



RESEARCH ARTICLE

Section: *Literature, Linguistics & Criticism***Fostering nationalism through digital poetry: A design-based study integrating constructivist and culturally responsive pedagogy in Indonesian elementary education**Onok Yayang Pamungkas^{1*}, Etty Sisdiana², Benny Widaryanto³, Jarwadi⁴, Iskandar Agung⁵, Novita Siswayanti⁶, Agus Fanar Syukri⁷¹Indonesian Language and Literature Education Study Program, Universitas Muhammadiyah Purwokerto, Indonesia²Research Center for Process Technology, Research Organization for Energy and Manufacture, National Research and Innovation Agency (BRIN), Indonesia³Research Centre for Education, Research Organization for Social Sciences and Humanities, National Research and Innovation Agency (BRIN), Indonesia⁴Research Centre for Education, Research Organization for Social Sciences and Humanities, National Research and Innovation Agency (BRIN), Indonesia⁵Research Center for Education, National Research and Innovation Agency (BRIN), Indonesia⁶Center Research Center of Research Centre for Society, National Research and Innovation Agency (BRIN), Indonesia⁷Research Center of Policy, National Research and Innovation Agency (BRIN), Indonesia*Corresponding author: onokyayangpamungkas@gmail.com**ABSTRACT**

This study examines the effectiveness of a digital poetry-based learning application, *SENANDI* (Seni dan Nasionalisme Digital), in fostering nationalism among elementary school students in Yogyakarta, Indonesia. Employing a design-based research (DBR) approach, the study integrated constructivist principles, the Technological Pedagogical Content Knowledge (TPACK) framework, and culturally responsive pedagogy across three iterative phases: design, expert validation, and empirical testing. Seventy-eight fourth-grade students participated in an eight-week intervention using the *SENANDI* platform. Quantitative results from a one-group pretest–posttest design revealed significant improvement in students' nationalism attitudes (Cohen's $d = 1.43$), with the highest gains observed in cultural appreciation ($d = 1.52$). Regression analysis indicated that the quality of poetry produced by students was the strongest predictor of nationalism gains ($\beta = .45$, $p < .001$), suggesting that creative depth contributes more meaningfully to value internalization than usage frequency. These findings highlight the pedagogical potential of creative digital tools to promote civic and character education, particularly when embedded in culturally grounded learning contexts. The study concludes that technology-mediated creative expression can serve as a transformative means of instilling national values in primary education.

KEYWORDS: digital learning, nationalism education, poetry writing, constructivist pedagogy, culturally responsive teaching

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Introduction

Nationalism education is the foundation for the formation of national identity and citizen character that contributes to the social cohesion and political stability of a country (Anderson, 2006; Smith, 2021). In the context of Indonesia as a country with extraordinarily complex ethnic, cultural, and linguistic diversity, nationalism education faces unique challenges in balancing unity and diversity in accordance with the spirit of *Bhinneka Tunggal Ika* (Hoon, 2017; Parker & Nilan, 2023). Recent research shows that conventional approaches in character education and nationalism, which tend to rely on didactic-transmissive methods and memorization of ideological material, fail to create a deep internalization of values in elementary level students (Berkowitz & Bier, 2005; Kristjánsson, 2020; Nucci et al., 2024). A comprehensive meta-analysis conducted by Jeynes (2019) and Walker et al. (2022) revealed that traditional character education interventions produced only moderate effect measures ($d=0.34-0.51$) on student attitudes, indicating the need for more effective pedagogical innovations. Digital transformation in education offers significant opportunities to address these limitations through more interactive, personalized, and meaningful learning (Haleem et al., 2022; Timotheou et al., 2023), but the implementation of educational technology in developing countries still faces substantial gaps in terms of pedagogical design quality and cultural appropriateness (Major et al., 2021; Pamungkas et al., 2025; Nikolopoulou et al., 2022; UNESCO, 2023).

The integration of digital technology in value education faces a fundamental paradox where the availability of technological infrastructure does not automatically result in meaningful learning without proper pedagogical design (Clark & Mayer, 2023; Selwyn, 2022). Empirical studies show that educational applications that do not consider evidence-based learning principles produce minimal or even negative effects on student learning outcomes (Kim et al., 2021; Sung et al., 2016). Cognitive Load Theory (Paas & van Merriënboer, 2020; Sweller et al., 2019) and the Technological Pedagogical Content Knowledge framework (Mishra & Koehler, 2006; Voogt et al., 2023) provide a theoretical framework for integrating technological affordances with developmentally appropriate curriculum and pedagogical content. In the context of nationalistic education, an additional challenge arises from the need to balance global-universal content with local-cultural values, where culturally responsive pedagogy becomes a critical design principle (Gay, 2018; Ladson-Billings, 2021). Research shows that learning that accommodates students' cultural identities not only increases engagement but also deepens conceptual understanding and internalization of values (Banks, 2020; Paris & Alim, 2024). However, the majority of educational applications are developed with universal assumptions that ignore cultural specificity, resulting in low relevance and effectiveness in non-Western contexts (Traxler & Kukulska-Hulme, 2022; Veletsianos & Moe, 2023).

Creative expression through language arts, particularly poetry writing, offers a pedagogical mechanism that has the potential to overcome the limitations of conventional approaches in value education by facilitating the construction of personal meaning and deep internalization (Creely et al., 2022; Hanauer, 2012). Constructivist learning theory emphasizes that knowledge and values are actively constructed by learners through meaning-making processes that involve cognitive, affective, and social dimensions simultaneously (Piaget, 1970; Vygotsky, 1978; Windschitl, 2022). Research in poetry pedagogy demonstrates that the creative process of poetry writing activates multiple learning pathways involving linguistic, symbolic, emotional, and reflective processing, creating optimal conditions for attitudinal transformation (Dymoke et al., 2022; Xerri, 2023). Bowyer and Kahne (2020) found that digital civic engagement involving creative production produces a stronger effect on civic attitudes than passive content consumption. However, the systematic integration between digital technology, creative expression of poetry, and nationalism education in the context of Indonesian primary education is still very limited (Anwar & Salim, 2023; Sisidiana et al., 2024). This gap raises fundamental research questions about how the design of poetry-based digital applications can be optimized to facilitate the development of elementary school students' nationalistic attitudes, what learning mechanisms explain the effectiveness of such interventions, and how evidence-based design principles can be applied to create educational technologies that are simultaneously culturally responsive and pedagogically effective.

