academic outcomes across diverse educational contexts (Alotaibi, 2024; Partovi & Razavi, 2019). Theoretical frameworks explain these effects through multiple Engagement dimensions. Plass et al (2015) argue that educational games facilitate integrated Engagement across affective, behavioral, cognitive, and socio-cultural domains. Games provide immediate feedback, optimal challenge levels, clear goals, and learner agency, all of which are key elements that foster intrinsic motivation and sustained Engagement (Hung et al., 2015). Students' requests for realistic three-dimensional images and opportunities to explore different areas indicate not only enthusiasm but also an

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intuitive understanding of design features that support experiential Learning. These preferences align with constructivist principles emphasizing exploration, autonomy, and knowledge construction through interaction.

One of the most significant findings of this study is the documented gap in students' local cultural knowledge (M = 1.9). This aligns with research demonstrating that learning disconnected from students' lived experiences produces shallow and decontextualized knowledge lacking personal relevance (Bulkani et al., 2022; Rahmawati et al., 2020). Culturally responsive pedagogy emphasizes that meaningful Learning occurs when formal knowledge connects with students' cultural backgrounds and community contexts (Sugiyo & Purwastuti, 2017). Integrating local wisdom into instructional media serves multiple pedagogical functions, including validating students' cultural identities, providing concrete anchors for abstract concepts, and encouraging civic Engagement and cultural preservation (Ahmar & Azzajjad, 2025). By embedding local cultural elements such as Jetis Batik, Reog Cemandi, and regional culinary traditions into gameplay, the proposed media addresses cultural literacy gaps while promoting national identity awareness.

Students' enthusiasm for real-looking three-dimensional images highlights the pedagogical potential of augmented Reality in cultural education. This interest aligns with meta-analytic findings indicating that augmented Reality significantly improves spatial understanding, conceptual Learning, and sustained Engagement (Chang et al., 2022; Tian & Ironsi, 2025). Augmented Reality enables digital cultural artifacts to be superimposed onto physical environments, creating contextualized and embodied learning experiences. In cultural education contexts, this allows students to interact with three-dimensional representations of traditional houses, clothing, and artifacts that would otherwise remain inaccessible (Basumatary et al., 2023). The Assemblr EDU platform, recognized for its user-friendly interface and educational affordances (Kusumawati, 2025), addresses implementation concerns raised by teachers and enables augmented reality integration that is pedagogically feasible even for educators with limited technical expertise.

The integration of Monopoly game mechanics with augmented reality technology and cultural content represents an innovative pedagogical synthesis that simultaneously addresses multiple identified needs. Monopoly's core mechanics, including strategic decision-making, resource management, competition, and social interaction, align well with educational objectives when appropriately adapted (Maryani & Sumiar, 2018; Nurhayati et al., 2022). Modified Monopoly games have demonstrated effectiveness in enhancing conceptual understanding, collaboration, and Engagement across subject domains (Firmansyah & Indana, 2018). When combined with augmented Reality, the game becomes a cultural exploration platform where students can visit regions, examine artifacts, and construct knowledge through guided play. This integration operationalizes socio-cultural learning theory by situating knowledge construction within meaningful and interactive contexts reflective of authentic cultural practices (Plass et al., 2015).

The triangulated needs analysis methodology employed in this study provides a robust foundation for media development. By integrating teacher perspectives identifying

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pedagogical challenges, student preferences revealing motivational patterns, and classroom observations documenting instructional realities, the study achieved a comprehensive understanding of authentic needs. This approach aligns with educational design research best practices, emphasizing stakeholder involvement and context-sensitive innovation (Creswell, 2014). The convergence of findings across multiple data sources, particularly regarding media inadequacy and demand for interactive Learning, provides compelling justification for the proposed intervention.

