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Development of Augmented Reality-Based Digital Literacy Media to Improve Elementary School Students' Understanding of Cultural Diversity

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Abstract

This research aimed to develop digital literacy media based on Augmented Reality (AR) to enhance elementary school students' understanding of cultural diversity. The research used the Instructional Development Institute (IDI) model, consisting of three main stages: define, develop, and evaluate. In the defined stage, the researchers conducted a needs analysis through curriculum review and classroom observation. During the development stage, AR-based media containing 3D representations of local Indonesian cultures such as traditional houses, dances, and attire was designed and validated by subject matter and media experts. In the evaluate stage, the media was tested through limited and wider trials using a pretest–posttest design. Data were collected through observation, questionnaires, interviews, and tests. The results showed that the developed media was valid, practical, and effective in improving students' cultural understanding. The study concluded that the integration of AR in digital literacy media provided an immersive and meaningful learning experience that supports 21st-century skills and character education aligned with the Merdeka Belajar curriculum.

Introduction

In the era of digital transformation, global education faces major challenges in adapting learning strategies to technological developments and the needs of the digital generation. Jaya et al. (2023) emphasizes that education systems must be able to respond to digital change by developing 21st-century skills such as critical thinking, communication, collaboration, and technological literacy. Education is no longer solely focused on academic achievement, but also on character development and the reflective thinking skills needed in a complex global society (Pare & Sihotang, 2023; Irwan et al., 2024; George, 2023). In this context (Rismana & Hernawati, 2025) stated that innovation in learning media is very important to provide a contextual, enjoyable and meaningful learning process.

Unfortunately, conventional text-based learning media and lecture methods still dominate classrooms, including in the learning of socio-cultural content at the elementary school level (Alwi et al., 2024; Asra et al., 2025; Khoirunisa & Sukardi, 2025). Yustitia (2024) noted that such methods are less effective in providing immersive and relevant learning experiences for 21st-century students. One impact is students' low understanding of cultural diversity as part of national character building. In a multicultural country like Indonesia, the ability to understand and appreciate cultural diversity is a crucial part of character and citizenship education (Mariyono, 2024; Mastura & Purwowidodo, 2024; Mulyana, 2024).

However, several studies show that students' understanding of cultural values is still relatively low. Nasution (2021) found that cultural material in textbooks was presented textually and passively, resulting in students' lack of interest and difficulty internalizing its values. This

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condition resulted in cultural learning tending to be purely informative and failing to address students' affective aspects or social skills (Annisa Dwi Hamdani, 2023). It also shows that a lack of cultural and civic literacy can diminish students' national character. Yet, multicultural education plays a crucial role in fostering empathy, tolerance, and national identity (Hashemi, 2025; Arfaton et al., 2025).

In response to these conditions, various technological innovations, such as Augmented Reality (AR), have been developed to improve the quality of learning. AR is a technology that allows users to integrate virtual elements into real-time environments using digital devices. In an educational context, AR can create more interactive, engaging, and contextual learning experiences. Ma'arif & Nursikin, (2024) calls AR a strategic approach that can bridge the gap between technological needs and cultural values in learning. Archives (2024) proves that the use of AR in citizenship learning can increase students' active participation and understanding of social values.

The use of AR in cultural learning not only presents 3D visual materials such as traditional houses, dances, and regional clothing, but also allows students to interact directly through animations, interactive audio, and local narratives that bring cultural contexts to life. This not only enriches students' cognitive abilities but also builds empathy and appreciation for differences (Nurfadilah Wa Ode, 2025). Moreover, this technology-based approach aligns with 21st-century learning principles that emphasize the integration of creativity, collaboration, and digital literacy (Lubis, 2022).

Theoretically, the development of AR-based digital literacy media is based on a constructivist approach that emphasizes students' active role in constructing knowledge through direct experience. Digital literacy, in this context, refers not only to the technical ability to use devices but also encompasses critical thinking skills in understanding and evaluating digital information Cynthia & Sihotang (2023); Arizal (2021). Unfortunately, although the use of AR in education is starting to grow, most research is still limited to the fields of science, mathematics, or foreign languages (Gusteti et al., 2023). Studies that specifically integrate AR as a digital literacy medium in cultural learning at the elementary school level are still very rare.

