

Integrating Local Culture into Digital Learning Media for Elementary School Students in Border Regions

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Abstract

This study aims to integrate local cultural values into digital learning media for elementary school students in border areas, to enhance artistic and civic literacy. The development used the Design and Development Research (DDR) approach with the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. The study was conducted in Entikong District, West Kalimantan, involving fourth-grade teachers and students from four elementary schools. Data were collected through observations, interviews, questionnaires, validation sheets, and Focus Group Discussions (FGD). The result shows that the integration of local culture into the “Go Buya” digital learning media effectively enhances students’ understanding of local traditions, cultural diversity, and civic values. The media demonstrated high feasibility in terms of content, design, and user engagement. Learning outcomes increased significantly after using the media, as indicated by improved post-test results and positive responses from students and teachers. The findings suggest that incorporating local culture into digital learning media can foster meaningful learning experiences, particularly for border-area students who face limited access to culturally relevant educational materials.



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INTRODUCTION

Education in border regions carries responsibilities that extend beyond academic instruction. For students living in frontier areas such as Entikong, West Kalimantan, one of Indonesia’s most active land border checkpoints, schools function as strategic spaces for strengthening cultural literacy and citizenship identity. However, available data indicate that elementary schools in Entikong face various limitations, including unequal teacher competencies, minimal integration of cultural content into the curriculum, and a

low availability of learning materials relevant to local Dayak and Malay cultural contexts (Pranata & Syamsijulianto, 2025b; Syamsijulianto, 2020; Syamsijulianto et al., 2022). Observations and preliminary interviews conducted with teachers in two Entikong elementary schools further reveal that students' understanding of local traditions, communal values, and national identity remains fragmented. Cultural literacy programs are implemented inconsistently and are rarely supported with digital-based learning resources.

Although previous studies have emphasized the importance of culturally responsive learning and the integration of local wisdom into classroom practices, the existing literature shows several gaps. First, most research focuses on urban or non-border schools, leaving limited evidence on how cultural literacy is operationalized in geographically isolated border areas. Second, earlier studies generally highlight conceptual arguments but seldom address the practical weaknesses in media design and its relevance to border contexts where cross-border mobility, linguistic diversity, and cultural shifts present unique challenges. Third, empirical data on how cultural values can be embedded effectively in digital learning media for elementary students remain scarce. These gaps show the need for research that is both context-specific and pedagogically grounded.

The challenges faced by Entikong schools underscore the urgency of developing learning media that not only convey cultural knowledge but also respond to the realities of border communities. The penetration of smartphones and government-supported ICT facilities, although limited, opens opportunities for digital media adoption. Digital platforms with interactive features and gamification have the potential to strengthen cultural engagement among students while aligning with the Merdeka Belajar curriculum. Yet, such innovations have not been systematically developed or evaluated in the Entikong context.

The first research problem concerns the current implementation of cultural literacy in elementary schools located in the Entikong border area. A descriptive–interpretive approach is required to understand how cultural literacy is practiced not only in formal instructional settings but also in the broader school environment. This exploration involves examining teachers' pedagogical strategies, the availability of learning resources, and the extent to which local cultural content is incorporated into classroom activities. Early observations and preliminary interviews indicate that cultural literacy programs are conducted inconsistently, often limited to thematic discussions without structured learning materials. The challenges encountered include limited teacher training on culturally responsive pedagogy, insufficient digital and non-digital media that reflect local cultural contexts, and contextual pressures arising from cross-border mobility and cultural influences from neighboring Malaysia. These conditions suggest that cultural literacy in Entikong schools, although present, lacks systematic implementation and adequate pedagogical support.

The second research problem explores how local cultural values can be integrated into a digital learning medium designed to support both civic and cultural literacy. This problem requires interpretive analysis of the cultural elements considered significant for the Entikong community, such as traditional arts, local narratives, communal values, and identity markers of Dayak and Malay groups. Integrating these components into digital media demands sensitivity to the learning needs of young students and compatibility with curriculum expectations. The design process should incorporate interactive features, gamification, and visual storytelling to transform cultural content into engaging learning experiences. This integration is not merely a technical task; it involves interpreting cultural symbols and translating them into pedagogical elements that remain authentic, respectful, and educationally meaningful.

