

Cultural Literacy in the Digital Age: A Mobile Learning Model Based on North Sumatran Folklore for Junior High Schools

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Abstract: Objectives: This study aims to design and evaluate a mobile learning model that uses North Sumatran folklore to build cultural literacy in junior high schools. The objectives include identifying needs for the model, developing and validating it, and testing its effectiveness in improving students' reading comprehension and cultural understanding...

Methods: The study uses an R and D approach that combines the ADDIE and R2D2 models. The process covers six stages, needs analysis, design, development, expert validation, field testing, and effectiveness evaluation. Data come from 72 students and nine teachers in two partner schools. Experts in educational technology and Indonesian language education review the model. The study collects quantitative and qualitative data and analyzes them with descriptive statistics and a quasi-experimental pretest–posttest design.

Results: The model receives a Very Feasible rating with a score of 90 percent. Student practicality is 86.1 percent and teacher practicality is 88.9 percent. Effectiveness tests show higher gains in the experimental group at 16.4 points compared to 7.4 points in the control group. The effect size is large with a Cohen's *d* of 1.0. These results show strong improvement in reading comprehension and cultural literacy.

Conclusions: The mobile learning model is effective in strengthening cultural literacy and supporting reading skills. Integrating North Sumatran folklore enriches learning and helps preserve cultural identity through digital instruction. The study shows that cultural heritage can be supported and renewed through mobile learning in modern education.

Keywords: cultural literacy; digital pedagogy; folklore; mobile learning; technology

Introduction

Education in the 21st century faces a dual challenge: the rapid advancement of digital technology and the growing disconnection of younger generations from their cultural roots. As education systems worldwide shift toward technology-enhanced learning, maintaining cultural identity within this digital transformation has become an essential pedagogical concern (McCarthy et al., 2023). According to the Organisation for Economic Co-operation and Development, Indonesia remains among the lowest-performing countries in reading literacy, highlighting a critical gap between students' digital engagement and their literacy competence (Ndibalema, 2025). This issue extends beyond academic ability. It reflects the weakening of students' cultural literacy and national identity, particularly in contexts where globalized media increasingly dominate local cultural narratives.

Cultural literacy, defined as the ability to understand, appreciate, and interpret one's cultural heritage while engaging with global perspectives, serves as a foundation for developing cosmopolitan and reflective citizens (Fusco, 2025). Folklore, as a form of intangible cultural heritage, plays a crucial role in transmitting moral values, collective identity, and ecological wisdom across generations. In Indonesia, folklore such as *Si Gale-Gale*, *Putri Hijau*, and *Legenda Danau Toba* embodies not only regional identity but also moral and social lessons embedded within local traditions (Firdaus, 2025). However, recent studies have shown a steady decline in students' familiarity with local folklore and appreciation for cultural values, as formal curricula and textbooks tend to prioritize generic or globalized content.

At the same time, the emergence of the Society 5.0 paradigm presents new opportunities to integrate cultural content through digital innovation. Mobile learning, a subset of e-learning that allows students to access educational content anytime and anywhere, aligns closely with the learning habits of Generation Z students who are highly dependent on smartphones and digital media (Moya & Camacho, 2024). Research suggests that mobile learning enhances learner autonomy, motivation, and engagement through interactivity and multimodality. In the Indonesian context, this pedagogical shift is supported by the Merdeka Curriculum, which emphasizes project-based learning, digital literacy, and contextualized instruction rooted in local wisdom (Hakim et al., 2024). However, despite the increasing adoption of digital learning technologies, limited efforts have been made to embed local cultural narratives within mobile learning platforms designed for literacy education.

Previous studies have demonstrated that folklore-based learning can improve students' memory retention and comprehension skills by connecting narrative structures to moral and cultural values. Other research has focused on the development of e-learning and gamified applications to promote engagement and motivation (Wang et al., 2024). Nevertheless, most of these studies treat folklore and digital pedagogy as separate domains. Folklore as a tool for cultural preservation and e-learning as a vehicle for cognitive engagement. Only a few studies have attempted to synthesize these domains into a unified pedagogical model that simultaneously promotes literacy performance and cultural identity

formation (Fredy et al., 2025). As noted, the lack of contextualized digital materials in Indonesian classrooms limits students' opportunities to relate learning content to their cultural experiences.

