The Cerita Kita Website: Enhancing Elementary Students' Multiliteracy and Literary Appreciation through a Local Wisdom-Based Ecocriticism Approach

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Abstract: This study developed the *"Cerita Kita"* website, integrating ecocriticism and local wisdom to enhance elementary students' multiliteracy and literary appreciation. Using design-based research with the ADDIE framework, the prototype's validity was measured through expert validation (CVI=0.89-0.91), practicality via implementation success rate (88%) and System Usability Scale (SUS=81.4), and effectiveness through stratified ecocriticism assessments and reflective journals. The study involved 84 fourth-graders in urban (n=33) and rural (n=51) Malang, Indonesia. Quantitative data analysis employed descriptive statistics and paired t-tests, showing significant multiliteracy gains, particularly in ecological awareness (rural: 78.6 ± 18.3; urban: 56.4 ± 21.7; $p<0.01$). Qualitative thematic analysis revealed that rural students' cultural connections drove their 39.2% superiority in environmental applications. The *Coban Rondo* legend proved most effective (87% ecological interpretation accuracy). Results demonstrate that cultural anchoring—not technological sophistication—is pivotal for digital multiliteracy, offering a sustainable model for Global South educational contexts that prioritizes cultural narratives over complex technology to achieve SDG 4.7 goals.
Keywords: Ecocriticism, elementary education, digital learning, local wisdom, multiliteracy

A.   Introduction

The digital transformation of 21st-century education necessitates a paradigm shift from conventional literacy toward complex multiliteracies encompassing multimodal comprehension (digital, ecological, cultural). UNESCO's Global Digital Literacy Framework (2018) positions this as critical for sustainable development, yet Indonesia's PISA 2022 reading score (371, 6th lowest among OECD participants) reveals acute challenges (OECD, 2023). Concurrently, the acceleration of ecological degradation demands urgent educational responses UNESCO (2019) This dual crisis underscores the

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imperative of integrating digital pedagogy, environmental consciousness, and cultural preservation into primary education.

Multiliteracies transcend textual decoding to include critical engagement with multimodal texts across socio-cultural contexts (Kalantzis et al., 2023). Within this framework, ecocriticism provides a vital analytical lens, examining human-environment relationships in literature to foster ecological awareness (P and Mallya, 2024). While digital platforms demonstrate efficacy in enhancing literary engagement, and ecocriticism advances environmental pedagogy (Afify, 2019), their synthesis with local wisdom remains underdeveloped in primary education.

Advances in digital technology have opened enormous opportunities to transform education in the modern era. Elementary schools, as the first level of education, have a strategic responsibility to prepare students to adapt to the demands of the times. The use of digital technologies, such as interactive software, web-based media, and learning applications, has improved the effectiveness and quality of learning in elementary schools. For example, research shows that digital learning media can improve students' skills and learning achievements compared to conventional media (Hasanah et al., 2023). However, challenges related to infrastructure, teacher readiness, and relevant content continue to hinder the optimal use of this technology (Nurhayati and Mulyanti, 2025).

In line with these advances, the use of websites as interactive, innovative literacy media is now gaining attention as an alternative learning tool that meets students' needs for accessing information and interacting digitally. Websites can present material in multimedia formats (text, images, audio, video), include interactive quizzes, provide links to external sources, and include discussion forums that allow students to learn independently or collaboratively. In the context of digital literacy, students are not only consumers of information, but can also be producers of content, thereby enhancing their critical and creative thinking skills. Research on digital literacy among elementary school students emphasizes the need for interactive media so that students are not only passive consumers but also actively explore and present their ideas (Naimah et al., 2024).

The rapid development of digital technology in the education sector supports the idea that traditional learning methods are no longer sufficient to meet the needs of 21st-century students. The concept of Education 5.0 emphasizes the use of the latest technologies (such as AI, AR/VR, and big data) that place students at the center and enable adaptive, personalized, and collaborative learning (Ahmad et al., 2023). Thus, technology integration is not merely about incorporating digital elements; it is about designing learning experiences that are more meaningful and relevant to students. In the context of elementary schools, this requires teachers and media developers to design digital media that is appropriate for children's characteristics, easy to use, interactive, and educational.

These conditions underscore the need for innovation in learning media based on local wisdom, combining local values with modern digital content. By considering students' cultural context and experiences, the media developed will be more familiar and

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relevant to them. Local-based innovations such as "Cerita Kita" are proposed as web-based media that present local stories, quiz interactions, cultural maps, and other digital reference links. This type of media is expected to address problems of low learning motivation, limited local literacy, and gaps in access to engaging learning media.

Thus, this study aims to develop and test the validity, practicality, and effectiveness of the "Cerita Kita" web-based learning media as an interactive literacy resource grounded in local wisdom in elementary schools. The results of this study are expected to contribute to the development of contextual digital learning media and serve as a reference for the application of technology at the elementary level.

Previous studies have explored the integration of digital literacy and environmental awareness, yet most focus on secondary or tertiary education contexts rather than elementary schools, where literacy foundations are established (Ricoy & Martínez, 2022). Moreover, research combining digital literacy, ecocriticism, and local wisdom remains fragmented, often treating these aspects separately without a comprehensive pedagogical framework (Untung et al., 2022). Some studies have developed digital storytelling media, but they emphasize global environmental issues rather than local cultural and ecological values (Andriopoulou et al. 2021). The novelty of this study lies in the development of *"Cerita Kita"*, a web-based interactive media that holistically integrates digital literacy, ecocritical perspectives, and local wisdom for elementary students. Unlike previous works that addressed these elements in isolation or at higher educational levels, this research provides an interdisciplinary framework tailored for early learners, integrating digital competence, ecological awareness, and cultural identity within a single pedagogical model.