The third research problem focuses on evaluating the effectiveness of the developed digital medium in improving students' understanding and appreciation of local culture. A descriptive–interpretive perspective emphasizes not only measurable learning outcomes but also students' experiential responses. Effectiveness, therefore, encompasses cognitive gains, such as increased knowledge of cultural traditions, and affective outcomes, including interest, pride, and emotional connection to their cultural heritage. Assessment includes analyzing students' interactions with the digital platform, their reflections on cultural content, and teachers' perceptions of classroom engagement. Interpretive insights help reveal how digital media may reshape students' cultural awareness and contribute to the reinforcement of civic identity in a border context.

Together, these three problem areas form an integrated framework: understanding the existing conditions, designing a culturally grounded digital solution, and evaluating its pedagogical impact. The descriptive–interpretive discussion highlights the interconnected nature of cultural literacy, local identity, and technological innovation in advancing equitable education for students in Indonesia's frontier regions.

The objectives of this study reflect a systematic effort to address the cultural literacy challenges faced by elementary schools in Entikong, a border area where educational practices are influenced by geographical isolation, cultural diversity, and cross-border interactions. The first objective, identifying empirical challenges, serves as a foundation for understanding how cultural literacy is currently practiced within local classrooms. Through observations, interviews, and document analysis, this study seeks to illuminate the concrete barriers that teachers and students encounter, such as limited instructional resources, the absence of culturally relevant materials, and the inconsistency of school-based cultural programs. Interpreting these findings allows for a deeper understanding of how structural, pedagogical, and socio-cultural factors intersect to shape students' cultural literacy experiences.

The second objective focuses on designing a digital learning medium that integrates local cultural values in ways that are pedagogically meaningful and contextually appropriate for border-region learners. The descriptive analysis

emphasizes the characteristics of Entikong's cultural environment, its Dayak and Malay traditions, its proximity to Malaysia, and its exposure to cross-border influences, while the interpretative dimension explores how these realities inform the design principles of the digital media. This includes considerations of representation, narrative framing, interactivity, and alignment with curriculum goals. The design process is thus understood not merely as a technical task, but as an effort to translate cultural knowledge into engaging educational experiences that strengthen students' sense of identity and belonging.

The third objective involves evaluating the effectiveness of the developed media in enhancing students' cultural understanding and civic awareness. This evaluation adopts both quantitative and qualitative approaches to capture not only improvements in students' knowledge but also shifts in attitudes, engagement, and cultural appreciation. The interpretative analysis seeks to explore how students interact with the media, which elements of the design resonate most strongly, and how these interactions contribute to their broader understanding of local traditions and citizenship values. This perspective acknowledges that effectiveness is not solely measured through test scores, but also through students' ability to connect learning materials with their lived experiences in the border community.

Collectively, the outcomes of this study are expected to make a meaningful contribution to the field of digital pedagogy. By grounding media development in the specific cultural and educational realities of a border region, the research offers insights that extend beyond technical innovation toward a more culturally responsive and inclusive digital learning framework. The findings are also intended to provide evidence-based recommendations for policymakers, educators, and curriculum developers seeking to improve cultural literacy programs in Indonesia's frontier areas. Through this integrated descriptive–interpretative approach, the study aims to support equitable access to culturally meaningful education for students in Entikong and similar border communities.

METHOD

Research Design

This study applied a Design and Development (D&D) research framework, interpreted and shaped through the logic of the ADDIE model: Analyze, Design, Develop, Implement, and Evaluate. Rather than functioning merely as a theoretical reference, the ADDIE model became a lived, procedural pathway that guided the researchers' actions and decisions throughout the development process. Each phase allowed the researchers to interpret emerging needs, respond to contextual realities, and refine the design of the digital learning medium iteratively and reflectively (Molenda, 2015).

Within this framework, the research unfolded in two interconnected movements. The first movement focused on the systematic development of a culturally integrated digital learning medium intended for fourth-grade students living in border

regions (Branch, 2009). This stage involved not only the technical construction of the media but also the interpretative exploration of how local cultural values could be meaningfully embedded into digital learning experiences. The development process became a negotiation between instructional principles, cultural authenticity, and the practical constraints of border-area schooling.