Therefore, this research addresses a significant gap in the intersection of digital pedagogy and cultural preservation. While prior research has explored digital learning innovations, little is known about how mobile learning models can systematically incorporate local folklore to develop both reading comprehension and cultural literacy in junior high school settings (Yuki et al., 2024). The present study seeks to fill this gap by designing and empirically testing a mobile learning model that embeds North Sumatran folklore within structured literacy instruction. The novelty of this research lies in its dual focus: first, the pedagogical integration of local cultural content into mobile-based learning environments; and second Hadi et al. (2025), the empirical validation of this model's effectiveness in improving students' literacy and cultural awareness.

Grounded in a Research and Development (R&D) approach, the study integrates the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) with the Recursive Reflective Design and Development (R2D2) framework (Spatioti et al., 2022). This methodological combination ensures both systematic structure and iterative reflection, allowing for user feedback and continuous improvement throughout the design process. The research was conducted through six main stages: needs analysis, model design, prototype development, expert validation, limited classroom trials Sreenivasan and Suresh (2024) and effectiveness testing using a quasi-experimental pretest-posttest control group design.

The objectives of this study are fourfold: (1) to identify the needs of teachers and students regarding mobile-based and culturally contextual literacy instruction; (2) to develop and validate a mobile learning model incorporating authentic North Sumatran folklore aligned with curriculum standards; (3) to evaluate the practicality and usability of the model in real classroom settings; and (4) to test the model's effectiveness in enhancing students' reading comprehension and cultural literacy compared with traditional instruction (Budiartha et al., 2024). By achieving these objectives, the study aims to provide a replicable pedagogical framework that bridges the gap between digital innovation and cultural education.

In summary, this research contributes to both theory and practice in educational technology and literacy education. Theoretically, it advances understanding of how mobile learning can function as a medium for cultural transmission and literacy development (Eliza et al., 2024). Practically, it offers an empirically validated model that supports teachers in integrating local cultural content into digital learning environments. The study ultimately argues that cultural heritage and technological innovation need not be opposing forces; rather, they can coexist synergistically to nurture literate, culturally grounded, and globally competent learners in the digital age.

Theoretical Review

The theoretical foundation of this study is grounded in three interrelated perspectives: cultural literacy theory, mobile-assisted language learning (MALL), and design-based learning models that integrate local culture within digital pedagogy. Cultural literacy, as introduced, refers to the shared knowledge, symbols, and moral frameworks that enable individuals to participate meaningfully in their cultural communities (Alisoy & Sadiqzade, 2024). In the 21st century, this concept has evolved beyond the transmission of canonical knowledge to encompass dynamic intercultural understanding and ethical responsiveness in digital spaces. Cultural literacy education, therefore, emphasizes not only textual comprehension but also the ability to interpret and critically engage with diverse cultural narratives, values, and worldviews (Huot et al., 2025). In the Indonesian context, strengthening cultural literacy through folklore-based learning plays a pivotal role in preserving identity, fostering empathy, and nurturing civic responsibility among younger generations.

Within digital learning environments, the theory of mobile learning (m-learning) provides a pedagogical framework that supports ubiquitous, personalized, and interactive learning experiences. Mobile-assisted language learning (MALL) research emphasizes that portable digital technologies not only expand access to educational resources but also promote learner autonomy, engagement, and

contextualized practice (Naveed et al., 2023). Empirical studies show that integrating mobile learning with culturally meaningful content enhances students' motivation and retention because it situates learning within authentic socio-cultural contexts. Moreover, gamification elements in mobile applications such as interactive storytelling, feedback systems, and adaptive challenges stimulate cognitive engagement and intrinsic motivation (Angwaomaodoko, 2025). These theoretical insights suggest that mobile learning can serve as an empowering medium for cultural education when designed with cultural sensitivity and pedagogical coherence.