This gap serves as an important starting point for this research. The lack of contextual and engaging AR-based digital literacy media for learning local culture at the elementary school level demonstrates the need for a new approach that simultaneously integrates technology, digital literacy, and local content. Furthermore, the Merdeka Belajar curriculum encourages project-based and contextual learning, opening up space for adaptive and value-laden media innovation.

This study aims to develop Augmented Reality-based digital literacy media specifically designed to improve elementary school students' understanding of Indonesia's cultural diversity. This media was developed using the Instructional Development Institute (IDI) model, taking into account the principles of student-oriented learning design. The research questions include: (1) how is the process of developing AR-based digital literacy media suitable for improving elementary school students' cultural understanding; (2) how is the media's feasibility based on validation by experts, teachers, and students; and (3) how effective is the media in improving understanding of cultural diversity.

By combining three main elements digital literacy, AR technology, and local cultural education this research is expected to provide theoretical contributions to the development of technology-based contextual learning media, as well as practical contributions in providing meaningful and

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transformative learning for elementary school students. This integration is crucial to address the challenges of globalization that tend to erode cultural identity, while also supporting the strengthening of the Pancasila Student Profile, which is rooted in Indonesian cultural values.

Methods

This research is a development research (Research and Development) which aims to produce digital literacy media.based Augmented Reality (AR) is feasible and effective in improving elementary school students' understanding of cultural diversity. The development model used in this study is the Instructional Development Institute (IDI) model.WAS) which consists of three main stages: define, develop, and evaluate. This model was chosen because it provides a systematic and structured approach to developing learning products that are contextual and tailored to student needs.

This research was conducted during the odd semester of the 2025/2026 academic year. The location of the research was at SD Ma'arif Taman, Sidoarjo Regency, East Java. The location was selected based on the availability of technological facilities, the school's openness to learning media innovation, and the relevance of the learning materials. IPA Swith local cultural content raised in the media.

The subjects in this study were fifth-grade students of Ma'arif Taman Elementary School as media users, and the class teacher as the party who assessed the practicality of the media in implementing learning. In addition, there were two other subject categories: material experts and media experts who assessed the appropriateness of the media content and design. The subject selection technique for the trial was carried out using purposive sampling, considering the representativeness of characteristics and experience in using learning technology.

The development procedure refers to the stages in the IDI model, which consist of:

Define: This stage includes an analysis of learning needs through curriculum review, classroom observations, and interviews with teachers and students. The goal of this stage is to formulate the core competencies to be achieved and to identify learning needs relevant to the cultural diversity material.

Develop: Based on the analysis results from the define stage, AR-based learning media was designed and developed. This process included storyboard design, 3D cultural object programming, cultural narrative development, and the integration of interactive elements. Validation was conducted by subject matter and media experts. Product revisions were made based on the validation results, followed by limited trials with students and teachers to assess initial responses.

Evaluate: The evaluation phase is conducted through a large-scale trial involving a larger group of students. The evaluation includes effectiveness testing using a quasi-experimental design using a one-group pretest–posttest design. This phase includes initial measurements (pretest), media implementation (treatment), and final measurements (posttest).

The instruments used in this study include: (1) media validation sheets for material experts and media experts, (2) practicality questionnaires for teachers and students, (3) cultural understanding tests in multiple choice form for pretest and posttest, (4) student activity observation guidelines, and (5) interview guidelines to explore student and teacher responses. Data collection techniques were carried out through direct observation during learning, distributing questionnaires to respondents, pre- and post-media use tests, and semi-structured interviews with teachers and students.

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Data obtained from expert validation were analyzed descriptively quantitatively using a Likert scale, then categorized into feasibility criteria such as very feasible, feasible, quite feasible, and not feasible. Questionnaire data were analyzed using averages and percentages to measure the level of practicality. To measure the effectiveness of the media, normalized gain (N-gain) analysis was used by comparing students' pretest and posttest scores. In addition, qualitative data from observations and interviews were analyzed thematically to strengthen the interpretation of quantitative results, providing a comprehensive picture of the acceptance and impact of media use on students' learning process.