The second movement centered on the empirical evaluation of the media's usability and effectiveness. Here, the researchers did not simply measure outcomes; they interpreted how students and teachers interacted with the media, how cultural elements influenced engagement, and how the digital platform supported the growth of cultural and citizenship literacy (Syamsijulianto, 2022). The evaluation process, therefore, served as both an assessment and a reflective lens, enabling the researchers to understand the media's role within real classroom dynamics and the lived experiences of border-area communities (Pranata & Syamsijulianto, 2025b).

Together, these two stages provided a comprehensive and interpretative understanding of how a culturally grounded digital learning medium can be designed, developed, and meaningfully utilized in elementary education contexts at the nation's borders.

ADDIE Model Procedures

Analyze Phase

The analysis phase focused on understanding contextual, pedagogical, and cultural needs. Procedures included:

- a. Classroom observations to examine learning conditions, available facilities, and student characteristics.
- b. Needs analysis interviews with teachers to identify challenges in integrating local culture into existing learning practices.
- c. Document analysis of the national curriculum and local cultural records obtained from community elders.

This phase ensured that the media development aligned with students' cultural backgrounds and curricular expectations, consistent with recommendations by recent D&D frameworks emphasizing contextual (Almelhi, 2021; Hokanson et al., 2018)

Design Phase

The design phase translated analytical findings into a structured product blueprint. Activities included:

- a. Storyboarding, where narrative flow, cultural elements, and learning tasks were visualized in sequential frames.
- b. Scriptwriting to refine cultural narratives and learning instructions.
- c. Interface mock-ups developed using Figma, outlining color schemes, iconography, layout structure, and navigation patterns reflective of local cultural motifs.
- d. Instructional design mapping, aligning competencies with digital activities, learning outcomes, and assessments.

Design decisions adhered to multimedia learning principles (Mayer, 2017) and culturally responsive pedagogy guidelines (Darling-Hammond & Snyder, 2015; Gay, 2018a).

Develop Phase

During development, the conceptual designs were converted into a functional digital media product. Key procedures included:

- a. Graphic production, involving the creation of illustrations, background elements, and culturally specific visual symbols using Adobe Illustrator.
- b. Prototype development, where an interactive digital module was built using Articulate Storyline.
- c. Internal alpha testing, conducted by the research team to identify usability errors, interface glitches, and content inconsistencies.
- d. Revision cycles, addressing issues such as readability, cultural accuracy, and interaction flow.

The development phase followed iterative prototyping approaches common in modern instructional design (Kang & Ritzhaupt, 2015; Ritzhaupt & Kumar, 2015).

Implement Phase

The implementation stage involved testing the media in real classroom settings. Procedures included:

- a. Teacher orientation sessions to introduce the media's features, cultural components, and application strategies.
- b. Classroom trials, where the digital media was used during thematic learning sessions for two weeks.
- c. Student engagement monitoring, noting interaction patterns, comprehension difficulties, and cultural responses.

The implementation approach ensured ecological validity, aligning with recent studies on digital learning deployment in remote settings (Ab. Rahman et al., 2018; Gustiana et al., 2023).

Evaluate Phase

Evaluation consisted of both formative and summative assessments. Formative evaluation occurred continuously during design and development, whereas summative evaluation assessed product effectiveness after implementation.

Procedures included:

- a. Expert validation involving *six validators*:
 1. 2 subject-matter experts
 2. 2 media design experts
 3. 2 local cultural experts
- b. Experts used Likert-scale validation sheets (1–5) measuring content accuracy, cultural relevance, technical quality, usability, and pedagogical alignment. A minimum acceptable validity score was set at ≥ 3.50 (valid category).

- c. Pre-test and post-test administration to evaluate gains in cultural literacy and citizenship understanding.
- d. Focus Group Discussions (FGD) with teachers, cultural leaders, and education practitioners to refine final improvements and reflect on cultural sensitivity.

This evaluation structure aligns with modern standards for product validation in educational technology research (Ritzhaupt & Kumar, 2020; Sumuer, 2023).

Data Collection

Data in this study were collected using various instruments to strengthen methodological rigor. Observations were conducted to document classroom conditions, cultural exposure, and challenges that emerged during the learning process. Questionnaires were administered to teachers and students to assess the practicality of media use, clarity of presentation, and cultural relevance. Furthermore, expert validation sheets were used to evaluate the validity of the content and function of the developed media. Focus group discussions (FGDs) were conducted involving pedagogical and cultural stakeholders to obtain more in-depth input. Learning effectiveness was measured through pre- and post-test results as indicators of student learning outcomes.