These findings also contribute to broader discourse on educational technology integration within the Society 5.0 framework. Effective technology adoption requires more than introducing digital tools; it demands pedagogical alignment with learner needs and technological cultures (Deguchi et al., 2020; Yaras & Öztürk, 2022). The needs analysis reveals that elementary school students possess sophisticated technological expectations shaped by exposure to digital games and media. Educational tools that ignore these expectations risk disengagement, whereas those integrating familiar mechanics with substantive content can bridge informal and formal learning ecosystems.

In conclusion, this needs analysis establishes a strong empirical and theoretical foundation for developing Assemblr EDU-based augmented reality Monopoly learning media for cultural education. The study identifies instructional limitations, documents stakeholder readiness for innovation, and defines specific design requirements for effective implementation. By integrating developmental theory, multimedia learning, game-based pedagogy, augmented reality research, and culturally responsive education, the proposed media offers both conceptual advancement and practical solutions to enhance cultural Learning in elementary Integrated Science and Social Studies instruction in Indonesia.

E. Implication

The findings of this needs analysis study have significant implications across theoretical, practical, and policy dimensions and inform future research directions. Theoretically, the study strengthens the connection between developmental learning theory, multimedia learning, game-based Learning, and culturally responsive pedagogy by demonstrating that the mismatch between elementary students' cognitive developmental stage and teacher-centered instruction supports Piaget's view that young learners require concrete and experiential learning environments. Students' strong preference for interactive and game-based media further reinforces multimedia learning principles, particularly the role of visual representation in reducing cognitive load and improving conceptual understanding. At the same time, the identified gap in local cultural knowledge provides empirical support for culturally responsive pedagogy that situates learning within students' cultural contexts. Practically, the findings highlight the need for teachers to adopt more interactive and student-centered instructional approaches, with the proposed Assemblr EDU–based augmented reality Monopoly game offering a feasible solution aligned with students' learning preferences and supporting cultural exploration and collaborative Learning. At the policy level, the study supports national educational priorities related to

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the Independent Curriculum and Society 5.0 by emphasizing learner-centered, culturally grounded technology integration, while also providing a foundation for investment in digital learning media, teacher training, and future research on augmented-reality–based cultural learning innovations.

F. Limitation and Suggestion for Further Research

This study highlights the importance of developing interactive, culturally grounded learning media but has several limitations. It was conducted in a single elementary school with a small sample (28 students, 3 teachers), limiting generalizability. Using a qualitative needs analysis, the study explored perceptions and classroom practices without measuring direct learning outcomes. Data from self-reports may contain bias, and the study did not examine technical implementation, usability, or effectiveness of the AR-based Monopoly media. Variations in infrastructure and teachers' digital literacy were noted but not systematically analyzed.

Future research should involve larger, more diverse samples to improve external validity and proceed to designing and experimentally testing the Assemblr EDU-based AR Monopoly game. Mixed-method or quasi-experimental approaches are recommended to assess its impact on literacy, cultural understanding, motivation, and engagement. Further studies should also explore teachers' readiness, training needs, and long-term effects, including comparative analyses with non-AR and conventional methods to better understand the added value of immersive technologies.

G. Conclusion

This study examined the instructional needs for developing interactive, culturally based learning media to support the teaching of cultural diversity within Integrated Science and Social Studies at the elementary school level. The findings reveal that current instruction remains largely teacher-centered and relies on static media that are insufficient for supporting students' understanding of abstract cultural concepts. Students demonstrate limited cultural literacy while strongly preferring visual, interactive, and game-based learning environments.

Triangulated evidence from questionnaires, interviews, and classroom observations indicates the need for learning media that are developmentally appropriate, experientially engaging, and culturally contextualized. Three primary needs were identified: interactive visual representations, integration of game-based learning, and incorporation of local wisdom content. These needs provide the empirical foundation for developing an Assemblr EDU-based augmented reality Monopoly Game as an innovative cultural learning medium.

Overall, this study contributes to educational media development by highlighting the importance of aligning technology integration with students' cognitive characteristics, motivational preferences, and cultural contexts. The integration of augmented Reality, board-game mechanics, and cultural content represents a promising direction for enhancing cultural Learning in elementary education within the digital era.

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