Results and Discussion

Expert Validation

The validation process marked the first milestone in ensuring that the developed Augmented Reality (AR)-based digital literacy media achieved both conceptual soundness and technical precision before being tested in real classrooms. Two experts were intentionally selected to represent complementary areas of expertise curriculum and instructional content on the one hand, and digital media design on the other so that the product could be judged not merely as a piece of software, but as a pedagogical artifact. Their dialogue during the evaluation became a meaningful exchange between technological creativity and educational integrity.

Quantitatively, both experts rated the product within the very feasible category. The subject matter expert assigned an average score of 89.67, particularly commending the relevance of the cultural materials, the clarity of language, and the alignment with elementary-level learning objectives. Meanwhile, the media expert provided an average score of 91.33, recognizing the visual coherence of the interface, the intuitive navigation, and the balanced integration of 3D models, sound, and narration. The details of their assessment are presented in Table 1.

Table 1. Validation Results of Material Experts and Media Experts

Rated Aspect	Subject Matter Expert (Max. 100)	Media Expert (Max. 100)
Material Suitability	90	–
Language Accuracy	88	–
Visualization & Design	–	92
Interactivity	–	89
Media Integration	91	93
Average	**89.67**	**91.33**
Category	**Very Feasible**	**Very Feasible**

While the scores clearly positioned the media within a strong validation range, the experts' qualitative reflections offered a deeper appreciation of its pedagogical resonance. Both noted that the visual presentation of traditional houses, local dances, and traditional clothing succeeded not merely in displaying cultural artifacts but in constructing *meaningful visual narratives* that draw students into authentic encounters with Indonesian cultural identity. The inclusion of local sounds and interactive gestures encouraged a multisensory engagement, enabling learners to experience cultural diversity not as distant knowledge but as lived experience.

Importantly, the experts emphasized that the media design maintained curricular relevance without sacrificing aesthetic innovation. They praised its gradual narrative flow from regional identities to the broader idea of national unity which mirrored the constructivist learning path

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of moving from the known to the new. The reliability of expert judgment, reaching 92% inter-rater agreement, further confirmed that the product met the essential indicators of validity required for classroom implementation. In essence, the validation stage affirmed that the media had achieved what many digital tools fail to do: integrating the elegance of technology with the depth of cultural education.

Practicality Evaluation

Once validated, the media proceeded to the practicality phase, which tested how easily teachers and students could use it within the dynamics of a real classroom. Unlike validation, which examined theoretical quality, practicality concerned the lived usability of the media how it interacted with real users, real devices, and real learning rhythms. The test involved two teachers and twenty-five fifth-grade students at SD Ma'arif Taman, who explored the media during a cultural diversity lesson.

The quantitative results indicated that both groups found the media highly practical. As shown in Table 2, the mean score for both teachers and students was 91.0, falling into the very practical category. Teachers reported that the AR platform eased the process of explaining abstract cultural content, particularly when students had to visualize architectural or costume variations across regions.

Table 2. Media Practicality Questionnaire Results

Respondent	Number of Items	Maximum Score	Total Score	Mean	Category
Teacher (n=2)	20	100	91	91.0	Very Practical
Students (n=25)	20	500	455	91.0	Very Practical

However, the numbers alone could not capture the vibrancy of classroom responses. Observations revealed a learning environment transformed: students leaned forward, rotated their tablets, and compared the structures of different traditional houses, exclaiming their discoveries aloud. Some attempted to mimic dance movements shown by animated figures, while others compared the motifs of batik patterns from Java and Sumatra. The atmosphere was one of curiosity and delight conditions rarely seen in conventional social studies lessons.

Teachers remarked that this transformation reduced their role from sole knowledge deliverers to facilitators of exploration. One teacher expressed, *"It felt as if the students were leading the lesson; they asked questions that even I had to think about."* Such moments reflect a deeper pedagogical shift the media did not just work technically; it reconfigured classroom relationships and fostered collaborative meaning-making. The practicality test thus confirmed that the AR-based media was not only accessible and engaging, but also compatible with the constructivist spirit of the *Merdeka Belajar* curriculum, which values independence, curiosity, and dialogic learning.