Methods

This study employed a Design-Based Research (DBR) methodology, emphasizing iterative cycles of design, implementation, evaluation, and reflection to develop a theoretically grounded and contextually relevant

instructional innovation (McKenney & Reeves, 2012; Voogt et al., 2023). The DBR framework was selected because it integrates empirical inquiry with pedagogical theory, enabling systematic refinement of both design and implementation (Anderson, 2006; Clark & Mayer, 2023). The study was conducted over a six-month period and consisted of three major phases: (1) conceptual design and development, (2) expert validation, and (3) multi-site empirical implementation in elementary schools across Yogyakarta, Indonesia.

1. Design and Development of the Application

The first phase involved the creation of *SENANDI (Seni dan Nasionalisme Digital)*, a Progressive Web Application (PWA) built with React Native and Node.js to ensure cross-platform functionality and access under both online and offline conditions (Nikolopoulou et al., 2022; Timotheou et al., 2023). The design was grounded in three theoretical foundations:

- a. **Constructivist learning theory**, emphasizing that learners construct knowledge through active engagement and creative expression (Piaget, 1970; Vygotsky, 1978);
- b. **The Technological Pedagogical Content Knowledge (TPACK) framework**, integrating technology, pedagogy, and subject matter for effective digital instruction (Mishra & Koehler, 2006; Voogt et al., 2023); and
- c. **Culturally Responsive Pedagogy**, aligning content with the sociocultural context of learners, particularly reflecting Yogyakarta's cultural identity and communal values (Gay, 2018; Ladson-Billings, 2021).

The application includes ten thematic learning modules reflecting Indonesia's *Merdeka Curriculum*, such as *Pancasila Sahabatku* ("Pancasila, My Friend") and *Pelangi Budaya Nusantara* ("Cultural Rainbow of the Archipelago"). Each module integrates digital poetry writing with visual scaffolding and thematic vocabulary banks to promote meaningful and creative learning engagement.

2. Expert Validation

The prototype was reviewed by six experts specializing in character education, digital learning, and Indonesian language pedagogy. Experts assessed usability, pedagogical soundness, cultural relevance, and curriculum alignment (UNESCO, 2023; Parker & Nilan, 2023). The Content Validity Index (CVI) was 0.91, indicating high inter-rater agreement. Following the validation phase, refinements were made to user interface consistency, lexical localization to Yogyakarta's linguistic context, and the addition of a module titled *Gotong Royong di Sekolahku* ("Mutual Cooperation in My School") to reinforce social cohesion values (Paas & van Merriënboer, 2020; Reinhold et al., 2024).

3. Multi-Site Empirical Implementation

The empirical implementation phase took place across three public elementary schools in Yogyakarta Province, namely SD Negeri Condongcatu (Sleman), SD Negeri Giwangan (Yogyakarta City), and SD Negeri Banguntapan 1 (Bantul). The inclusion of multiple sites was intended to capture contextual variations in socio-economic and cultural characteristics, thereby enhancing external validity. A total of 236 fourth-grade students participated in the eight-week intervention, representing diverse academic achievement levels and ethnic backgrounds.

A one-group pretest–posttest design was employed to examine the effectiveness of the *SENANDI* intervention in promoting nationalism attitudes (Creswell & Creswell, 2018). The nationalism attitude scale contained 30 items measuring five key dimensions: patriotism, national pride, unity in diversity, cultural appreciation, and civic responsibility. The instrument demonstrated high internal consistency (Cronbach's $\alpha = 0.92$). Application analytics automatically tracked user behavior, including login frequency, session duration, and poem production metrics (Major et al., 2021; Almulla, 2023).

4. Data Analysis

Data were analyzed using paired-sample t-tests to compare pre- and post-intervention scores and hierarchical multiple regression to identify predictors of nationalism improvement. In addition, a multi-dimensional content analysis was applied to the student-generated poems to evaluate cognitive complexity, affective depth, and national value expression (Hanauer, 2012; Dymoke et al., 2022). Inter-rater reliability reached Cohen's $\kappa = 0.84$,

indicating strong agreement between coders. This mixed-method analytical approach enabled a comprehensive interpretation of how creative digital expression mediates the internalization of civic and cultural values among young learners (Creely et al., 2022; Gay, 2018).

Result

1. Application Development and Validation

The development of SENANDI followed a systematic design-based research approach (McKenney & Reeves, 2012), integrating iterative cycles of design, evaluation, and refinement. This process occurred over six months and comprised three distinct phases: preliminary design grounded in theoretical frameworks, expert validation with multi-stakeholder input, and empirical pilot testing with target users.

a. Theoretical Foundations and Design Principles

The application architecture was grounded in three complementary theoretical frameworks. First, constructivist learning theory (Piaget, 1970; Vygotsky, 1978) informed the design emphasis on active knowledge construction through creative expression rather than passive content consumption. The poetry writing interface required students to synthesize nationalism concepts into original compositions, facilitating deeper cognitive processing than receptive learning modes. Second, the Technological Pedagogical Content Knowledge framework (Mishra & Koehler, 2006) guided the integration of technology affordances with nationalism curriculum content and developmentally appropriate pedagogy for elementary students. Third, culturally responsive design principles (Gay, 2018) ensured the application reflected Indonesian cultural values, aesthetics, and linguistic patterns, enhancing relevance and resonance for target users.

These theoretical foundations translated into five core design principles. The principle of cognitive scaffolding provided graduated support through visual prompts, sentence starters, and exemplar poems, enabling students to engage with challenging creative tasks within their zone of proximal development. The principle of multimodal representation integrated text, imagery, and interactive elements to accommodate diverse learning preferences and reduce cognitive load. The principle of social learning embedded peer interaction opportunities through shared poem repositories and commenting features, leveraging collaborative knowledge construction. The principle of authentic expression prioritized student voice and personal meaning-making over template-driven formulaic responses, supporting intrinsic motivation. Finally, the principle of cultural congruence ensured visual design, character representations, narrative contexts, and linguistic patterns reflected Indonesian cultural identity and values, fostering identification and engagement.

b. Application Architecture and Technical Specifications

To support the pedagogical objectives of SENANDI—an innovative digital poetry platform designed to cultivate nationalism and creative literacy among Indonesian elementary students—the application’s architecture was carefully structured to balance cultural responsiveness, accessibility, and technological scalability. The system design integrates pedagogical theory with technical precision, ensuring that the learning experience remains engaging, contextually grounded, and operable under varied school infrastructure conditions across Yogyakarta. The development process prioritized a user-centered interface enriched with local cultural motifs and mascots familiar to young learners, aligning with principles of culturally responsive design and constructivist interaction.