Data Sources

The primary data sources in this study came from fourth-grade teachers and students at four public elementary schools located in Entikong, West Kalimantan. Meanwhile, secondary data were obtained from curriculum documents, local cultural archives, and various literature related to digital learning and culturally responsive pedagogy. Data analysis was conducted using qualitative and quantitative approaches. Qualitative data, including observation notes, FGD transcripts, and expert comments, were analyzed through coding and grouping, followed by thematic interpretation and triangulation between data sources. This analysis focused on uncovering the integration of cultural values, learning feasibility, and the usability of the media design. Quantitative data were analyzed using normality and homogeneity tests as statistical prerequisites, followed by paired-sample t-tests to compare pre-test and post-test scores, and descriptive statistical analysis of the validators' assessments. The results of the statistical analysis were used to determine the effectiveness of the media in improving students' cultural and civic literacy.

RESULT AND DISCUSSION

Result

The development and trial of the Go Buya digital learning media produced several noteworthy findings that collectively help answer the main research question: to what extent can culturally embedded digital media improve cultural literacy and citizenship understanding among students in border-area elementary schools? The results, drawn from expert validation, quantitative testing, and classroom observations, point toward a consistent pattern of improvement across multiple dimensions.

Expert Validation Results

The Go Buya digital learning media was evaluated by material, media, and cultural experts using a 4-point Likert assessment rubric. The results are presented in Table 1.

Table 1. Expert Validation Results

Validator Type	Mean Score	Percentage (%)	Category
Material Expert	3.62	90.5	Highly Valid
Media Expert	3.66	91.5	Highly Valid
Cultural Expert	3.70	92.5	Highly Valid
Overall Average	3.66	91.5	Highly Valid

The initial validation carried out by three groups of experts, material, media, and cultural specialists, showed a high level of agreement regarding the feasibility of Go Buya. Although the mean scores across validators were not drastically different, they formed a steady cluster in the “highly valid” category (90.5%–92.5%). The slightly higher rating from the cultural expert (92.5%) is particularly telling. It suggests that the cultural elements embedded in the media were not only accurate but also considered meaningful and representative of the community’s identity.

This matters because the backbone of Go Buya lies in its cultural narrative. If this component were weak, the teaching media would risk becoming just another generic digital resource. The alignment of scores across domains (content quality, media design, and cultural relevance) reflects that the development process successfully balanced pedagogical, technological, and cultural considerations, a balance that is often difficult to achieve in educational media development projects.

Pre-Test and Post-Test Learning Outcomes

A total of 124 elementary students across four schools participated. Learning outcomes were measured using a 20-item cultural literacy and citizenship test administered before and after the intervention.

Table 2. Students’ Learning Outcomes

Variable	Pre-test Mean (SD)	Post-test Mean (SD)	Δ Score	Sig. (p)
Cultural Literacy	58.12 (9.44)	79.45 (8.32)	+21.33	0.001*
Citizenship Understanding	55.76 (10.11)	77.02 (9.21)	+21.26	0.003*
Overall Learning Score	56.94 (9.78)	78.19 (8.77)	+21.25	0.001*

*Significant at $p < 0.05$ (paired t-test)

There was a statistically significant improvement across all indicators, with an average gain score of 21.25 points. Quantitative testing revealed a substantial leap in students’ test scores after using Go Buya. While the raw improvement of 21 points

across variables appears quite large, the meaningful aspect lies in how consistently the gains occurred across the four participating schools. Cultural literacy scores increased from an average of 58.12 to 79.45, while citizenship understanding rose from 55.76 to 77.02. The tests were designed to assess not memorization, but recognition of cultural symbols, understanding of civic duties, and the ability to relate these to everyday situations.

The relatively moderate standard deviations in the post-test (8.32 and 9.21) also indicate a narrowing performance gap among students. One plausible explanation is that the digital format helped level the playing field for students who usually struggle with traditional text-heavy instruction. The interactive and visual nature of Go Buya might have provided alternative entry points for understanding, allowing low-performing students to catch up with their peers.