Effectiveness of the Media

The third stage, measuring effectiveness, aimed to verify whether the AR-based digital literacy media genuinely improved students' understanding of cultural diversity. Using a one-group pretest–posttest quasi-experimental design, researchers compared students' scores before and after the learning intervention. The test included 20 multiple-choice items designed to measure three domains of understanding: knowledge of cultural facts, appreciation of diversity, and empathy toward cultural differences.

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The results were unmistakably positive. The mean pretest score of 61.2 increased to 83.6 in the posttest, representing a gain of 22.4 points. The N-Gain value of 0.58, categorized as moderate, indicated substantial learning improvement. Further statistical analysis using a paired-sample t-test confirmed that this increase was highly significant ($t(24) = 7.82$, $p < 0.001$). The effect size (Cohen's $d = 1.03$) suggested a large educational effect, implying that the use of AR media meaningfully influenced student learning outcomes. These findings are summarized in Table 3 and visually represented in Figure 1.

Table 3. Comparison of Pretest and Posttest Scores

Test	Mean	Standard Deviation
Pretest	61.2	8.4
Posttest	83.6	7.1
N-Gain	**0.58**	–
Category	**Moderate**	–

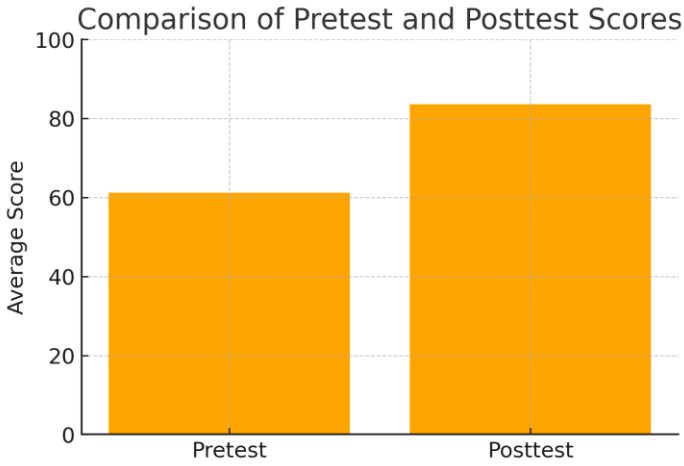

Figure 1. Comparison Pretest and Posttest Scores

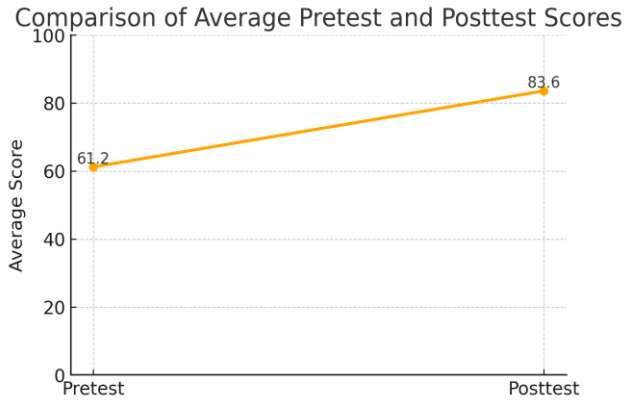

Figure 2 .Comparison average pretest and posttest scores

(Bar chart illustrating gain in scores)

Numbers, however, cannot fully express the transformation that took place during learning. Students began not only recalling facts but reasoning through them comparing traditions across provinces and identifying common cultural values. For instance, one group linked the architectural design of traditional houses to environmental adaptation, while another discussed

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how regional dances symbolized communal harmony. Such analytical engagement reveals that the learning moved beyond memorization into conceptual understanding.

Teachers confirmed these observations, noting visible changes in classroom dynamics. Students who had previously been passive became active participants; discussions extended beyond the screen to include stories from their families and local communities. In these interactions, AR served as a bridge connecting digital literacy with lived culture. The data thus illustrate that the technology's effectiveness lay not merely in transmitting information but in transforming the learning experience into an embodied encounter with diversity.