Figure 1. SENANDI Application Login Interface Featuring Mascot Character and Culturally Resonant Visual Design

SENANDI was developed as a responsive web application using the React Native framework, ensuring cross-platform compatibility for Android and iOS mobile devices as well as desktop browsers. The backend infrastructure utilized Node.js with a MongoDB database architecture, enabling scalable data storage for user accounts, poem repositories, and usage analytics. The application employed Progressive Web App (PWA) technology, allowing offline functionality for core features including poem writing and viewing saved content, with automatic synchronization upon internet reconnection. This technical design addressed anticipated connectivity challenges in Indonesian school contexts. Moreover, the system architecture was intentionally modular, allowing for iterative updates in alignment with the Design-Based Research (DBR) methodology used throughout the project. Each module—from user authentication to poetry composition—was integrated with an analytics layer that captured learning behaviors to inform future pedagogical refinements. By bridging educational theory, cultural identity, and adaptive digital infrastructure, SENANDI demonstrates how localized educational technology can operationalize Technological Pedagogical Content Knowledge (TPACK) principles in a sustainable and context-sensitive manner.



Figure 2. Ten Nationalism Themes in SENANDI Application with Corresponding Visual Representations and Navigation Structure

The content architecture comprised ten thematic modules aligned with Indonesian national curriculum standards for character education (Kurikulum Merdeka). Each theme addressed specific nationalism dimensions: *Bendera Berkibar* (Unity in Diversity) explored pluralism and national integration; Pancasila *Sahabatku* (Pancasila Values) introduced foundational state ideology through child-friendly narratives; *Pahlawanku Inspirasiku* (National Heroes) featured biographical content on independence struggle figures; *Alamku yang Indah* (Natural Beauty) connected environmental appreciation to patriotic sentiment; *Pelangi Budaya Nusantara* (Cultural Diversity) celebrated Indonesia's ethnic and artistic traditions; *Gotong Royong dan Persahabatan* (Cooperation and Friendship) highlighted communal values; *Indonesia Damai dan Rukun* (Peaceful Nation) emphasized harmony and tolerance; *Sekolahku Cinta Indonesia* (School Nationalism) linked everyday school experiences to national identity; *Bangga Jadi Anak Indonesia* (National Pride) built positive national identification; and *Menjaga Lingkungan, Menjaga Negeri* (Environmental Care) framed ecological responsibility as citizenship duty.



Figure 3. Learning Interface Demonstrating Scaffolded Poetry Writing Module with Visual Prompts and Vocabulary Support

Each thematic module integrated four interconnected functional components. The Popular Poems library provided curated exemplar texts at varied complexity levels, serving as models for structure, vocabulary, and thematic treatment. The Writing interface incorporated multiple scaffolding elements including theme-relevant visual prompts, customizable sentence starters, vocabulary suggestion dropdowns organized by semantic fields (emotion words, descriptive adjectives, action verbs), and real-time character counting to guide appropriate length. The Search functionality enabled keyword-based exploration across the poem corpus using natural language processing for semantic matching beyond literal term retrieval. The User Profile component displayed individual poem portfolios, achievement badges earned through sustained engagement, and basic analytics visualizing writing productivity over time. This integrated design facilitated a dynamic feedback loop between creative expression and reflective learning, enabling students to iteratively refine their writing while internalizing cultural and linguistic concepts. The inclusion of multimodal scaffolding—visual, lexical, and structural—was grounded in cognitive load theory to ensure optimal engagement without overwhelming young learners' working memory. Additionally, adaptive algorithms within the system progressively adjusted the level of linguistic support based on prior user performance, thereby operationalizing principles of personalized learning within a culturally specific framework. Through these features, SENANDI effectively transformed poetry writing into an interactive, values-driven literacy practice that reinforces both national identity and 21st-century digital competencies.



Figure 4. SENANDI Main Interface Featuring Characters Representing Indonesian Ethnic Diversity and Intuitive Navigation Design

The visual design system employed culturally resonant aesthetic elements while maintaining contemporary digital interface standards. The color palette centered on red and white reflecting the Indonesian flag, complemented by warm earth tones and vibrant accent colors characteristic of traditional Indonesian textiles. Character illustrations depicted children from diverse Indonesian ethnic groups wearing regional traditional clothing, visually reinforcing the *Bhinneka Tunggal Ika* (Unity in Diversity) national motto. Navigation employed universally recognized iconography combined with simple Indonesian language labels appropriate for elementary reading levels. Typography utilized the Poppins font family for high legibility on mobile screens, with generous spacing and clear visual hierarchy supporting emerging readers.

2. Learning Outcomes and Engagement Patterns

The evaluation of SENANDI's implementation focused on assessing both learning outcomes and behavioral engagement dynamics to determine the intervention's pedagogical efficacy and theoretical validity. This section presents empirical findings derived from quantitative analyses of students' nationalism attitude development, engagement behavior, and predictive modeling of learning gains. Consistent with the Design-Based Research (DBR) framework, the analysis not only examined outcome effectiveness but also explored the mechanisms through which learning and engagement co-evolved within the digital environment. By combining psychometric measures, system analytics, and inferential statistics, the study aimed to capture a holistic representation of how SENANDI fostered affective and cognitive dimensions of nationalism through culturally grounded creative expression. Furthermore, triangulating self-report, behavioral, and performance-based data provided robust evidence for both internal validity and ecological authenticity, ensuring that the observed improvements reflected genuine educational impact rather than testing or novelty effects.

a. Nationalism Attitude Development

Seventy-eight fourth-grade students participated in the eight-week SENANDI intervention, representing diverse achievement levels and ethnic backgrounds from Primary School in Yogyakarta, Indonesia. Nationalism attitude was assessed using a validated thirty-item scale measuring five dimensions: love of homeland, national pride, unity in diversity, cultural appreciation, and civic responsibility. The instrument demonstrated excellent psychometric properties with Cronbach's alpha of 0.89 at pre-test and 0.92 at post-test, strong content validity confirmed by expert review, and adequate test-retest reliability of 0.84 over two weeks. Pre-test assessment occurred one week before intervention commencement, with post-test following identical protocols one week

after the final session, both administered by research assistants blind to study hypotheses to minimize potential bias.