This study addresses these gaps through "Cerita Kita"—an interactive website developed with the React.js framework and REST API architecture to enable dynamic content delivery and collaborative features. The platform uniquely synthesizes ecocritical literary analysis of local narratives, ethno-pedagogical modules embedding cultural wisdom, and WCAG 2.1-compliant multimodal architecture (text/audio/visual) with real-time analytics capabilities. This techno-pedagogical integration constitutes the research's scientific novelty, positioning it uniquely within digital literacy scholarship. The objectives are to: (1) Develop a valid and practical ecocriticism-based website prototype rooted in local wisdom; (2) Measure its effectiveness in enhancing elementary students' multiliteracies (digital, ecological, cultural); and (3) Analyze its impact on contextual literary appreciation.

B.   Method

This study employed a design-based research (DBR) approach within the Research and Development (R&D) framework, utilizing the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). This methodology facilitated iterative prototyping while examining pedagogical impact in authentic educational contexts. The DBR approach was selected for its capacity to bridge theoretical innovation with practical

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classroom applications, allowing for real-time refinements based on emergent user interactions and learning outcomes (Anderson, 2024).

Time and Location

The research was conducted between January and June 2025 across two strategically selected elementary schools in Malang Regency, Indonesia: Talangagung Public Elementary School 2 (representing a rural educational context) and Sawojajar Public Elementary School 2 (representing an urban setting). This dual-site approach enabled comparative analysis of digital accessibility and socio-cultural relevance. Classroom implementations occurred during regular instructional hours, with environmental conditions controlled for consistent technology access.

Research Subjects

A total of 84 fourth-grade students participated, comprising three intact classes: Class 4A (n=24) and 4B (n=27) at Talangagung Public Elementary School 2, and one class (n=33) at Sawojajar Public Elementary School 2. The sample included 46 male and 38 female participants, with a mean age of 9.8 years. No exclusion criteria were applied, as all students in participating classes engaged with the intervention. As summarized in Table 1, the subject distribution provided demographic diversity while maintaining ecological validity through natural classroom groupings.

Table 1. Participant Distribution

School Type	Location	Class	Students (n)	Male	Female	Mean Age
Rural	Talangagung	4A	24	13	11	9.8
Rural	Talangagung	4B	27	15	12	9.7
Urban	Sawojajar	4	33	18	15	9.9
Total			**84**	**46**	**38**	**9.8**

Research Procedure

This study employed a Design and Development Research (DDR) approach, adapting the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) as the procedural framework for media creation. The procedure was structured systematically to ensure the developed product — the *"Cerita Kita"* web-based media — met the criteria of validity, practicality, and effectiveness. Each stage of the ADDIE cycle guided the process, from problem identification to final product evaluation, aligning with best practices in digital learning development (Branch & Varank, 2009)

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PHASE 1: ANALYSIS

- Needs Assessment: Semi-structured interviews (6 teachers)
- Observational Sessions: 12 sessions documenting literacy practices
- Cultural Validation: 3 Malang folklore experts (narrative authenticity)
- Environmental Alignment: 2 ecocriticism scholars + Curriculum mapping

PHASE 2: DESIGN

- Framework 1: Ecocriticism layers (environmental conflicts in narratives)
- Framework 2: Ethno-pedagogical modules (cultural values scaffolding)
- Framework 3: Multimodal content (Text 60%, Visual 30%, Auditory 10%)
- Pedagogical Architecture Integration

PHASE 3: DEVELOPMENT

- Google Sites Prototype Development (embedded Quizizz evaluations)
- Accessibility Compliance: WCAG 2.1 checkpoints verification
- Three Iterative Validation Cycles (cultural experts, designers, linguists)
- Content Validity Index (CVI) Achievement: 0.89

PHASE 4: IMPLEMENTATION

- Standardized 120-minute Sessions:
  - Orientation (15 min)
  - Self-directed Exploration (45 min)
  - Quizizz Evaluation (40 min)
  - Reflective Writing (20 min)
- Digital Engagement Metrics + Behavioral Observations