Aspect-Based Analysis

To further understand how learning improvement occurred, posttest data were analyzed across three dimensions: cultural knowledge, attitude, and empathy. The results, shown in Table 4, reveal a nuanced progression across these domains.

Table 4. Aspect-Based Improvement of Cultural Understanding

Aspect	Pretest Mean	Posttest Mean	N-Gain	Category
Cultural Knowledge	63.4	86.1	0.62	High
Attitude toward Diversity	59.8	81.2	0.54	Moderate
Empathy and Appreciation	60.3	83.5	0.56	Moderate

The most remarkable improvement was found in cultural knowledge, with an N-Gain of 0.62, indicating that students became substantially more knowledgeable about Indonesia's cultural symbols, practices, and geographical diversity. The moderate improvements in attitude (0.54) and empathy (0.56) were equally significant, suggesting that the AR experience cultivated not only intellectual comprehension but also emotional connection and social awareness.

Observation supported these numbers vividly. Students engaged in conversations comparing cultures without judgment, acknowledging that "each region has its own beauty." This ability to perceive difference as richness rather than division represents a crucial affective outcome in multicultural education. Through AR's immersive representation where students could virtually enter traditional homes or observe local performances they developed what teachers described as "a sense of respect born from experience, not instruction." The media thus acted as both a digital and emotional bridge, allowing empathy to emerge naturally from encounter rather than prescription.

Qualitative Reflections

Beyond the structured observations and questionnaires, spontaneous classroom behaviors offered invaluable insight into the lived experience of learning with AR. The lessons were often punctuated by excitement: laughter, exclamations, and students huddling together to examine objects from new angles. Teachers reported that the atmosphere was markedly different from typical lessons less hierarchical, more exploratory. One teacher shared,

"For the first time, I saw students teaching each other about culture"

Students' reflections deepened this impression. Several mentioned showing the AR models to their parents at home, demonstrating that the learning extended beyond the classroom and into family dialogue. This intergenerational transfer underscores a subtle but powerful impact: AR technology not only disseminated information but also revitalized cultural storytelling as a shared practice.

Teachers further noted improvements in students' confidence in using digital tools. Many who were initially hesitant with tablets became more independent by the end of the activity,

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reflecting growth in *digital self-efficacy*. This intersection between technological competence and cultural appreciation embodies the core principle of *digital literacy with character* a balance between skill and value that the *Merdeka Belajar* policy envisions.

Interpreting the Transformative Role of Augmented Reality in Cultivating Digital Literacy and Cultural Understanding

The results of this study affirm that Augmented Reality (AR) is far more than an instrument of technological novelty; it is a pedagogical force capable of reshaping how young learners perceive, interact with, and internalize cultural knowledge. When placed in the hands of elementary students, AR becomes not just a window into culture but a bridge between the cognitive and the affective, between the familiar and the unknown. The experience of cultural learning, once confined to static textbook illustrations or teacher narration, transforms into an embodied encounter where culture is seen, heard, and emotionally felt. The substantial improvement in students' comprehension and the qualitative traces of empathy observed throughout the learning sessions reveal that AR, when anchored in thoughtful design, can move learners beyond information toward insight from merely knowing about diversity to understanding it as a living, human experience.

This transformation does not occur by chance. It reflects a broader shift documented in the past five years of educational research, where scholars have begun to recognize AR's pedagogical value not in its technological sophistication but in its capacity to reorganize the ecology of learning. Recent meta-analyses of AR-based instruction (Wang & Gao, 2025; Xu et al., 2022; Howard & Davis, 2023) reveal that the most impactful interventions share three features: contextual relevance, narrative immersion, and reflective scaffolding. These studies argue that AR achieves educational depth only when learners can connect virtual representations to real-world meaning. The present study's design, which guided students from local cultural familiarity toward the wider Indonesian mosaic, mirrors this insight precisely. The AR media allowed learners to see culture dynamically not as a fixed heritage to be memorized, but as a living system shaped by human adaptation and creativity. As students rotated 3D models of traditional houses, listened to local music, and observed regional attire in motion, they were not just absorbing data; they were entering into a dialogue with culture itself.