Table 2. Pre-test and Post-test Comparison of Nationalism Attitude (N=78)

Dimension	Pre-test M(SD)	Post-test M(SD)	Mean Diff	95% CI	t(77)	p	Cohen's d
Overall Nationalism	107.35 (12.84)	125.62 (11.37)	18.27	[15.40, 21.14]	12.64	<.001	1.43
Love of Homeland	21.23 (3.42)	25.87 (2.91)	4.64	[3.82, 5.46]	11.28	<.001	1.28
National Pride	20.85 (3.67)	25.14 (3.02)	4.29	[3.45, 5.13]	10.15	<.001	1.15
Unity in Diversity	21.56 (3.28)	24.92 (2.84)	3.36	[2.60, 4.12]	8.76	<.001	0.99
Cultural Appreciation	20.12 (3.91)	26.03 (2.76)	5.91	[5.04, 6.78]	13.42	<.001	1.52
Civic Responsibility	23.59 (3.15)	23.66 (3.42)	0.07	[-0.69, 0.83]	0.18	.856	0.02

Note. Possible scores: dimensions 6-30, overall 30-150. CI=confidence interval.

Paired-samples t-tests revealed statistically significant improvements in overall nationalism attitude with very large effect size (Cohen's $d=1.43$), representing approximately 17% increase from baseline and substantially exceeding the 0.80 threshold for large practical effects. Cultural appreciation demonstrated the largest improvement ($d=1.52$), suggesting SENANDI's multicultural content featuring diverse Indonesian traditions particularly resonated with students, followed by love of homeland ($d=1.28$) and national pride ($d=1.15$), both indicating successful fostering of emotional attachment and positive national identification. Civic responsibility showed no significant change ($d=0.02$), reflecting limited coverage of behavioral citizenship dimensions in SENANDI's content which emphasized affective and cognitive rather than action-oriented civic behaviors. This dimension-specific pattern supports construct validity, demonstrating the intervention affected targeted domains while leaving unaddressed domains unchanged. Individual-level analysis revealed 93.6% of participants demonstrated positive gains, with only two students showing slight decreases attributable to documented personal stressors affecting overall school engagement. Subgroup analyses revealed no significant gender differences in learning gains ($t(76)=-0.25$, $p=.801$, $d=-0.06$), indicating equal effectiveness across gender, while one-way ANOVA demonstrated significant achievement level effects ($F(2,75)=8.42$, $p<.001$, $\eta^2p=.18$) with low achievers gaining significantly more ($M=24.17$) than moderate ($M=17.84$) and high achievers ($M=12.23$), positioning SENANDI as an equity-enhancing intervention particularly supporting struggling students through multimodal scaffolding, individualized pacing, and creative expression modes that reduced traditional learning barriers.

b. Engagement Patterns and User Behavior

The application's analytics system automatically recorded comprehensive usage data throughout the intervention period, providing objective behavioral measures of engagement that complemented self-report and observational data. Students demonstrated strong sustained engagement with mean login sessions of 24.8 over eight weeks, substantially exceeding the two mandatory classroom sessions per week and confirming voluntary supplementary access. Session duration averaged 18.7 minutes, exceeding typical attention span estimates for ten-year-old children and indicating the application maintained engagement beyond expected developmental thresholds. Students created an average of 6.4 poems and accessed 7.3 of ten available themes, demonstrating both productivity and autonomous exploration beyond assigned content. The 94.9% completion rate, defined as students logging at least twenty sessions, demonstrated sustained participation rather than dropout patterns common in educational technology implementations.

Table 4. Application Usage Statistics and Engagement Correlations (N=78)

Metric	M	SD	Range	Correlation with Learning Gain	p
Total login sessions	24.8	5.3	12-38	.58***	<.001
Mean session duration (min)	18.7	4.2	9.5-31.2	.47***	<.001
Total poems created	6.4	2.1	2-12	.58***	<.001
Unique themes accessed	7.3	1.8	3-10	.51***	<.001
Popular poems viewed	15.6	6.8	3-34	.39**	<.01
Peer poems viewed	8.9	4.3	0-22	.34**	<.01
Poetry quality score (1-5)	3.74	0.68	2.0-5.0	.64***	<.001

Note. Learning gain = post-test minus pre-test nationalism attitude score. ** $p < .01$, *** $p < .001$.

All engagement metrics correlated significantly and positively with nationalism attitude gains, with poetry quality demonstrating the strongest relationship ($r = .64$, $p < .001$), followed by poems created and login sessions (both $r = .58$, $p < .001$), themes accessed ($r = .51$, $p < .001$), session duration ($r = .47$, $p < .001$), and social learning activities including popular poems viewed ($r = .39$, $p < .01$) and peer poems viewed ($r = .34$, $p < .01$). The substantially stronger correlation for poetry quality compared to quantitative metrics suggests depth of engagement mattered more than mere activity volume, consistent with constructivist learning theories emphasizing cognitive processing quality over time-on-task. Hierarchical cluster analysis identified three natural engagement profiles validated through discriminant function analysis with 94.9% correct classification: high engagement students (35.9%, $n = 28$) demonstrated intensive voluntary participation with mean 31.2 logins and 9.3 poems created, moderate engagement students (47.4%, $n = 37$) showed typical expected participation meeting basic requirements with some supplementary access, and low engagement students (16.7%, $n = 13$) met minimum participation with limited voluntary engagement creating only 3.2 poems. These profiles demonstrated construct validity through expected relationships with learning outcomes, with high engagement students achieving significantly higher nationalism attitude gains ($M = 23.54$) than moderate ($M = 17.28$) and low engagement students ($M = 10.85$), $F(2,75) = 7.91$, $p = .001$, supporting both the engagement classification validity and its theoretical relevance to learning outcomes while raising questions about causality direction that subsequent regression analyses addressed.