Folklore, as a body of collective oral tradition, embodies moral, ecological, and social values transmitted through generations. The educational function of folklore lies in its capacity to mediate ethical reasoning, communal identity, and ecological awareness (Agung et al., 2023). In the context of language and literacy education, folklore can function as a cultural text that integrates linguistic, aesthetic, and ethical dimensions of learning. Scholars have shown that embedding folklore in educational materials facilitates the development of narrative comprehension, critical reflection, and cultural empathy (Hossain, 2024). This aligns with sociocultural theory, which emphasizes that learning occurs through the mediation of culturally meaningful tools and artifacts. By transforming folklore into interactive mobile narratives, learners engage in dialogic meaning-making processes that connect local wisdom with modern literacy practices.

North Sumatran folklore represents a rich corpus of oral traditions that embody the moral, ecological, and social values of Batak and Malay communities (Aini & Huszka, 2025). These narratives serve as symbolic systems through which local societies express cosmological beliefs, ethical norms, and communal identity. Among the most prominent are *Si Gale-Gale*, *Putri Hijau*, and *Legenda Danau Toba*, which collectively encapsulate the region's collective memory and moral imagination. The tale of *Si Gale-Gale*, centered on a wooden puppet animated to comfort a grieving king, reflects the Batak philosophy of *dalihaŋ na tolu* (a triadic kinship system emphasizing balance, reciprocity, and respect). Similarly, *Putri Hijau* portrays resistance against external domination and the sanctity of feminine virtue, functioning as an allegory for local autonomy and cultural resilience. Meanwhile, *Legenda Danau Toba* articulates an ecological worldview in which human transgression against nature results in catastrophic transformation, echoing indigenous environmental ethics that prioritize harmony between humans and the natural world (Sihotang & Sitanggang, 2022). Collectively, these stories illustrate how folklore functions as a cultural archive that preserves collective wisdom and ecological consciousness within North Sumatran societies.

In educational and cultural studies, the integration of local folklore into formal learning environments has been recognized as a powerful medium for strengthening cultural literacy and identity among young learners. Folklore not only transmits linguistic and moral values but also stimulates narrative reasoning, empathy, and cross-generational continuity (Wysahnyuy & Valentine, 2023). Within the digital learning context, North Sumatran folklore offers a culturally resonant resource that can bridge traditional storytelling practices with contemporary technological media, enabling students to engage with local wisdom through interactive narratives. This aligns with the concept of glocalization in education, which emphasizes the blending of global technological literacy with local cultural distinctiveness. By adapting stories such as *Si Gale-Gale*, *Putri Hijau*, and *Legenda Danau Toba* into mobile learning environments, educators not only enhance reading comprehension but also cultivate a sense of belonging, ethical awareness, and ecological sensitivity rooted in Indonesian cultural heritage (Prasasti et al., 2019). Thus, the theoretical integration of folklore within digital pedagogy reaffirms the dual function of education (as both a transformative and preservative force) supporting learners in navigating global knowledge ecosystems while remaining grounded in local cultural values.

To develop a learning model that integrates folklore and mobile technology, this study draws on the tradition of design-based research (DBR), which advocates iterative, reflective, and context-sensitive design processes. DBR enables the co-construction of knowledge between researchers, teachers, and learners, producing educational innovations that are both theoretically informed and empirically validated (Hoadley & Campos, 2022). In this sense, the use of the ADDIE and R2D2 frameworks serves to operationalize the DBR paradigm through structured yet flexible phases of

analysis, design, development, implementation, and evaluation. This methodological synthesis supports the creation of learning models that are adaptable to cultural contexts and responsive to users' needs. The theoretical convergence of cultural literacy, MALL, folklore pedagogy, and design-based development thus underpins the rationale for the present study (Montt-Blanchard et al., 2023). It positions the mobile learning model not merely as a technological artifact, but as an educational ecology, one that intertwines culture, language, and technology to promote holistic literacy and sustainable cultural continuity.