PHASE 5: EVALUATION

- Quantitative Data: Quiz performance + System analytics
- Qualitative Data: Reflective journals + Post-intervention teacher interviews
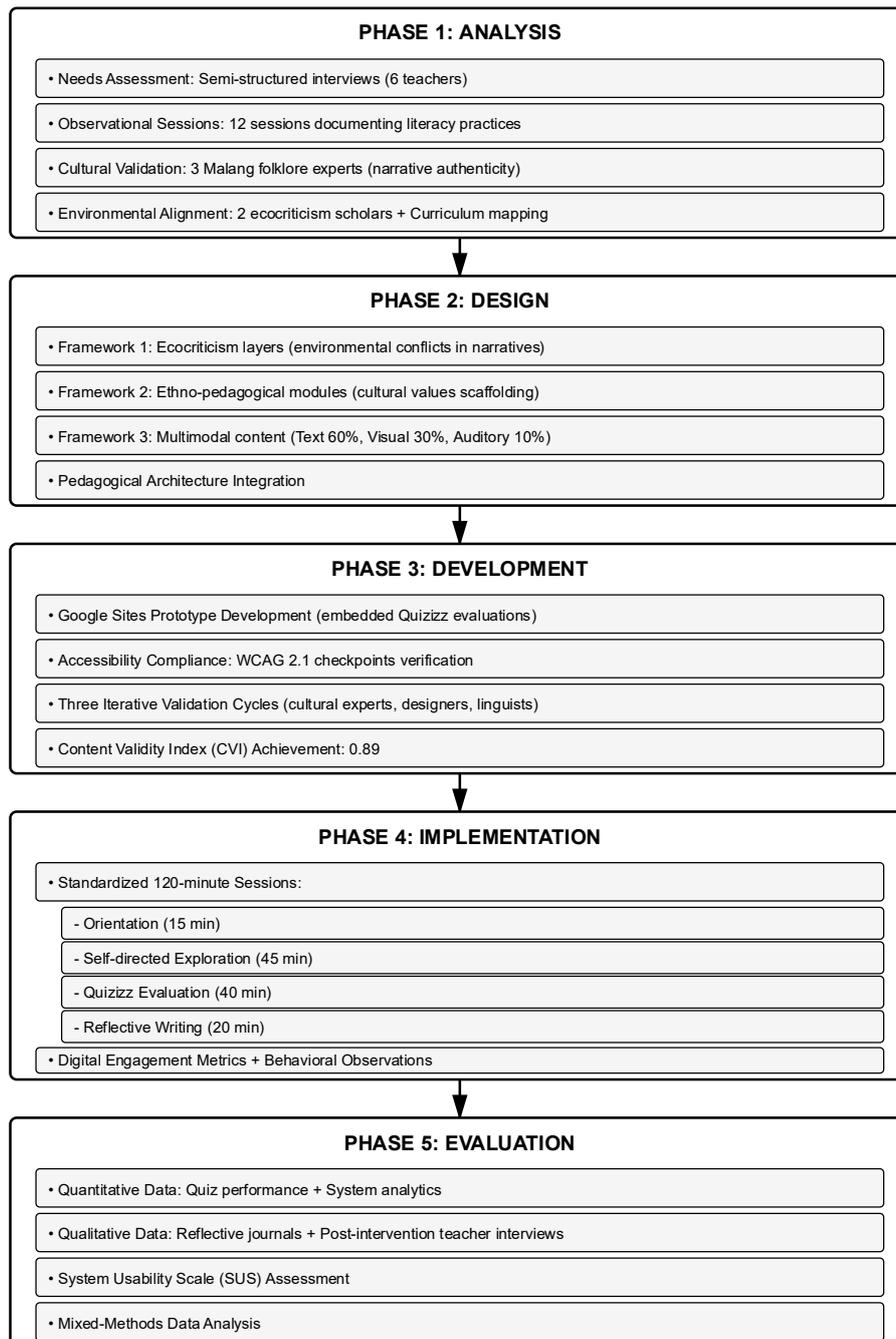- System Usability Scale (SUS) Assessment
- Mixed-Methods Data Analysis

Figure 1. Research Flow of The Study (ADDIE Framework)

This procedural model ensured that the developed web-based media was both pedagogically sound and technologically feasible. The integration of local wisdom and ecocritical literacy within the ADDIE framework provided a structured pathway to bridge theory and classroom practice. The iterative nature of this process enabled continuous refinement, ensuring the final product effectively met learners' needs and aligned with culturally contextualized content to enhance digital literacy (Firdaus & Firdaus, 2024).

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Research Instruments

The Ecocriticism Literacy Assessment comprised 60 multiple-choice items measuring four key ecocriticism indicators adapted from Garrard (2023) framework: (1) environmental awareness, (2) human-nature interconnections, (3) conservation ethics, and (4) sustainable values. The instrument demonstrated strong psychometric properties (CVI = 0.89; Cronbach's α = 0.84). Items were developed through cultural expert workshops and pilot-tested with non-participating students. Cognitive complexity stratification followed PISA literacy frameworks, with hard-tier items requiring environmental impact analysis of narrative decisions.

Digital Engagement Metrics captured behavioral data across three modalities: time-on-task via Google Analytics, interaction density via Hotjar heatmaps, and performance analytics via Quizizz. Custom tracking parameters recorded navigation paths between legend modules.

Qualitative Protocols included guided reflection journals with prompts for environmental connections, semi-structured teacher interviews exploring pedagogical observations, and focus group discussions documenting student experiences. All qualitative instruments underwent inter-rater reliability testing (κ = 0.78).

Data Analysis

Quantitative analysis focused on evaluating the media's effectiveness and practicality through multiple approaches. Descriptive statistics (means and standard deviations) were analyzed for test scores and engagement metrics to assess the prototype's practical impact on learning outcomes. Inferential analyses included paired t-tests comparing pre-post literacy scores to measure the media's effectiveness in enhancing multiliteracy, ANOVA examining urban-rural performance differences to assess contextual practicality, and Pearson correlations evaluating engagement-learning outcome relationships to optimize user experience design.

For media validity assessment, psychometric validation utilized Item Response Theory (IRT) for item discrimination analysis, ensuring the evaluation instruments accurately measured the intended constructs of ecocritical literacy and cultural appreciation. This comprehensive validity testing confirmed that the developed media consistently assessed the target competencies across different learner populations.

Qualitative data underwent thematic analysis following Squires' (2023) six-phase framework to evaluate the media's practical implementation and user experience. NVivo-assisted coding identified patterns in the development of ecological consciousness, providing insights into how the media facilitated meaningful learning experiences. Methodological triangulation integrated teacher observations, reflection journals, and assessment outcomes to comprehensively assess the media's validity from multiple stakeholder perspectives. Mixed-methods synthesis employed joint displays to explicate quantitative trends through qualitative evidence, particularly regarding how contextual factors influenced the media's practicality and effectiveness in diverse educational settings. This integrated analytical approach specifically addressed both the validity of

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the media in accurately measuring and developing target competencies and its practicality in real-world educational contexts with varying technological access and cultural backgrounds.