c. Predictive Modeling of Learning Gains

Hierarchical multiple regression examined key predictors of nationalism attitude improvement and tested dose-response relationships between engagement intensity and learning outcomes. The analysis employed a theoretically-motivated sequential entry strategy where Step 1 entered pre-test nationalism attitude scores to control for baseline differences and ceiling effects, establishing variance attributable to initial individual differences, while Step 2 added four engagement metrics representing different dimensions: total poems created representing productivity, mean session duration representing sustained attention, unique themes accessed representing breadth of exploration, and poetry quality scores averaged across compositions representing depth of engagement. This hierarchical approach tested whether engagement variables predicted learning gains beyond baseline attitudes and examined which specific engagement dimensions most strongly influenced outcomes. Diagnostic checks confirmed all statistical assumptions were met, including absence of outliers exceeding three standard deviations, approximately normal residual distributions verified through probability plots, homoscedastic error variance confirmed through residual scatterplots, and acceptable multicollinearity levels with all variance inflation factors below three despite moderate correlations among engagement metrics. To ensure robustness, the analysis was grounded in constructivist learning theory, which posits that the depth of cognitive engagement mediates attitudinal change more strongly than surface-level activity frequency. The inclusion of both quantitative and qualitative engagement dimensions enabled a multi-layered understanding of learner interaction patterns, bridging behavioral analytics with educational psychology. This modeling approach thus not only quantified predictive relationships but also illuminated the mechanistic pathways through which sustained, meaningful creative engagement within SENANDI translated into measurable transformations in

Table 6. Hierarchical Multiple Regression Predicting Nationalism Attitude Improvement (N=78)

Mod- el	Predictor	B	SE B	β	t	p	95% CI	VIF
Step 1	(Constant)	42.67	8.53	-	5.00	<.001	[25.70, 59.64]	-
	Pre-test score	-0.58	0.14	-.42	-4.05	<.001	[-0.86, -0.30]	1.00
<i>Model: R²=.18, Adjusted R²=.17, F(1,76)=16.42, p<.001</i>								
Step 2	(Constant)	-12.34	9.87	-	-1.25	.215	[-31.99, 7.31]	-
	Pre-test score	-0.39	0.13	-.28	-3.02	.003	[-0.65, -0.13]	1.32
	Poems created	0.89	0.62	.15	1.44	.154	[-0.34, 2.12]	2.87
	Session duration (min)	0.31	0.28	.11	1.12	.267	[-0.24, 0.86]	2.34
	Themes accessed	1.23	0.64	.18	1.92	.059	[-0.05, 2.51]	2.56
	Poetry quality	4.78	1.12	.45	4.27	<.001	[2.55, 7.01]	2.41
<i>Model: R²=.55, Adjusted R²=.52, ΔR^2=.37, F(4,72)=13.87, p<.001</i>								

Note. Final model F(5,72)=17.64, p<.001. VIF=variance inflation factor.

Step 1 demonstrated that pre-test scores significantly predicted learning gains negatively ($\beta=-.42$, $p<.001$), accounting for 18% of variance and confirming ceiling effects where students with higher initial nationalism attitudes had less room for measurable improvement, validating the importance of controlling for baseline in quasi-experimental designs. Step 2 adding engagement metrics significantly improved prediction with $\Delta R^2=.37$ ($p<.001$), yielding a final model explaining 55% of learning gain variance (adjusted $R^2=.52$) and indicating that engagement variables substantially enhanced prediction beyond baseline attitudes alone. Among engagement variables, poetry quality emerged as the sole significant independent predictor ($\beta=.45$, $p<.001$), with each one-point increase in poetry quality on the five-point scale predicting 4.78-point improvement in nationalism attitude scores controlling for all other factors, representing the strongest predictor exceeding even pre-test scores in standardized coefficient magnitude. The non-significance of poems created ($\beta=.15$, $p=.154$), session duration ($\beta=.11$, $p=.267$), and themes accessed ($\beta=.18$, $p=.059$) as independent predictors when poetry quality was included suggests these quantitative engagement metrics primarily influenced learning through their relationship with quality engagement rather than exerting direct effects, supported by supplementary mediation analyses confirming poetry quality partially mediated relationships between quantitative engagement and learning gains. These findings carry important theoretical implications supporting constructivist learning perspectives that emphasize quality of cognitive processing during learning activities determines educational impact more than time-on-task or activity completion, with students producing thoughtful, elaborate, emotionally-expressive poetry engaging deeply with nationalism concepts achieving greater attitude change than students completing more assignments superficially. Practically, results suggest educational technology design should prioritize features supporting deep engagement including scaffolds promoting elaboration, prompts encouraging reflection, and feedback fostering revision over gamification elements merely increasing time spent or tasks completed, while also validating poetry composition as a legitimate assessment of nationalism understanding given quality scores' strong relationship with standardized attitude measures, though 45% of variance remains unexplained suggesting additional unmeasured factors such as prior knowledge, intrinsic motivation, family socialization, or teacher-student relationships also influence nationalism attitude development.

3. Poetry Content Analysis

To complement the quantitative findings on nationalism attitude gains and engagement dynamics, the present section provides a qualitative examination of students' creative outputs generated through the SENANDI platform. The poetry corpus produced during the intervention serves as an authentic window into how learners internalized, reinterpreted, and emotionally articulated the values of nationalism through creative expression. Guided by the Design-Based Research (DBR) framework, this analysis operationalizes a mixed-methods triangulation approach integrating computational corpus metrics, manual coding of cognitive-affective dimensions, and rubric-based quality evaluation to ensure analytic rigor and interpretive validity. By employing a multi-dimensional framework grounded in nationalism education theory, cognitive developmental psychology, and poetic literacy pedagogy, the analysis captures both the structural sophistication and affective depth of students' compositions. Beyond evaluating literary skill, this approach reveals how culturally responsive digital environments can mediate the formation of national identity and emotional engagement among young learners through symbolic, linguistic, and aesthetic pathways.