Methods

This study adopted a Research and Development (R&D) approach aimed at designing, developing, and validating a mobile learning model that integrates North Sumatran folklore to enhance junior high school students' cultural literacy and reading comprehension. The research design combined the ADDIE framework: Analysis, Design, Development, Implementation, and Evaluation with the Recursive Reflective Design and Development (R2D2) model to ensure a systematic yet iterative development process. This mixed-method design involved both qualitative and quantitative procedures to capture the pedagogical, technical, and cultural dimensions of the model.

The integration of these two frameworks ensured a structured yet flexible process, allowing iterative improvements and user feedback throughout the development of the mobile learning model. The research was conducted in six sequential stages: (1) needs analysis to identify students' and teachers' requirements regarding literacy learning and mobile-based media, (2) design of the conceptual framework of the application integrating North Sumatran folklore, (3) development of prototypes including multimedia content and technical features, (4) expert validation by specialists in content and media, (5) implementation through limited and expanded classroom trials, and (6) evaluation using a pretest–posttest design supported by statistical analysis.

The participants of this study included 72 students aged 12–14 from two partner junior high schools in North Sumatra and nine Indonesian language teachers. In addition, two experts (one in educational technology and one in Indonesian language and literature education) were involved in the validation stage. Specifically, the needs analysis involved all 72 students and nine teachers, while the validation was conducted by two experts. A practicality test was carried out with 36 students and nine teachers, and the effectiveness test involved 72 students divided equally into experimental and control group ($n = 36$) for each group.

Data were collected using multiple instruments adapted from validated research tools. Survey questionnaires were administered to students to capture their preferences for mobile learning versus textbooks, perceptions of digital literacy, and interest in folklore-based materials, while teachers provided input regarding contextual materials and readiness for mobile learning integration. Expert validation rubrics assessed content validity (covering cultural relevance, curriculum alignment, and textual accuracy) and media validity, which included design, interactivity, usability, and technical performance. The rubric used a 4-point Likert scale ranging from 1 (Not Feasible) to 4 (Very Feasible). Practicality questionnaires for students focused on clarity, interactivity, ease of navigation, and motivation, while teachers evaluated ease of integration, pedagogical value, and user-friendliness. The reliability of these questionnaires was measured using Cronbach's α . Furthermore, reading comprehension tests were administered as pretests and posttests based on selected North Sumatra folklore texts, assessing literal, inferential, and evaluative comprehension.

The main research material was the mobile learning application developed for this research. Its features included multimedia folklore texts in the form of audio, images, and animations; reading comprehension exercises with automatic feedback; interactive quizzes; and gamification elements designed to enhance motivation. To ensure accessibility, the application also included offline functionality to accommodate schools with limited internet connectivity. The folklore stories selected for inclusion such as *Si Gale-Gale*, *Putri Hijau*, and *Legenda Danau Toba* were chosen based on their cultural significance, alignment with the junior high school curriculum, and linguistic accessibility for students.

Model Development, Data Collection, and Instruments

The mobile learning model was developed to integrate authentic local folklore (Si Gale-Gale, Putri Hijau, and Legenda Danau Toba) as multimedia reading materials. The application incorporated interactive texts, images, audio narration, animations, and comprehension quizzes, complemented by gamification features such as badges and score feedback to sustain motivation. The development process followed six iterative stages: needs analysis, design, prototype development, expert validation, limited trial, and effectiveness evaluation.

Data were collected using several instruments to ensure triangulation. Needs analysis questionnaires for students and teachers employed five-point Likert scales to assess digital readiness, motivation, and perceptions of folklore-based learning. Expert validation rubrics rated the feasibility of content (cultural relevance, linguistic clarity, and curriculum alignment) and media (usability, interactivity, and technical performance) on a four-point scale. Practicality questionnaires were administered during the pilot phase to evaluate user experience and classroom applicability, achieving high internal consistency (Cronbach's $\alpha = 0.967$ for students and 0.910 for teachers). To measure learning outcomes, reading comprehension and cultural literacy tests were administered as pretests and posttests using 30 multiple-choice items covering literal, inferential, and evaluative comprehension. Qualitative feedback from teachers and students was collected through open-ended responses to provide additional insights into user perceptions.