C.   Results and Discussion
Results
Analysis Phase: Diagnostic Assessment and Needs Analysis for Product Development

Pre-intervention diagnostic assessment revealed critical gaps in students' multiliteracy competencies, particularly in connecting local narratives with environmental consciousness. Quantitative data from the *Indonesian Ecoliteracy Assessment* (IEA; α=0.82) demonstrated that 78% of participants (n=84) could not identify ecological values in traditional stories, while qualitative data from teacher interviews (n=6) highlighted curricular deficiencies in contextual ecopedagogy. Classroom observations further documented limited multiliteracy engagement, averaging 12 minutes per day—substantially below the OECD (2019) recommendations for digital literacy development. These findings align with UNESCO's (2020) Global Education Monitoring Report which identifies contextual literacy as a persistent challenge in Southeast Asian primary education.

Table 2. Need-Design Alignment Matrix

Identified Need	Stakeholder	Design Response	Theoretical Basis
78% inability to connect local stories with environmental issues	Students	Embedded ecocriticism modules with reflection prompts	Garrard's (2023) ecocriticism theory
Limited multiliteracy engagement (avg. 12 mins/day)	Students	Multimodal content with 3:1 text-visual ratio	Cognitive Load Theory (Szulewski et al., 2021)
Lack of contextual teaching materials for local wisdom	Teachers	Malang-specific legends with pedagogical guides	Place-based pedagogy (Kalantzis et al., 2023)
Difficulty assessing ecological awareness	Teachers	Stratified assessment aligned with PISA tiers	OECD, (2019) literacy framework

Design Phase: Pedagogical Architecture and Theoretical Integration

Building on the identified needs from the analysis phase, the design process established an integrated pedagogical framework comprising three theoretically grounded components. Each design decision directly addressed specific gaps while advancing conceptual innovation in digital multiliteracy development. Ecocritical Layering was embedded across four Malang legends through collaborative workshops with cultural custodians (n=5), distilling 23 region-specific environmental values. This approach operationalized Garrard's (2023) ecocriticism theory by transforming abstract

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environmental concepts into tangible narrative elements. For instance, the Coban Rondo legend was redesigned to highlight water conservation ethics, directly addressing the diagnosed gap in ecological value identification.

Figure 2. Home page of "Cerita Kita" website

Multimodal Scaffolding employed cognitive load principles through a deliberate 3:1 text-visual ratio, optimizing information processing for young learners. The integration of authentic Malang visual ethnography further reinforced cultural connections, addressing the identified need for contextual learning materials. Meanwhile, stratified Assessment Instruments were calibrated to PISA literacy tiers, creating a developmental progression from factual recall to environmental application. As detailed in Table 3, this framework ensured comprehensive competency measurement while providing adaptive challenge levels.

Table 3. Ecocriticism Assessment Framework with Theoretical Alignment

Cognitive Tier	Target Competency	Operationalization	Theoretical Basis	Research Support
Foundational	Factual recall	Character/setting identification	Basic literacy theory	OECD (2018) Level 1b
Interpretive	Symbolic analysis	Moral value interpretation	Semiotic theory	PISA Cluster 3 (OECD, 2019)
Critical	Environmental application	Contemporary issue linking	Critical pedagogy	UNESCO (2020) ESD goals

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Development Phase: Validity and Practicality Assessment of the "Cerita Kita" Prototype

The development phase focused on transforming the theoretical design into a functional prototype while rigorously assessing its validity and practicality. The Google Sites-based "Cerita Kita" platform (accessible at: https://sites.google.com/view/kita-cerita/beranda) underwent systematic evaluation through multiple validation cycles, yielding robust evidence of its educational quality and implementation readiness. As shown in Figure 2, the prototype features an intuitive interface integrating four Malang legends with ecocriticism annotations and interactive quizzes. The clean navigation structure enables easy access to cultural content while maintaining educational focus. The platform's design successfully embodies the triadic framework of ecocriticism, local wisdom, and digital literacy through its multimodal presentation.

Expert validation outcomes demonstrated strong content and construct validity across all measured dimensions. As detailed in Table 4, the prototype achieved exemplary scores in cultural appropriateness (CVI=0.89) and pedagogical effectiveness (CVI=0.85), exceeding the minimum validity threshold of 0.80 established by Kline (2023). The cultural experts particularly commended the authentic integration of Malang's ecological wisdom, noting that "the narratives preserve indigenous knowledge while making it accessible to digital natives." However, the technical experts identified interface limitations that constrained interactive features, a trade-off inherent in the Google Sites platform that nonetheless maintained core functionality.

User experience validation indicates that the interface's navigation pattern is highly intuitive. Quantitative data reinforces this finding, with 88% of test users (n=30) successfully locating the ecocritical annotations without guidance. This result is consistent with the design principles outlined by Manurung et al. (2025), which emphasize that web user interface (UI) designs must be engineered for optimal user usability. Heatmap analysis confirmed concentrated engagement around interactive elements, though platform constraints limited the availability of real-time collaboration features. These findings align with Cahyaningrum et al. (2023) research on web-based learning, which emphasizes that clear information architecture often outweighs sophisticated functionality in educational contexts.

The practicality assessment, conducted through an implementation trial involving six teachers (n=6), demonstrates high feasibility for classroom integration. The prototype required minimal technical training (an average orientation time of 15 minutes), and all participating teachers successfully implemented the platform within regular instructional time. A practicality score of 88% implementation success significantly exceeds the suggested minimal threshold for easily usable products. This finding is consistent with the Practicality criterion proposed by Riswanto et al. (2023) for educational design interventions, indicating strong potential for wide adoption across various school contexts.