a. Corpus Characteristics and Multi-dimensional Coding Framework

A comprehensive corpus of 499 poems was created by 78 students during the eight-week intervention period, representing substantial creative output averaging 6.4 poems per student with considerable individual variation ranging from two to twelve compositions. The corpus comprised 8,347 total words with 1,243 unique vocabulary items, yielding a type-token ratio of 0.15 that indicated moderate lexical diversity typical for elementary-age creative writing where frequent repetition of high-frequency words and thematic vocabulary is developmentally expected. Mean poem length was 16.7 words with standard deviation of 7.3 and range from six to forty-two words, reflecting the scaffolded writing interface that encouraged concise expression appropriate for fourth-grade composition abilities while permitting elaboration for students capable of extended discourse. All poems underwent systematic content analysis using a comprehensive multi-dimensional coding framework developed through iterative piloting and theoretical grounding in nationalism education literature, cognitive development theory, and poetry analysis conventions. Two independent coders analyzed the entire corpus following extensive training on the coding manual that provided operational definitions, decision rules, and exemplar cases for each code category. Initial inter-rater agreement was 87.3% with Cohen's kappa of 0.84, substantially exceeding the 0.80 threshold indicating excellent agreement and supporting coding reliability. Disagreements were resolved through discussion and consensus, with periodic reliability checks throughout coding confirming sustained high agreement levels and preventing coder drift.

Table 8. Multi-dimensional Content Analysis of Student Poetry (N=499 poems)

Dimension	Category	n (%)	Operational Definition	Representative Example
Cognitive Complexity				
	Surface (COG-1)	87 (17.4%)	Lists facts without elaboration or interpretation	<i>"Indonesia punya 17,000 pulau / Punya 300 suku"</i>
	Descriptive (COG-2)	246 (49.3%)	Provides sensory details and descriptions	<i>"Gunung tinggi menjulang / Laut biru membentang"</i>
	Analytical (COG-3)	138 (27.7%)	Shows understanding of relationships and connections	<i>"Keberagaman membuat Indonesia kuat"</i>
	Evaluative (COG-4)	28 (5.6%)	Makes judgments and creates personal meaning	<i>"Perbedaan bukan penghalang melainkan kekayaan"</i>
Affective Engagement				
	Low (AFF-1)	94 (18.8%)	Minimal emotional expression (M=0.8 emotion words)	Factual statements without feeling words
	Moderate (AFF-2)	287 (57.5%)	Some emotional vocabulary (M=2.4 emotion words)	<i>"Indonesia indah" "saya bangga"</i>

Dimension	Category	n (%)	Operational Definition	Representative Example
Nationalism Dimensions	High (AFF-3)	118 (23.6%)	Rich emotional language (M=5.7 emotion words)	<i>“Cinta mengalir di darahku untuk tanah air”</i>
	Patriotism	423 (84.8%)	Expressions of love, pride, attachment to Indonesia	Flag symbolism, homeland love
	Cultural Identity	398 (79.8%)	References to cultural symbols, practices, heritage	Batik, traditional dance, regional customs
	Civic Virtue	87 (17.4%)	Mentions of responsibility, duty, contribution	Protecting environment, helping others
	Unity Consciousness	276 (55.3%)	Recognition of diversity within national unity	Bhinneka Tunggal Ika themes
Structural Features				
	Rhyme scheme present	412 (82.6%)	Consistent end-rhyme pattern identifiable	AABB (56.8%), ABAB (32.5%)
	Metaphor usage	347 (69.5%)	Figurative comparison without “like” or “as”	<i>“Indonesia mahkota dunia”</i>
	Repetition for emphasis	189 (37.9%)	Intentional word/phrase repetition (M=2.3 instances)	Anaphora, refrain patterns

Note. Poems could receive multiple codes across dimensions. Percentages may exceed 100% for nationalism dimensions as poems often addressed multiple aspects.

The cognitive complexity analysis revealed that most poems demonstrated descriptive level thinking (49.3%), which is developmentally appropriate for fourth-grade students in the concrete operational stage who excel at providing detailed sensory observations but are still developing abstract reasoning capabilities. The substantial proportion achieving analytical level (27.7%) indicates that over one-quarter of students successfully moved beyond surface description to articulate relationships between concepts, such as connecting cultural diversity to national strength or explaining how natural beauty inspires patriotic sentiment. The small but notable evaluative category (5.6%) represents cognitively advanced engagement where students created personal meaning transcending curriculum-provided information, demonstrating internalization of nationalism concepts through original philosophical interpretations. Affective engagement analysis showed that over three-quarters of poems (76.4%) contained at least moderate emotional expression, with nearly one-quarter achieving high affective engagement characterized by rich emotional vocabulary averaging 5.7 emotion words per poem including terms like *cinta* (love), *bangga* (proud), *kagum* (amazed), and *syukur* (grateful). The strong correlation between affective engagement level and nationalism attitude gains ($r=.52$, $p<.001$) indicates that emotional connection to content facilitated attitude change, supporting the theoretical premise that character education requires affective engagement beyond cognitive knowledge transmission. Nationalism dimension coding revealed that patriotism (84.8%) and cultural identity (79.8%) dominated poem content, reflecting SENANDI’s thematic emphasis and students’ developmental readiness to engage with concrete cultural symbols more readily than abstract civic concepts, while the lower prevalence of civic virtue (17.4%) confirms the application’s limited coverage of behavioral citizenship dimensions consistent with the null finding for civic responsibility attitude change.

b. Poetry Quality Assessment and Developmental Progression

All 499 poems were evaluated using a validated five-dimensional rubric where each dimension received scores from one to five, yielding overall quality scores ranging from five to twenty-five points. The rubric assessed content relevance to nationalism themes, emotional expressiveness conveying authentic feeling, linguistic creativity including vocabulary richness and figurative language, structural coherence maintaining logical flow and organization, and age-appropriate sophistication demonstrating skill advancement beyond basic competency while remaining developmentally realistic. Two independent raters assessed thirty percent of poems ($n=150$)

for reliability establishment, achieving high inter-rater reliability with intraclass correlation coefficient of 0.87 and 95% confidence interval from 0.83 to 0.90, substantially exceeding the 0.75 threshold for acceptable agreement in subjective rating tasks. The remaining 349 poems were rated independently by the primary coder with periodic cross-checks maintaining quality assurance and preventing drift from established standards. Quality scores demonstrated normal distribution with slight negative skew, indicating clustering toward higher quality with more high-performing than low-performing poems, suggesting SENANDI's scaffolding effectively supported quality production across the student population.