This trend resonates with findings from previous research showing that culturally contextualized media tends to enhance comprehension by providing familiar touchpoints that anchor new knowledge (Gay, 2018; Kuo et al., 2021). The significant p-values reinforce that the gains were unlikely to be random fluctuations but represent actual learning progress stimulated by the intervention.

Qualitative Classroom Observations

The qualitative data added texture to these numerical results. During lessons, students tended to move beyond passive compliance and displayed visible enthusiasm, especially in tasks that involved narrative exploration or cultural missions. Teachers noted that students often leaned forward, asked spontaneous questions, and even repeated certain parts of the story, indicating genuine interest rather than procedural engagement.

Another recurring observation was how students began to articulate cultural attributes in their own words. For example, several students referenced local customs or values when answering task prompts, suggesting that the media helped activate cultural memory or understanding that was previously dormant. Collaborative dynamics also shifted noticeably; group tasks that would typically be dominated by a few outspoken students became more evenly distributed as quieter students began contributing ideas. These small behavioral shifts, while not captured numerically, help contextualize the score improvements. They indicate that the learning process, not only the outcomes, became more participatory and meaningful.

Teacher Feedback

Teacher feedback reinforced this interpretation. Several teachers commented that Go Buya reduced the amount of time they usually spent explaining basic cultural concepts. In their view, the digital format worked almost like an additional “co-teacher,” taking over the initial explanation and freeing them to facilitate deeper discussion. Teachers also emphasized that students who were typically disengaged, often those from households with limited access to cultural storytelling or civic education, seemed to benefit the most. These students showed increased confidence and willingness to

participate, which teachers attributed to the “entry-level friendliness” of the digital format.

The fact that Go Buya functioned smoothly within a low-bandwidth, border-area environment also holds practical significance. In many rural and frontier schools, infrastructure constraints are a major barrier to adopting digital learning tools. The ability of Go Buya to operate effectively despite these limitations suggests that it could be realistically scaled to similar contexts without requiring major infrastructural upgrades.

DISCUSSION

The results of this study offer a clearer picture of how culturally embedded digital media can influence learning processes in border-area elementary schools. At a fundamental level, the sharp increase in students’ test scores from the mid-50s to the high-70s shows that cultural integration within digital platforms is not merely an aesthetic choice, but a pedagogically consequential design element. This aligns with the central aim of the research: to examine whether the Go Buya digital media could meaningfully enhance students’ cultural literacy and civic understanding in a setting where cultural identity is constantly negotiated at the margins of two nations.

Interpretation of the Findings

The quantitative improvements observed in this study suggest that the Go Buya learning media did more than introduce new cultural information; it appeared to reorganize how students interpreted and connected cultural concepts with civic values. This finding aligns directly with the research objective, which sought to determine whether a culturally embedded digital tool could strengthen cultural literacy and citizenship understanding in a border-region context (Pranata & Syamsijulianto, 2025c; Syamsijulianto et al., 2025). The magnitude of the improvement, exceeding twenty points across both domains, indicates that the learning experience resonated with students cognitively rather than functioning as a superficial exposure to cultural content.

A closer look at the nature of the gains helps clarify this pattern. Literacy in culture and citizenship is inherently relational; it depends on the learner’s ability to link symbols, narratives, and social norms to broader notions of identity, responsibility, and community. Students who initially recognized cultural motifs only at a surface level gradually developed the ability to articulate their meaning, suggesting a shift toward deeper conceptual processing (Hicham et al., 2025). This kind of progression is unlikely to emerge from rote learning alone. Instead, it supports the idea that interactive and narrative-based media provide fertile ground for constructing meaning, consistent with sociocultural learning theories that emphasize contextualized knowledge-building (Gay, 2018b; Vygotsky et al., 1979).

Several mechanisms may explain why Go Buya triggered these changes. First, its narrative structure, which ties cultural artifacts to civic dilemmas, community

responsibilities, and character-driven scenarios, likely created cognitive “anchor points” that helped students integrate disparate cultural elements into coherent frameworks (Pranata & Syamsijulianto, 2024). Narrative-based learning has been shown to promote schema formation and retention because stories activate emotional as well as cognitive pathways (Plass et al., 2015). When students in this study began expressing not only what a particular cultural item looked like but what it represented, they were effectively demonstrating this form of schema-building.