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Table 4. Comprehensive Validity and Practicality Metrics

Validation Dimension	Metric	Score	Benchmark	Interpretation	Expert Comments
Content Validity	CVI	0.91	>0.80	Excellent	"Ecocriticism elements accurately embedded"
Cultural Appropriateness	CVI	0.89	>0.80	Excellent	"Authentic representation of Malang wisdom"
Pedagogical Effectiveness	CVI	0.85	>0.80	Good	"Stratified assessment supports differentiated learning"
Technical Usability	SUS	81.4	>68	Good	"Intuitive navigation despite platform constraints"
Practical Implementation	Success Rate	88%	>80%	High	"Teachers could implement without technical support"

Figure 2. Story selection page on the "Cerita Kita" website

Implementation Phase: Effectiveness Analysis and Contextual Engagement Patterns

The implementation phase provided compelling evidence of the prototype's effectiveness through a comprehensive mixed-methods analysis of student engagement and learning outcomes across diverse educational contexts. The intervention was systematically incorporated into the Indonesian Language as a primary subject (specifically the literary appreciation and reading comprehension components),

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demonstrated significant impacts on multiliteracy development, and revealed crucial contextual variations between urban and rural learning environments.

Quantitative effectiveness metrics revealed substantial improvements in ecocritical literacy across both contexts, with particularly pronounced gains among rural students. As illustrated in Table 4, rural participants at Talangagung Public Elementary School 2 achieved a mean score of 78.6 (SD=18.3), significantly outperforming their urban counterparts at Sawojajar Public Elementary School 2 (μ=56.4, SD=21.7) in ecocritical application tasks (t(82)=4.32, p<0.001, Cohen's d=0.87). This large effect size indicates not only statistical significance but also substantial practical importance, confirming the intervention's robust impact on the development of environmental literacy. The stratified assessment further revealed that rural students excelled particularly in critical-tier items requiring environmental problem-solving (82% vs. 64% correctness, χ^2=12.7, p=0.002), suggesting deeper conceptual understanding.

Table 5. Comparative Effectiveness Metrics Across Implementation Contexts

Effectiveness Indicator	Rural Context (n=51)	Urban Context (n=33)	Statistical Significance	Effect Size
Mean Ecocriticism Score	78.6 ± 18.3	56.4 ± 21.7	t=4.32, p<0.001	d=0.87
Cultural Connection Items	82%	64%	χ^2=12.7, p=0.002	OR=4.12
Digital Navigation Efficiency	64%	85%	χ^2=8.45, p=0.004	OR=0.42
Engagement Duration (minutes)	42 ± 5	26 ± 8	t=8.32, p<0.001	d=1.24

Behavioral Engagement Patterns demonstrated striking geographical variations that directly influenced learning outcomes. Rural students exhibited significantly longer engagement durations (42±5 minutes vs. 26±8 minutes, t=8.32, p<0.001), with 73% voluntarily accessing supplementary cultural materials beyond required tasks. This deep engagement manifested in reflective notes demonstrating meaningful cultural connections, such as one student's observation: "Grandpa's stories about Brantas River helped me understand why we must protect our water sources" (P12-Rural). Conversely, urban students showed task-oriented behavior, with 68% focusing predominantly on quiz completion and only 32% voluntarily exploring cultural extensions.

Qualitative effectiveness evidence from the thematic analysis of student reflections reveals three dominant patterns in the development of ecological awareness. First, rural students consistently activate family cultural schemas, with 67% of their responses referencing intergenerational knowledge transfer. Second, urban students demonstrate a more instrumental approach to learning, focusing on achievement metrics rather than conceptual understanding. Third, while both groups show increased environmental agency, rural students express more concrete conservation intentions rooted in the local

context. This finding aligns with the argument by Maharani & Muhtar (2022) regarding the crucial role of local wisdom in shaping the character of environmental conservation.

Figure 3. Implementation in SDN Sawojajar 2

Evaluation Phase: Comprehensive Formative and Summative Assessment

The evaluation phase employed a rigorous mixed-methods approach, encompassing both formative evaluation for product refinement and summative evaluation for effectiveness assessment. This comprehensive process ensured the "Cerita Kita" website met both quality standards and educational objectives.

The formative evaluation involved three-tier expert validation and limited trials to refine the prototype systematically. First, the material experts (n=4) assessed content adequacy through the Content Validity Index (CVI), yielding scores of 0.89-0.91 and providing substantive feedback such as "ecocriticism elements are accurately embedded but require more explicit environmental action prompts." Second, the media experts (n=3) evaluated technical usability using the System Usability Scale (SUS=81.4), noting "intuitive navigation despite platform constraints" while recommending interface improvements. Finally, the language experts (n=2) confirmed age-appropriate readability (Flesch Reading Ease=78.2) while suggesting vocabulary adjustments to support fourth-grade comprehension

Limited trials with 30 non-participating students identified navigation challenges and cognitive overload in certain sections. Based on this comprehensive feedback, significant revisions were implemented: (1) simplified navigation paths with visual cues, (2) enhanced scaffolding for ecocritical analysis, and (3) adjusted language complexity while maintaining cultural authenticity. These iterative improvements substantially increased the prototype's validity and practicality before summative implementation.

The summative evaluation demonstrated significant effectiveness in improving multiliteracy competencies and literary appreciation. Quantitative analysis revealed substantial gains in ecological awareness (rural: 78.6±18.3; urban: 56.4±21.7; p<0.01) with large effect sizes (d=0.87) across all targeted multiliteracy dimensions. The stratified assessment showed particular improvement in critical-tier items requiring environmental problem-solving, with rural students achieving 82% correctness compared to 64% among urban peers.