This dialogic nature of AR echoes what Szubielska et al. (2021) describe as the "aesthetic encounter" of learning a process where knowledge is not transmitted but experienced through perception and interpretation. Their research on AR-enhanced cultural heritage education found that students developed deeper appreciation when learning was accompanied by narrative cues that invited them to imagine and empathize. In our study, this pattern was evident when students compared architectural designs or dance movements and asked why these differences existed. The questions that emerged were not prompted by assessment rubrics but by genuine curiosity the kind that arises when learning feels alive. Similarly, Bagher et al. (2021) observed that AR's interactivity catalyzes embodied cognition, allowing learners to transform visual manipulation into conceptual understanding. This cognitive process was mirrored in our findings: students began linking cultural forms with environmental adaptation or social values, bridging sensory experience with analytical thought. In doing so, they enacted precisely what constructivist theory envisions knowledge as something constructed, not delivered.

Beyond cognition, however, the emotional texture of learning deserves equal attention. Cultural education has long struggled to move students from cognitive recognition of difference to genuine empathy and intercultural respect. Recent research into AR and empathy (Siddiqi, 2024; Dick, 2021) offers compelling evidence that immersive technologies can bridge

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this gap by enabling students to momentarily inhabit perspectives different from their own. These studies demonstrate that empathy is not taught through instruction but cultivated through experience through being placed, even virtually, within the life-world of another. The moderate yet significant gains in our students' attitudinal and empathic understanding align closely with these findings. During classroom reflections, several students remarked that they "felt proud" of Indonesia's diversity or "understood why traditions matter" statements that signify emotional engagement rather than rote acceptance. Teachers, too, noted that students' discussions shifted in tone: curiosity replaced indifference, and appreciation replaced stereotype. In this sense, AR served not as a digital substitute for empathy but as a scaffold for emotional connection a medium through which abstract ideals of tolerance became personally meaningful experiences.

Yet, empathy alone does not capture the full intellectual ambition of this study. The AR intervention was also designed to develop what contemporary scholars describe as critical digital literacy the ability to navigate digital content thoughtfully, ethically, and creatively. As Cynthia & Sihotang (2023) argue, digital literacy in the twenty-first century must transcend operational competence and evolve into a disposition toward critical inquiry and moral discernment. Our observations resonate with this shift. Students did not merely manipulate the AR interface; they engaged it critically, questioning representations, validating meanings, and comparing interpretations with peers. Such behaviors reflect the emergence of critical digital inquiry, a form of literacy that unites information processing with reflective judgment. Lubis et al. (2022) emphasize that this form of literacy flourishes in interactive environments that demand collaboration and self-direction precisely the conditions our AR-based lessons cultivated. Through this lens, the improvement in cultural understanding was not only an outcome of technological exposure but a manifestation of deepened digital consciousness: students learning with technology, not merely through it.

The role of teachers within this transformation cannot be overstated. As recent studies by Ma'arif & Nursikin (2024) and Rismana & Hernawati (2025) have shown, AR's pedagogical success depends less on the sophistication of the software than on the teacher's ability to translate virtual experience into conceptual dialogue. These scholars emphasize that AR requires teachers to act as mediators, guiding learners to make sense of sensory information and to connect it to curriculum goals and social values. The teacher observations in our study confirm this principle. Educators noted that AR changed their pedagogical rhythm: they spoke less, listened more, and guided reflection rather than delivered explanation. One teacher described feeling "more like a storyteller than an instructor," an identity shift that epitomizes the philosophy of Merdeka Belajar where learning is dialogical, exploratory, and grounded in the learner's agency. However, both our teachers and the wider literature acknowledge enduring structural constraints. Access to devices, limited class time, and insufficient professional development remain persistent barriers to equitable AR implementation. International studies from 2024 and 2025 warn that without systemic investment in teacher training and infrastructure, AR may remain a privilege of technologically rich schools, not a right of all learners. This caution invites policymakers to treat digital literacy not as a luxury but as an essential component of twenty-first-century citizenship education.