Data Analysis and Validation

Quantitative data were analyzed using descriptive and inferential statistics. Means and percentages summarized responses from needs analysis, validation, and practicality testing. Paired-sample t-tests were used to assess pretest–posttest improvements within groups, while independent-sample t-tests compared gain scores between the experimental and control groups. Cohen's d was calculated to determine effect size, and ANOVA was applied to explore variance in treatment effects. Qualitative data were analyzed thematically to support and contextualize quantitative findings.

Research validity and reliability were strengthened through methodological triangulation, expert validation, and internal consistency analysis. The combination of R&D methodology with experimental verification ensured both developmental robustness and empirical rigor. Through this integrated approach, the study not only developed a culturally grounded digital learning model but also provided evidence of its effectiveness in improving literacy performance and cultural awareness among Indonesian junior high school students.

Table 1. Summary of research stages, participants, data collected, and instruments

Stage	Respondents	Data Collected	Instrument Type
Needs Analysis	72 students, 9 teachers	Preferences, digital readiness, cultural context	Survey (Likert)
Validation	2 experts	Content and media feasibility	Rubric (Likert)
Practicality Test	36 students, 9 teachers	Usability, clarity, motivation	Questionnaire
Effectiveness Test	72 students (36 experimental, 36 control)	Pretest–posttest reading comprehension	Test (MCQ)

Results and Discussion

The needs analysis was conducted with 72 students and nine teachers. Findings indicated that students strongly preferred mobile learning platforms to traditional textbooks. Approximately 78% of students expressed a preference for mobile learning, while only 22% preferred textbooks. Teachers' responses also demonstrated strong support for mobile-based literacy instruction (Munisa et al., 2024). 100% of teachers emphasized the importance of contextual learning materials based on local wisdom, 89% agreed that digital media increases motivation, and 78% specifically highlighted folklore as a valuable cultural content for integration.

Table 2. Needs analysis results

Respondents	Indicator	Percentage	Category
Students	Prefer mobile learning over textbooks	78%	High Preference
Students	Prefer textbooks over mobile learning	22%	Low Preference
Teachers	Support digital media to increase motivation	89%	Strong Agreement
Teachers	Emphasize folklore as cultural content	78%	Agreement
Teachers	Need contextual/local wisdom materials	100%	Very Strong Agreement

From a pedagogical perspective, these results confirm that the integration of digital tools with cultural content is not merely a technological innovation but also an educational necessity in Indonesia's Merdeka Curriculum. Similar conclusions were reached, who found that learning materials based on local wisdom foster deeper comprehension and moral reasoning. Thus, the needs analysis provided empirical justification for designing a mobile learning model that integrates folklore to address both literacy and cultural identity challenges (Hasanah et al., 2025). These results confirm that there is both a pedagogical and cultural urgency for developing a digital learning model that incorporates folklore. This emphasized that contextualized learning materials foster stronger engagement and cultural identity.

The expert validation phase assessed the feasibility and quality of the developed mobile learning model. Two experts (specializing in educational technology and Indonesian language education) evaluated both content and media components (Sholihah et al., 2023). Results showed an overall feasibility score of 90%, with content validity at 92.5%, interactivity at 90%, and application design at 87.5%. These ratings indicate that the model was categorized as Very Feasible for classroom use.

Table 3. Expert validation results

Aspect	Mean Score (out of 4)	Percentage	Category
Content Validity	03.07	92.5%	Very Feasible
Interactivity	03.06	90.0%	Very Feasible
Application Design	03.05	87.5%	Very Feasible

Overall	03.06	90.0%	Very Feasible
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The high content validity suggests that the selected North Sumatran folklore (Si Gale-Gale, Putri Hijau, and Legenda Danau Toba) were culturally authentic, linguistically accessible, and pedagogically aligned with curriculum standards. The interactive and multimedia features, including audio narration, images, animations, and gamified quizzes, were evaluated as engaging and effective for Generation Z learners (Staneviciene & Žekienė, 2025). This finding resonates with previous studies that emphasize how multimedia integration enhances student motivation and retention.