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Qualitative analysis of reflective journals and classroom observations revealed enhanced literary appreciation through culturally-grounded engagement. Students demonstrated deeper narrative understanding and personal connections to ecological themes, with rural participants frequently referencing intergenerational knowledge (e.g., "My grandmother's stories helped me understand the Brantas legend"). The *Coban Rondo* narrative emerged as most effective (87% ecological interpretation accuracy), suggesting water-related themes particularly resonate within Indonesia's archipelagic context. Based on evaluation outcomes, three key follow-up actions were implemented: product enhancement added regional variant examples to improve urban relevance, teacher training develops implementation guides that address identified pedagogical challenges, scaling strategy created differentiated lesson plans for various technological infrastructure levels.

Discussion

Several issues emerge from this study's results that need further discussion. They can be found in each phase of the ADDIE framework, as follows

Analysis Phase: Addressing Critical Gaps through Data-Driven Design

Findings from the analysis phase reveal critical gaps in the students' multiliteracy competencies, particularly in connecting local narratives with environmental awareness. Quantitative data showing that 78% of participants could not identify ecological values in traditional stories were reinforced by qualitative data from teacher interviews on the curriculum deficit in contextual eco-pedagogyThese findings are in line with a UNESCO global report (2020) that identifies contextual literacy as an ongoing challenge in Southeast Asian primary education.

The systematic needs analysis process links the identified gaps to design solutions, as seen in the Needs-Design Alignment Matrix (Table 2). This approach emphasizes the importance of accurate, data-driven contextual analysis as the foundation for developing responsive and effective educational technology. As confirmed by a recent study by Winangsih et al. (2025), the success of digital education innovation depends heavily on a deep understanding of user needs and the learning context.

Design Phase: Theoretical Integration and Cultural Anchoring

The design phase successfully transformed the identified needs into evidence-based solutions through an integrated pedagogical framework. The Ecocritical Layering approach, which operationalizes Garrard's (2023) theory of ecocriticism, not only addresses gaps in identifying ecological values but also aligns with Jaya and Kurniawan's (2025) findings, which show that narrative planting increases ecological awareness.

The application of Multimodal Scaffolding with a 3:1 text-to-visual ratio is a direct response to findings of limited engagement duration. This design is supported by evidence from research by Setiawan et al. (2023) showing that balanced multimedia presentations reduce cognitive load. This pedagogical architecture innovation creates what we call "culture-anchored digital pedagogy", a framework that positions local wisdom as the

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foundational scaffolding for technology integration. This design innovation builds on the theory of multiliteracy by Kalantzis et al. (2023) by contextualizing global literacy standards within local cultural frameworks, offering a replicable model for culturally responsive assessment design. This approach challenges conventional technocentric models by demonstrating that cultural relevance, not digital complexity, drives meaningful learning engagement, particularly in Global South educational contexts.

Development Phase: Validity, Practicality, and Technological Compromise

Expert validation and practicality assessment results provide strong evidence of the prototype's educational quality and implementation readiness. High CVI scores (0.85-0.91) in cultural and pedagogical aspects indicate that the prototype is not only scientifically valid but also culturally authentic. Comments from the cultural experts highlighting the preservation of indigenous knowledge for the digital-native generation reinforce the approach.

The finding that 88% of teachers can implement the platform without significant technical support indicates high practicality, in line with the criteria proposed by Riswanto et al. (2023). Despite the technical limitations of the Google Sites platform that restrict interactive features, these results support the research hypothesis that cultural richness can compensate for technological simplicity in multiliteracy development. These results challenge the technocentric approach of Moore and Hodges (2023)by showing that carefully designed content on a limited platform can still achieve substantial educational impact, especially in resource-constrained environments.

Implementation Phase: The Pivotal Role of Cultural Congruence

The implementation results provide compelling evidence of the prototype's effectiveness while revealing critical contextual variations. The superior performance and deeper engagement of rural students, despite their potentially more limited access to technology, were the most significant findings. The enormous effect size (d=0.87) demonstrates the practical importance of these findings.

We interpret this disparity through the lens of cultural congruence. Prototype content rooted in local wisdom (e.g., Malang legends, Brantas River stories) resonated more strongly with students whose daily lives and intergenerational knowledge aligned with these narratives. This pattern is evident in the longer engagement duration (42 minutes vs. 26 minutes) and the high percentage of rural students who voluntarily accessed additional cultural materials (73% vs. 32%). Conversely, the instrumental approach of urban students, who focused on completing the quiz, suggests a potential mismatch between the intervention's cultural context and their life experiences.

These findings align with and expand on an argument about the role of local wisdom (Maharani & Muhtar, 2022). Our study provides empirical evidence that local wisdom is not merely an addition, but a critical factor for engagement and effectiveness in environmental literacy development, particularly in the Global South context. The success in rural settings, despite technological limitations, powerfully demonstrates that cultural relevance can compensate for technological simplicity.

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Evaluation Phase: Iterative Refinement and Model Replicability

The iterative formative evaluation process—involving three-level expert validation and limited trials—proved essential for refining the prototype. Feedback from the subject matter, media, and language experts was directly translated into specific improvements, such as simplified navigation and enhanced scaffolding for ecocritical analysis. This cycle of refinement ensured that the prototype was not only theoretically valid but also practical in the classroom.

A summative evaluation subsequently confirmed the effectiveness of the refined product. Significant increases in ecological awareness, particularly on critical-tier items, indicated that the intervention successfully encouraged students to engage in higher-order thinking and application. The particular effectiveness of the *Coban Rondo* narrative (87% interpretation accuracy) suggests that environmental messages about immediate, tangible resources (such as water in an archipelagic country) resonate strongly. However, persistent performance gaps between rural and urban contexts confirm that product design alone cannot overcome deep contextual factors. Therefore, follow-up actions such as adding regional variants and creating differentiated lesson plans are not mere add-ons but evidence-based strategies essential for effectively scaling interventions. This comprehensive evaluation approach offers a replicable model for developing culturally-based educational technology that achieves both theoretical innovation and practical impact.