Second, the improvement across all participating schools, despite their variation in resources and learning conditions, suggests that Go Buya lowered some of the barriers typically faced by students in border regions. In many rural and frontier communities, cultural knowledge is unevenly transmitted. Some families maintain strong traditions, while others are more influenced by cross-border media and commercial culture (Syamsijulianto, 2023). The consistency of the gains implies that Go Buya provided a shared cultural reference point that transcended these differences (Pranata & Syamsijulianto, 2025b). This aligns with research showing that well-designed digital media can help equalize access to cultural narratives by offering a stable, structured presentation of content that students might not otherwise encounter (Kuo et al., 2021).

Another important interpretive layer concerns students’ visible shift in confidence when discussing cultural meaning. Confidence itself is not a measured variable in this study, but qualitative observations reveal that many students became more vocal and assertive in explaining cultural symbolism (Riadil, 2020). This behavioral shift likely interacted with cognitive outcomes: when learners feel authorized to speak about cultural identity, they are more willing to test ideas, ask questions, and connect new information with their lived experience. In border regions, where cultural identity can be fluid or contested, this sense of ownership is particularly significant (Dalyono, 2016). The intervention may have functioned not only as a learning tool but also as a stabilizing cultural frame, helping students make sense of their local context in relation to national identity.

There are also practical explanations for why the intervention yielded consistent effects. Go Buya’s visual and interactive design may have been especially beneficial for students who struggle with text-heavy instruction, a common issue in multilingual border communities where proficiency in the national language varies (Syamsijulianto, Sapriya, Sa’ud, et al., 2024). By presenting cultural and civic concepts through imagery, simplified dialogue, and guided tasks, the media bypassed some linguistic barriers and allowed students to construct meaning through multimodal cues. This aligns with findings in multimodal literacy studies, which argue that visual and interactive representations can make abstract cultural ideas more accessible and memorable (Bezemer & Kress, 2015).

Taken together, these findings suggest that the effectiveness of Go Buya stems not from a single instructional feature but from a convergence of factors: culturally grounded narratives, emotionally engaging tasks, multimodal presentation, and a

structure that invites students to make sense of their own social world. Conceptually, this highlights the role of digital media not only as delivery mechanisms for content but as cognitive environments that mediate identity, belonging, and cultural interpretation (Pranata et al., 2025; Syamsijulianto, Sapriya, Sa'ud, et al., 2024). Practically, the results imply that culturally embedded digital tools may offer a viable strategy for mitigating disparities in cultural exposure in border regions, where traditional forms of cultural transmission are uneven or disrupted (Yao, 2025).

Overall, the interpretation of the findings points to a promising conclusion: when cultural learning is designed to be contextual, interactive, and personally meaningful, students are more likely to internalize cultural narratives and connect them to civic roles. The consistent improvement across diverse school contexts underscores the potential scalability of such interventions, while the observed behavioral shifts indicate that the cognitive gains were accompanied by meaningful changes in students' confidence and engagement, an outcome that may have lasting implications in culturally complex educational environments (Freeman-Green et al., 2023).

Comparison With Previous Studies

The results of this study align with a growing body of research that positions game-based digital learning as an effective catalyst for improving student engagement and conceptual depth. Prior studies by Yao (2025) and (Plass et al., 2015) consistently argue that the interactive features embedded in digital games, such as branching narratives, immediate feedback, and challenge-based missions, create learning conditions that help students construct meaning rather than memorize facts. What distinguishes the present research, however, is the explicit integration of regional cultural material within this interactive framework. Instead of relying on generic game scenarios, Go Buya situates learning in the lived reality of Entikong's border community (Courtois et al., 2024). This localized design appears to have amplified the cognitive benefits commonly observed in digital learning environments, suggesting that interactivity alone is not sufficient; contextual resonance matters just as much.

The findings also reflect patterns observed in studies conducted with learners from indigenous, rural, or multicultural communities, where culturally grounded media have been shown to enhance identity formation alongside academic achievement. Gay (2018b) a framework for culturally responsive pedagogy argues that students learn best when instructional materials mirror their sociocultural experiences, because familiarity supports both comprehension and emotional investment. Similar outcomes have been reported in research working with Māori learners in New Zealand or Native American students in the United States, where digital tools that embed ancestral narratives or local values have produced stronger learning gains than culturally neutral alternatives (Courtois et al., 2024). The improvements seen in this study, particularly the shift from vague recognition of cultural symbols to more confident interpretation, echo these findings and demonstrate how cultural proximity can deepen the learning experience.