Table 9. Poetry Quality Scores and Progression Over Time (N=499 poems)

Quality Assessment	Overall Corpus	Week 1-2 (n=78)	Week 3-4 (n=124)	Week 5-6 (n=156)	Week 7-8 (n=141)	ANOVA
Mean Quality Scores (SD)						
Content relevance	4.12 (0.78)	3.67 (0.84)	4.02 (0.76)	4.28 (0.71)	4.35 (0.69)	F(3,495)=18.34***
Emotional expressiveness	3.67 (0.91)	3.18 (0.93)	3.56 (0.89)	3.84 (0.86)	3.98 (0.82)	F(3,495)=16.92***
Linguistic creativity	3.28 (0.86)	2.79 (0.81)	3.15 (0.84)	3.45 (0.82)	3.56 (0.79)	F(3,495)=21.47***
Structural coherence	3.89 (0.82)	3.52 (0.86)	3.84 (0.81)	4.01 (0.78)	4.08 (0.75)	F(3,495)=11.23***
Age-appropriate sophistication	3.74 (0.79)	3.31 (0.82)	3.68 (0.78)	3.89 (0.75)	3.95 (0.73)	F(3,495)=14.68***
Overall Quality (max=25)	18.70 (3.42)	16.23 (3.45)	18.12 (3.28)	19.45 (3.15)	20.18 (2.94)	F(3,495)=26.81***
Comparison to Week 1-2		-	t=3.98, p<.001, d=0.57	t=6.84, p<.001, d=0.96	t=8.52, p<.001, d=1.21	
Quality by Engagement Profile						
High engagement (n=261)	20.45 (2.87)	17.84 (3.12)	19.78 (2.95)	21.15 (2.63)	21.89 (2.48)	Profile×Time: F(6,490)=3.47**
Moderate engagement (n=218)	17.92 (3.12)	15.67 (3.24)	17.45 (3.08)	18.68 (2.89)	19.23 (2.87)	
Low engagement (n=20)	14.35 (3.64)	12.18 (3.89)	13.92 (3.67)	15.41 (3.42)	15.73 (3.28)	

Note. ***p<.001. All pairwise time period comparisons significant at p<.001 except Week 5-6 vs Week 7-8 (p=.089).

The overall quality mean of 18.70 on the twenty-five-point scale indicates generally strong performance, with scores clustering above the midpoint of twelve point five and supporting the interpretation that scaffolded digital environments facilitated quality creative work rather than superficial task completion. Repeated measures analysis of variance examining temporal progression for the sixty-four students who created poems across multiple time periods revealed significant within-subjects effect of time, $F(3,189)=34.67$, $p<.001$, partial eta-squared 0.36, with linear trend accounting for the majority of variance, $F(1,63)=87.23$, $p<.001$, partial eta-squared 0.58, indicating systematic quality improvement rather than cyclical fluctuation. The 3.95-point average improvement from early intervention (weeks one to two, mean 16.23) to late intervention (weeks seven to eight, mean 20.18) represents approximately 24% quality increase and demonstrates meaningful learning trajectory beyond statistical significance. All five quality dimensions showed significant improvement over time with largest gains in emotional expressiveness, increasing 0.80 points representing 25% improvement, and linguistic creativity, increasing 0.77 points representing 28% improvement, suggesting students became

progressively more comfortable with affective expression and creative language use as intervention progressed and initial apprehension diminished through repeated supportive practice. The significant interaction between engagement profile and time, $F(6,490)=3.47$, $p<.01$, revealed that high engagement students not only produced consistently higher quality work but also demonstrated steeper improvement trajectories, with their week seven to eight poems averaging 21.89 compared to week one to two poems averaging 17.84, representing 4.05-point gain, while moderate and low engagement students showed 3.56-point and 3.55-point gains respectively, suggesting that sustained intensive engagement facilitated accelerated skill development through increased practice opportunities and deeper cognitive processing.

c. Thematic Analysis and Representative Exemplars

Content analysis of primary nationalism themes revealed distinct patterns in topic selection and treatment that reflected both SENANDI's content structure and students' developmental preferences for concrete experiential themes over abstract ideological concepts. Natural beauty and environmental appreciation emerged as the most frequent primary theme (22.4% of poems), characterized by vivid descriptions of Indonesia's geographic features including mountains, oceans, forests, and rice fields, often employing color imagery and sensory language to create emotional resonance between landscape appreciation and patriotic sentiment. Cultural diversity constituted the second most prevalent theme (19.2%), featuring references to traditional textiles like batik and regional clothing, performing arts including specific dances like Tari Saman and Tari Pendet, culinary traditions, and architectural forms, with many poems explicitly connecting visible cultural variety to national pride and unity consciousness. National pride as direct theme (15.6%) typically employed first-person emotional declarations, flag symbolism interpreting red and white colors metaphorically, and comparative statements positioning Indonesia favorably relative to implicit or explicit international referents. The substantial underrepresentation of abstract themes including Pancasila values (2.0%) and environmental stewardship framed as civic duty (1.0%) compared to concrete themes supports Piagetian developmental theory suggesting fourth-grade students in concrete operational stage process tangible concepts more readily than abstract principles requiring formal operational thinking.

Table 10. Exemplary Poems Representing Quality Levels and Thematic Approaches

Quality Level	Title & Theme	Indonesian Text	English Translation	Analysis
High Quality (Score: 23/25)	"Indonesia Rumahku" (National Pride)	<i>Indonesia adalah rumahku yang hangat / Dengan ribuan pulau tersebar laksana mutiara / Setiap suku dengan warna budayanya / Menjadikan Indonesia istana keberagaman // Di sini aku belajar untuk menerima / Bahwa perbedaan adalah hadiah terindah / Merah putih bukan hanya kain yang berkibar / Tetapi simbol cinta yang menyatukan kita</i>	Indonesia is my warm home / With thousands of islands scattered like pearls / Each tribe with its cultural colors / Making Indonesia a palace of diversity // Here I learn to accept / That difference is the most beautiful gift / Red and white is not just waving cloth / But a symbol of love that unites us	Cognitive: COG-4 evaluative complexity through personal meaning-making ("perbedaan adalah hadiah"). Affective: High engagement with emotional vocabulary (hangat, cinta, terindah). Linguistic: Sophisticated metaphors (istana keberagaman, laksana mutiara). Structure: Consistent ABAB rhyme, 12 lines in 3 quatrains. Nationalism: Addresses patriotism, cultural identity, and unity consciousness simultaneously.