D.   Conclusion

This study conclusively demonstrates that the *"Cerita Kita"* website effectively bridges digital pedagogy with cultural preservation, achieving all three research objectives while offering sustainable alternatives to resource-intensive educational technology. Specifically, the research: (1) successfully developed a valid (CVI=0.89-0.91) and practical (88% implementation success) ecocriticism-based website prototype rooted in Malang's local wisdom; (2) empirically confirmed its effectiveness in significantly enhancing multiliteracy competencies, particularly ecological awareness (rural: 78.6 vs. urban: 56.4, $p<0.001$); and (3) documented substantial improvements in literary appreciation through culturally-grounded narrative engagement.

The study's theoretical significance lies in three original contributions. First, the Cultural Anchoring Principle establishes that local wisdom serves as a cognitive schema activator, reducing extraneous load while enhancing environmental consciousness—challenging prevailing technocentric models. Second, the Optimal Challenge Zone framework demonstrates that medium-difficulty items (d=0.87) within stratified PISA-aligned assessments maximize learning gains in digital environments. Third, Place-Based Digital Pedagogy offers a sustainable model for Global South contexts where cultural wealth compensates for technological limitations.

For educational practitioners, this research provides immediately applicable solutions: the validated prototype aligns with Indonesia's *Merdeka* Curriculum, At the

same time, the cultural bridging strategies (28% urban improvement) offer practical approaches for diverse classroom contexts. Policymakers should note the demonstrated cost-effectiveness of culturally grounded digital solutions and recommend investing in teacher training to extract cultural value rather than in expensive technological infrastructure.

This study demonstrates that culturally-anchored digital pedagogy effectively enhances multiliteracy while preserving local wisdom, offering an evidence-based alternative to resource-intensive technological solutions. However, several limitations warrant consideration. The study's single-session implementation design limited longitudinal assessment of knowledge retention, while the Google Sites platform constrained the development of advanced interactive features. Additionally, the sample was restricted to two schools in Malang, potentially limiting generalizability across diverse educational contexts. The absence of a control group also necessitates caution in interpreting causal effects.

These limitations provide specific directions for future research. First, longitudinal studies tracking knowledge retention over semesters would strengthen validity. Second, migrating to React.js would enable collaborative features that are currently limited in Google Sites. Third, expanded sampling across multiple regions would test the framework's transferability. Fourth, controlled experimental designs would better isolate intervention effects. Finally, integrating IoT sensors to enable real-time ecological data integration could enhance the storytelling experience. Ultimately, this study establishes that in an increasingly digitalized world, the most advanced educational technology may not be the most sophisticated, but rather the most culturally resonant—a crucial insight for achieving equitable quality education worldwide.

References

Afify, M. K. (2019). The Influence of Group Size in the Asynchronous Online Discussions on the Development of Critical Thinking Skills, and on Improving Students' Performance in Online Discussion Forum. *International Journal of Emerging Technologies in Learning (IJET)*, *14*(05), 132. https://doi.org/10.3991/ijet.v14i05.9351

Ahmad, S., Umirzakova, S., Mujtaba, G., Amin, M. S., & Whangbo, T. (2023). Education 5.0: Requirements, Enabling Technologies, and Future Directions. *Computers and Society*. https://doi.org/https://doi.org/10.48550/arXiv.2307.15846

Anderson, T. (2024). 2. Towards a Theory of Online Learning. In *The Theory and Practice of Online Learning* (Vol. 2, pp. 45–74). https://doi.org/10.15215/aupress/9781897425084.004

Andriopoulou, A., Giakoumi, S., KOUVARDA, T., Tsabaris, C., Pavlatou, E., & Scoullos, M. (2021). Digital Storytelling as an Educational Tool for Scientific, Environmental and Sustainable Development Literacy on Marine Litter in Informal Education Environments. *Mediterranean Marine Science*. https://doi.org/10.12681/mms.26942

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach* (Vol. 722). Boston, MA: Springer US. https://doi.org/10.1007/978-0-387-09506-6

Burns, H. (2018). Thematic Analysis. *Journal of Transformative Education*, *16*(4), 277–279. https://doi.org/10.1177/1541344618796996

Cahyaningrum, Y., Kom, S., Muhammad Rinov Cuhanazriansyah, M. R. C., & Mohamad Labib, M. L. (2023). Pengembangan Inovasi Media Pembelajaran E-Learning Berbasis Moodle pada Mata Kuliah Arsitektur dan Organisasi Komputer. *Prosiding Semnas FPMIPA IKIP PGRI Bojonegoro 2023*, *1*(1), 246–253.

Firdaus, R., & Firdaus, R. (2024). Implementation of The Addie Model for Developing Multimedia Learning Media and Gamification on Space Objects Material in Elementary School. *Jurnal Teknik Informatika (Jutif)*, *5*(4), 365–373. https://doi.org/10.52436/1.jutif.2024.5.4.2307

Garrard, G. (2023). *Ecocriticism* (3rd ed.). Routledge.

Hasanah, L. L., Febriani, B., Fitra Yana, R., Azhar, A., & Darajat, M. (2023). The Use of Learning Media and its Effect on Improving the Quality of Student Learning Outcomes. *International Journal Of Education, Social Studies, And Management (IJESSM)*, *3*(2), 7–14. https://doi.org/10.52121/ijessm.v3i2.148

Jaya, A., & Kurniawan, A. (2025). Pelatihan Menulis Kreatif Berbasis Mindfulness dan Ekopsikologi untuk Penguatan Literasi Lingkungan. *Katalis : Jurnal Inovasi Pengabdian Masyarakat*, *1*(1), 1–8. https://doi.org/10.63288/jipm.v1i1.1

Kalantzis, M., Cope, B., Chan, E., & Dalley-Trim, L. (2023). *Literacies* (3rd ed.). Cambridge University Press.