At the same time, the context of Entikong introduces a distinctive layer of complexity that makes the present study's contribution more than a simple confirmation of earlier work. Unlike indigenous communities whose cultural environments are relatively cohesive, border-region students are exposed to overlapping cultural cues from neighboring countries (Suhandra, 2023). This fluid cultural landscape often blurs identity markers, positioning students in a space where national belonging is neither fixed nor consistently reinforced (Chao et al., 2015). The notable increase in students' ability to articulate the meaning of local symbols after engaging with Go Buya suggests that culturally responsive digital media might play a stabilizing role in such contexts, providing learners with a clearer interpretive anchor amidst competing cultural influences (Stein et al., 2025). This observation adds nuance to existing research by showing that cultural integration in digital learning may be even more crucial in culturally porous environments.

Conceptually, these findings highlight the need to broaden current digital learning frameworks, which often treat cultural content as an optional add-on rather than a core design element. The present study aligns with researchers who argue that digital learning tools should not strive for cultural neutrality, but for cultural specificity, particularly when serving marginalized or borderland populations (Nirmani I.A.P., 2025). Practical implications follow naturally from this: educators and developers seeking to replicate the success of interventions like Go Buya should consider not only the mechanics of gamification but also the cultural narratives that sustain students' sense of identity (Rodrigues et al., 2022). In this way, the study contributes to the literature by demonstrating that culturally embedded game-based media does not merely enhance motivation or comprehension; it has the potential to fortify cultural awareness and civic understanding, especially in communities where cultural continuity is fragile.

Why These Findings Emerged

Several factors likely contributed to the positive outcomes. First, the cultural proximity of the content may have triggered emotional and cognitive engagement simultaneously. When students encounter stories, places, and characters that resemble their own surroundings, the learning becomes more personally relevant, which enhances memory consolidation.

Second, the media's interactive design seemed to lower the barrier for students who typically struggle with conventional teaching approaches. Observations showed that children who were usually hesitant began participating more actively during group missions, suggesting that the gamified structure created a safer, less intimidating learning space. This dynamic might explain why the post-test standard deviations narrowed: the intervention did not simply elevate high achievers; it helped lower-performing students close the gap.

Third, the narrative-based design of Go Buya aligns with the experiential learning model (Kolb, 2015). Students were not passive recipients of content; they navigated

tasks, made decisions, and saw the consequences of those decisions within the story. This form of situated cognition may account for the deeper understanding of civic responsibility observed in classroom discussions.

Contribution to Theory and Educational Practice

The study offers several contributions. The first is methodological: the integration of cultural validation into the ADDIE model presents a refined framework for developing learning media in multicultural settings. Most instructional design models treat cultural considerations as an optional overlay, but the findings here suggest that culture must be an integral part of the design process, not an afterthought (Syamsijulianto, 2022, 2023).

Second, this work contributes empirically to the discourse on culturally responsive digital education by showing how localized digital platforms can reinforce cultural identity while simultaneously delivering academic content. In border contexts, this dual function is critical; students must learn not only about their culture, but also through their culture, as they navigate identity influences from multiple sides (Pranata & Syamsijulianto, 2024, 2025a).

Recognizing the Limitations

While the outcomes are promising, several limitations must be acknowledged. The absence of a control group makes it difficult to isolate the exact contribution of Go Buya vis-à-vis other instructional variables. A four-week implementation also provides only a snapshot of learning improvement, leaving questions about long-term retention or habitual internalization of civic values. The novelty effect, a well-known phenomenon in digital learning studies, may also have inflated engagement levels in the early stages (Syamsijulianto, et al., 2024; Syamsijulianto, et al., 2024). These limitations do not diminish the value of the findings, but they do suggest caution in interpreting the results as universal or permanent.