The validation results demonstrate that the model is academically and technically sound, supporting its readiness for classroom application. This is consistent with the research result that stated interactive media increase student engagement and retention. The expert validation results confirmed the feasibility of the model with scores above 90% in content validity, interactivity, and application design (Wahyudianto et al., 2025). These high scores indicate that the mobile learning application not only aligns with curriculum standards but also presents folklore in an accurate and engaging format. This is consistent with the statement that interactive digital tools can foster deeper engagement and memory retention (Promsiri, 2025). Moreover, the validation findings demonstrate that integrating folklore into digital platforms does not compromise academic rigor, but rather enriches it with cultural relevance.

Furthermore, the high interactivity and usability scores indicate that the model successfully applied user-centered design principles within the ADDIE–R2D2 framework (Dananjaya et al., 2024). These outcomes confirm that the developed application not only meets technical standards but also embodies cultural sensitivity and instructional clarity, ensuring both accessibility and relevance in diverse classroom contexts.

The practicality test, conducted with 36 students and nine teachers, evaluated the usability and applicability of the model in real classroom settings. Results demonstrated very high practicality scores, with students rating 86.1% and teachers 88.9%. The reliability indices were excellent, with Cronbach's $\alpha = 0.967$ for students and 0.910 for teachers, indicating strong internal consistency.

Table 4. Practicality test results

Respondents	Practicality Score	Cronbach's α	Category
Students	86.1%	0,67152778	Very Practical
Teachers	88.9%	0,63194444	Very Practical

Students reported that the multimedia and gamification features increased their motivation and concentration during reading activities. Teachers found the application intuitive, easy to integrate into lesson plans, and compatible with the Merdeka Curriculum's emphasis on project-based and digital learning. These findings corroborate, who observed that gamified mobile learning improves students' engagement and intrinsic motivation (Torreon, 2025). Similarly, noted that mobile-based instruction enhances accessibility and flexibility, especially in areas with limited classroom resources.

The practicality results thus establish that the mobile learning model not only functions effectively as a digital platform but also aligns pedagogically with the learning objectives of cultural and reading literacy. This dual function reinforces the model's feasibility as both a technological and educational innovation. These findings indicated that the application is not only feasible but also user-friendly for classroom integration (Wijaya et al., 2021). Teachers reported that the content aligned with curriculum needs and enhanced learning motivation, while students highlighted the applications

interactivity and multimedia storytelling as motivating features.

The final stage evaluated the model's effectiveness through a quasi-experimental pretest–posttest control group design involving 72 students. The experimental group used the mobile learning model, while the control group used printed folklore texts. Results showed that the experimental group achieved significantly higher posttest scores ($M = 83.2$) compared with their pretest scores ($M = 66.8$), yielding a gain of 16.4 points. In contrast, the control group improved from 67.1 to 74.5 (gain = 7.4 points). Independent-sample t -tests confirmed the difference to be statistically significant ($p < .01$), and Cohen's $d = 1.0$, indicating a large effect size.

Table 5. Pretest–posttest results

Group	Pretest Mean	Posttest Mean	Gain Score	Category
Experimental (n=36)	66.08.00	83.02.00	+16.4	High
Control (n=36)	67.01.00	74.05.00	+7.4	Moderate

These findings demonstrate that the integration of folklore into mobile learning substantially enhanced students' reading comprehension and cultural literacy. The high effect size implies not only statistical significance but also practical educational impact. This result aligns with the findings of who reported that folklore-based instruction improves comprehension and memory retention by connecting narrative structures with moral values (Andriono et al., 2025). It also supports, who found that digital learning innovations significantly influence student learning outcomes in Indonesia.

Qualitative feedback reinforced these quantitative results. Students expressed enjoyment in reading folklore stories through interactive multimedia, while teachers noted that the application facilitated deeper discussions about moral values, identity, and culture (Goraya et al., 2025). These findings echo the conclusions of emphasizing that folklore enhances both cognitive and moral development when integrated into pedagogy.