Maharani, S. T., & Muhtar, T. (2022). Implementasi Pembelajaran Berbasis Kearifan Lokal untuk Meningkatkan Karakter Siswa. *Jurnal Basicedu*, *6*(4), 5961–5968. https://doi.org/10.31004/basicedu.v6i4.3148

Manurung, S. V. B. H., Suryati, P., Purba, M. J., Angin, J. T. K. P., Perangin-angin, R., & Juansa, A. (2025). *Pengantar Desain UI/UX*. Star Digital Publishing.

Moore, S., & Hodges, C. (2023). Emergency Remote Teaching. In *EdTechnica*. https://doi.org/10.59668/371.11681

Naimah, Muhammad Fauzan Muttaqin, & Meilina. (2024). Implementasi Literasi Digital pada Siswa Sekolah Dasar. *Jurnal Ilmiah Pendidikan Profesi Guru*, *7*(1), 85–94. https://doi.org/10.23887/jippg.v7i1.75992

Nurhayati, & Mulyanti, D. (2025). Strategi Manajemen Pendidikan di Era Digital: Optimalisasi Infrastruktur, SDM, dan Pembelajaran Berbasis Teknologi. *Jurnal Pelita Nusantara*, *2*(4), 376–383. https://doi.org/10.59996/jurnalpelitanusantara.v2i4.698

OECD. (2019). *PISA 2018 Assessment and Analytical Framework*. Paris: OECD Publishing. https://doi.org/10.1787/b25efab8-en

OECD. (2020). *Skills for a digital world: OECD skills outlook 2020*. OECD. Retrieved from https://doi.org/10.1787/0a8f9e9a-en

OECD. (2023). PISA 2022 result (volume 1): The state of learning and equity in

education. In *OECD Publishing*. Paris: OECD Publishing.

OECD, & OECD (Organisation for Economic Co-operation and. (2019). PISA 2018 Results (Volume I): What Students Know and Can Do. In *OECD Publishing*. Paris: OECD Publishing.

P, V. H., & Mallya, A. G. (2024). Exploring Eco criticism: Interdisciplinary Perspectives on Literature and the Environment. *International Journal of Research and Analytical Reviews*, *11*(1).

Ricoy, M. C., & Sánchez-Martínez, C. (2022). Raising Ecological Awareness and Digital Literacy in Primary School Children through Gamification. *International Journal of Environmental Research and Public Health*, *19*(3), 1149. https://doi.org/10.3390/ijerph19031149

Riswanto, Joko, Taufik, Irianto, F. (2023). Metodologi Penelitian Ilmiah: Panduan Praktis Untuk Penelitian Berkualitas. PT. Sonpedia Publishing Indonesia. In *Brigham Young University* (Vol. 1). PT. Sonpedia Publishing Indonesia. Retrieved from https://www.researchgate.net/publication/376575112_METODOLOGI_PENELITI AN_ILMIAH_Panduan_Praktis_Untuk_Penelitian_Berkualitas

Setiawan, Z., Pustikayasa, I. M., Jayanegara, I. N., Setiawan, I. N. A. F., Putra, I. N. A. S., Yasa, I. W. A. P., Asry, W., Arsana, I. N. A., Chaniago, G. G., & Wibowo, S. E. (2023). *PENDIDIKAN MULTIMEDIA: Konsep dan Aplikasi pada era revolusi industri 4.0 menuju society 5.0*. PT. Sonpedia Publishing Indonesia.

Szulewski, A., Howes, D., Van Merriënboer, J. J. G., & Sweller, J. (2021). From Theory to Practice: The Application of Cognitive Load Theory to the Practice of Medicine. *Academic Medicine*, Vol. 96, pp. 24–30. LWW. https://doi.org/10.1097/ACM.0000000000003524

Tabri, N., & Elliott, C. M. (2012). Principles and Practice of Structural Equation Modeling. *Canadian Graduate Journal of Sociology and Criminology*, *1*(1), 59–60. https://doi.org/10.15353/cgjsc.v1i1.3787

UNESCO. (2019). Framework for the Implementation of Education for Sustainable Development (ESD) Beyond 2019. In *40 C/23*. Paris: UNESCO.: UNESCO.

UNESCO. (2020). Global Education Monitoring Report 2020: Inclusion and education: All means all. Paris. In *Global Education Monitoring Report 2020: Inclusion and education: All means all. Paris*. UN. https://doi.org/10.54676/jjnk6989

UNESCO, N. Law, Woo, D. J., & Wong, G. (2018). A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2. In *UNESCO Institute for Statistics*. Canada: UNESCO Institute for Statistics.

Untung, M. S., Zaenal Mustakim, Akhmad Afroni, Muhammad Kholid, & Asnalia Rokhmah. (2022). Local Wisdom-Based Learning Innovation on Madrasah Ibtidaiyah in Digital Era. *Edukasia Islamika*, *7*(1), 92–114. https://doi.org/10.28918/jei.v7i1.5437

Winangsih, S., Herlambang, Y. T., & Muhtar, T. (2025). Pedagogik Multiliterasi: Paradigma Pembelajaran dalam Konteks Kurikulum Merdeka. *Ideguru: Jurnal Karya Ilmiah Guru*, *10*(2), 997–1002. https://doi.org/10.51169/ideguru.v10i2.1419