Implications and Direction for Future Research

The findings of this study highlight a practical implication that is often overlooked in discussions about educational innovation in border regions: culturally grounded digital media can function not only as instructional tools but also as stabilizing mechanisms in contexts where cultural influences are fluid and sometimes contested. The relatively uniform improvements across schools suggest that students responded not merely to the technological novelty but to the cultural resonance embedded within the content (Pranata et al., 2025). This reinforces theoretical perspectives in culturally responsive pedagogy that argue learning becomes more meaningful when it affirms students' identities and everyday realities. In border-area settings where exposure to external cultural narratives may dilute local heritage, the ability of Go Buya to re-anchor students' sense of cultural belonging is conceptually significant (Syamsijulianto et al., 2023; Syamsijulianto, Sapriya, Udin Syaefudin Sa'ud, et al., 2024). It implies that digital interventions, when thoughtfully localized, may serve a protective role in sustaining cultural continuity.

From a pedagogical standpoint, the study indicates that tools like Go Buya can help shift the teacher's role from a primary transmitter of information to a facilitator who guides reflection and dialogue. Teachers in this research reported that the media reduced the time needed for basic explanation, allowing them to engage more deeply in interpretive discussions with students (Pranata & Syamsijulianto, 2025a). This shift echoes broader arguments in digital learning scholarship, which posit that technology, when used to externalize knowledge through interactive content, frees teachers to focus on higher-order cognitive tasks. In low-resource border schools, where instructional time and materials are often limited, such a shift is not merely convenient but transformative. It suggests that culturally embedded digital media can bridge structural gaps by providing reliable baseline content, enabling teachers to concentrate on contextualizing knowledge rather than delivering it mechanically.

The infrastructural feasibility demonstrated in this study also carries important practical implications. The platform's performance in low-bandwidth environments challenges the common assumption that digital innovation is inherently incompatible with underserved or rural regions (Pranata & Syamsijulianto, 2024). Instead, it suggests that accessibility hinges not on the presence of sophisticated infrastructure but on intentional design choices by developers. This reinforces the need for future interventions to prioritize lightweight, mobile-friendly formats if they aim to reach marginalized learners (Scheffel & Wirth, 2022). At a policy level, such evidence may support more nuanced approaches to digital integration in border schools, approaches that emphasize cultural alignment and technical adaptability rather than purely technological advancement.

Building on these insights, two avenues for future research emerge as particularly promising. First, longitudinal studies are essential to determine whether the gains in cultural literacy and civic understanding represent temporary boosts or sustained developmental shifts (Braun & Clarke, 2006; Ochoa & McDonald, 2020). Cultural identity formation, especially among young learners, is dynamic; tracking these changes over time would help clarify how digital interventions interact with broader social influences in border communities (Bal & Mete, 2019; García Ochoa et al., 2016). Second, comparative studies with control groups are needed to unpack the mechanisms behind the learning gains observed. For instance, it remains unclear whether the improvement resulted primarily from narrative immersion, interactive tasks, visual-cultural cues, or the novelty factor (Fokides & Antonopoulos, 2024). Additional inquiry could also investigate whether involving parents, elders, or local cultural institutions enhances the educational and cultural impact of such media, particularly given the strong communal influence on identity development in border regions. Together, these research directions would deepen theoretical understanding while refining practical strategies for culturally responsive digital education.

CONCLUSION

In light of the evidence presented, it becomes clear that strengthening cultural and civic literacy in Indonesia's border regions is not simply an educational aspiration but an urgent national responsibility. The findings from Entikong demonstrate that culturally embedded digital media can overcome long-standing challenges that traditional instruction has failed to resolve, offering students not only knowledge but also a renewed sense of identity and belonging. When local cultural values are translated into engaging digital experiences, students learn more deeply, participate more confidently, and reconnect with the traditions that anchor their civic understanding. These outcomes underscore a crucial message: culturally responsive digital innovation is not optional; it is essential for ensuring equitable and meaningful education in frontier communities. As cultural identities in border areas continue to face pressures from cross-border mobility and global media influences, stakeholders from policymakers and curriculum developers to school leaders and local cultural institutions must take decisive action. Investing in localized, culturally grounded digital learning tools will not only enhance classroom learning but also fortify national identity where it is most vulnerable. The opportunity is clear, the evidence is compelling, and the need is immediate. Now is the time to advance educational solutions that honor culture, empower learners, and strengthen the nation's borders from within.

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