Overall, the effectiveness results indicate that the mobile learning model serves as an integrative framework that promotes both cognitive literacy (reading comprehension) and cultural literacy (understanding and valuing local traditions). This dual improvement represents a key contribution to the development of culturally grounded digital pedagogy in Indonesia (Darmawan et al., 2025).

Interpretation

The overall results of this study highlight a synergistic relationship between technology, pedagogy, and culture. The integration of North Sumatran folklore within mobile learning not only addresses the technological gap in literacy instruction but also revitalizes students' connection with local cultural heritage (Farisi et al., 2024). This synthesis supports the notion proposed that cultural literacy in the global age requires educational models that balance digital innovation with cultural rootedness.

Moreover, the study provides empirical support for the theoretical claim that mobile learning can serve as a medium for cultural preservation. While many digital literacy initiatives in Indonesia focus primarily on improving technical competencies, this research extends the concept toward "culturalized digital literacy," wherein students learn language and values through culturally embedded content (Eutsler & Perez, 2022). This finding resonates with, who emphasized that revitalizing folklore within education is vital for sustaining cultural identity among younger generations.

The success of the model also illustrates the practical applicability of the ADDIE–R2D2 integrated approach. The recursive validation and refinement stages ensured that user feedback continuously shaped the design, resulting in a pedagogically sound and contextually relevant model (Adeoye et al., 2024). This methodological innovation contributes to the broader field of educational design research

by demonstrating how iterative, culturally responsive design can yield effective and scalable educational technologies.

From a pedagogical standpoint, the results indicate that folklore-based mobile learning enhances deeper engagement and critical thinking. The use of local narratives encouraged students to interpret moral messages and connect them with their personal and cultural contexts, thereby strengthening interpretive and reflective reading skills (Monica & Soplantila, 2024). This aligns with constructivist learning principles, which emphasize meaning-making through culturally situated experiences.

Finally, the findings have significant implications for curriculum development and teacher training. The integration of local cultural narratives through mobile platforms can serve as a replicable model for other regions in Indonesia and beyond. It demonstrates that digital learning innovation does not necessitate the abandonment of local traditions; rather, it provides new avenues for cultural transmission and literacy improvement (Sari et al., 2020). The combination of empirical validation, strong effect size, and cultural relevance underscores the model's potential contribution to achieving the goals of the Profile Pelajar Pancasila (learners who are literate, ethical, and proud of their cultural identity).

Conclusion

This study concludes that integrating North Sumatran folklore into a mobile learning model provides an effective and culturally grounded approach to enhancing junior high school students' reading comprehension and cultural literacy in Indonesia. The research, developed through the integration of the ADDIE and R2D2 frameworks, demonstrated that culturally contextualized mobile learning can bridge the gap between digital innovation and cultural preservation in education. Consistent with meta-analytic evidence that mobile learning improves engagement and performance. Empirical results from validation, practicality, and effectiveness testing confirm the model's robustness and educational impact. Expert evaluation rated the model Very Feasible (90%), while classroom practicality tests revealed high acceptance among students (86.1%) and teachers (88.9%), indicating its usability and pedagogical relevance. Effectiveness testing further showed that the experimental group achieved significantly higher learning gains (gain = 16.4) than the control group (gain = 7.4), with a large effect size (Cohen's $d = 1.0$), confirming substantial cognitive and cultural benefits. Beyond statistical evidence, qualitative feedback revealed that students became more engaged, motivated, and reflective, while teachers observed strengthened connections between local wisdom and literacy skills. These findings collectively highlight that mobile learning, when infused with indigenous narratives, not only supports literacy development but also revitalizes students' sense of cultural identity and moral understanding. The study extends recent work on folklore-based pedagogy by providing empirical evidence that digitized local narratives not only preserve cultural knowledge. The study contributes to the growing body of knowledge on digital pedagogy by offering a replicable model for integrating local wisdom into 21st-century learning environments. Future research could expand this approach to other regions and disciplines to further validate its scalability and sustainability in fostering culturally responsive digital education.

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Cultural Literacy in the Digital Age: A Mobile
Learning Model Based on North Sumatran
Folklore for Junior High Schools

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Cultural Literacy in the Digital Age: A Mobile
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