When viewed collectively, the findings of this study and the broader research landscape reveal a consistent triad of forces through which AR exerts its educational impact: embodied visualization, narrative contextualization, and social mediation. These three processes intertwine to produce what can be termed "immersive meaning-making." Embodied visualization transforms cultural abstraction into sensory presence; narrative contextualization situates that presence within stories and symbols that invite interpretation; and social mediation

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allows those interpretations to be negotiated collaboratively, turning personal insight into shared understanding. This triadic framework aligns with constructivist epistemology but also extends it by demonstrating that digital experience can be as emotionally and culturally formative as traditional social interaction. In our classrooms, AR did not isolate learners behind screens it brought them together in discussion, curiosity, and reflection. The technology's power, then, lay not in its digital surface but in its ability to generate human connection.

Even so, the literature reminds us that such transformations are fragile if not sustained. Longitudinal analyses (Logston, 2025; Rambaree et al., 2023) indicate that empathy and cultural awareness cultivated through AR may diminish over time without reinforcement across subjects and contexts. Likewise, small-sample, short-duration studies ours included cannot fully account for long-term behavioral change. Future research must therefore move beyond immediate learning gains to examine how AR-mediated understanding translates into enduring dispositions: do students exposed to immersive cultural learning continue to exhibit tolerance, curiosity, and digital discernment months or years later? Addressing such questions would position AR not just as a pedagogical tool but as a developmental intervention capable of shaping social consciousness. Moreover, integrating mixed-method approaches combining statistical data with longitudinal narratives would provide richer, more humane portraits of how children's thinking evolves in digital-cultural spaces.

Ultimately, the significance of this study lies not in proving that AR "works," but in revealing how it transforms learning when embedded in culturally responsive pedagogy. The results reaffirm that technology, when humanized through thoughtful design and reflective facilitation, can deepen rather than dilute the moral and cultural dimensions of education. Within Indonesia's Merdeka Belajar paradigm, this realization holds profound implications. AR offers a tangible way to embody the curriculum's ideals learning that is independent yet communal, creative yet rooted, digital yet deeply human. It encourages a generation of students to see technology not as a distraction from culture but as a lens through which culture can be rediscovered, reimagined, and cherished. In this sense, the transformation is not merely pedagogical; it is civilizational. It reaffirms the idea that education, at its best, remains a human endeavor one that evolves with tools and times, yet always returns to the same essential pursuit: understanding ourselves and one another more deeply.

Conclusion

This study demonstrates that the development of Augmented Reality (AR)-based digital literacy media is feasible, practical, and effective in enhancing elementary school students' understanding of cultural diversity. This media is designed by integrating interactive visualization of local culture through AR technology, presenting 3D objects such as traditional houses, dances, and traditional clothing. Validation results indicate that the media meets the criteria for content and design feasibility, while practicality tests indicate that the media is easy to use and attracts students' interest. Implementation of the media in learning results in a significant increase in cultural understanding, which not only enriches cognitive knowledge but also fosters an appreciative attitude toward diversity.

The primary contribution of this research lies in the innovative integration of digital literacy, AR technology, and local cultural content into a single learning medium designed for elementary education. These findings reinforce the view that cultural learning can be delivered in a more contextual, engaging, and meaningful way through technology-based media designed with a constructivist approach. Furthermore, the research findings support the Merdeka Belajar (Freedom to Learn) policy, which emphasizes the importance of project-based learning, local wisdom, and technology.

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Based on the findings of this study, it is recommended that teachers and schools begin integrating AR-based learning media as an alternative to delivering cultural materials, which have traditionally been passive and textual. The use of this interactive media can be a strategic step in building student character that values diversity and strengthens the nation's cultural identity.

For future development, it is recommended that similar media expand its reach to cultural content from other regions in Indonesia and be developed in a multi-platform format compatible with various digital devices. Future researchers can conduct further effectiveness tests using a full experimental approach, involving more variables such as attitudes, social skills, or intercultural collaboration, to optimize and measurably enhance the media's contribution to learning.

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