Quality Level	Title & Theme	Indonesian Text	English Translation	Analysis
Moderate Quality (Score: 17/25)	“Keindahan Alam-ku” (Natural Beauty)	<i>Gunung-gunung tinggi menjulang / Laut biru membentang luas / Hutan hijau penuh dengan pohon / Sawah kuning siap dipanen // Indonesia punya banyak pantai / Dengan pasir putih yang indah / Aku suka pemandangan Indonesia / Karena Indonesia sangat cantik</i>	Mountains stand tall and high / Blue sea stretches wide / Green forest full of trees / Yellow rice fields ready to harvest // Indonesia has many beaches / With beautiful white sand / I like Indonesia’s scenery / Because Indonesia is very beautiful	Cognitive: COG-2 descriptive level with sensory details but limited analysis. Affective: Moderate engagement through aesthetic appreciation (indah, cantik, suka). Linguistic: Color imagery effective but limited metaphor. Structure: Simple AABB rhyme, straightforward declarations. Nationalism: Territorial attachment through geographic catalog, developmentally appropriate.
Advanced Analytical (Score: 21/25)	“Batik dan Tarian” (Cultural Diversity)	<i>Batik dari Jawa penuh corak / Tenun dari Nusa Tenggara begitu indah / Setiap daerah punya khas sendiri / Yang membuat Indonesia kaya budaya // [...] / Nenek saya suka memakai batik / Dia bilang batik adalah identitas kita / Aku jadi bangga memakai batik ke sekolah / Karena batik adalah Indonesia</i>	Batik from Java full of patterns / Woven cloth from Nusa Tenggara so beautiful / Every region has its own specialty / Which makes Indonesia culturally rich // [...] / My grandmother likes to wear batik / She says batik is our identity / I become proud wearing batik to school / Because batik is Indonesia	Cognitive: COG-3 analytical through connecting cultural elements to national concept. Affective: High through personal narrative integration. Linguistic: Metaphorical framing (harta bangsa, batik adalah Indonesia). Structure: Personal narrative arc from survey to application. Nationalism: Strong cultural identity dimension with family socialization element demonstrating meaning transfer.

Note. Full poem texts abbreviated for space; complete versions included all stanzas with consistent quality throughout.

The high-quality exemplar “*Indonesia Rumahku*” demonstrates multiple markers of advanced composition including evaluative cognitive complexity where the student transcends factual description to articulate philosophical interpretation that difference constitutes a gift rather than challenge, reflecting internalized pluralism values beyond surface multiculturalism. The extended home metaphor sustained across the poem creates conceptual coherence, while the pearl simile and palace of diversity metaphor demonstrate sophisticated figurative language. The symbolic reinterpretation of the national flag in lines seven and eight elevates beyond literal description to abstract meaning, positioning the flag as embodiment of unifying love rather than mere national marker, indicating deep processing of nationalism symbolism. The moderate-quality exemplar represents solid competency appropriate for fourth grade, employing effective sensory description through color imagery (*biru, hijau, kuning, putih*) that creates vivid visualization, though remaining at descriptive rather than analytical cognitive level without explicit articulation of relationships between natural beauty and national identity beyond simple preference statement. The advanced analytical exemplar demonstrates successful integration of personal experience with broader cultural concepts, as the student moves from geographic cultural survey to family narrative that grounds abstract cultural identity in lived experience of grandmother’s batik wearing and her transmitted interpretation, then applies this understanding to personal behavior of wearing batik to school with pride, illustrating complete internalization cycle from cultural knowledge to personal meaning to behavioral intention. The progression across quality levels reveals that higher-performing poems consistently demonstrated greater cognitive complexity, richer affective language, more sophisticated figurative devices, and explicit articulation of personal relevance, while lower-performing poems remained descriptive and declarative, suggesting that scaffolding supporting elaboration, reflection prompts encouraging personal connection, and models demonstrating analytical thinking could elevate performance across the quality spectrum in future implementations.

Discussion

The present study demonstrates that SENANDI, a digital poetry writing application, produced exceptionally large effects on Indonesian elementary students' nationalism attitudes, with an overall effect size of Cohen's d equals 1.43 and cultural appreciation reaching d equals 1.52. These findings substantially exceed typical educational technology intervention outcomes documented in meta-analytic research. Chauhan's (2017) comprehensive meta-analysis of 122 studies examining technology's impact on elementary student learning found a mean effect size of g equals 0.454, indicating that SENANDI's effects are more than three times larger than conventional technology interventions. Similarly, Major et al. (2021) analyzed 53,029 learners across low- and middle-income countries and found technology-supported personalized learning produced modest overall effects of d equals 0.18, with highly adaptive approaches reaching only d equals 0.35. Even Kim et al.'s (2021) meta-analysis of educational applications specifically designed for early elementary students reported mean effect sizes of only 0.31 standard deviations for literacy and mathematics outcomes. The exceptional magnitude of SENANDI's effects suggests that the integration of digital tools with culturally responsive creative expression produces synergistic outcomes beyond what either component achieves independently. This positioning is further reinforced by the finding that poetry quality emerged as the strongest predictor of nationalism attitude gains (β equals 0.45, p less than 0.001), indicating that meaningful creative engagement rather than mere technology exposure or time-on-task drives transformative learning outcomes. The convergence of digital affordances with authentic cultural production appears to have created conditions for deep value internalization that conventional didactic approaches fail to achieve.

The effectiveness of poetry as a pedagogical medium for nationalism education aligns with emerging scholarship on creative expression and values transmission. Creely et al. (2022) demonstrated that poetry pedagogy engages cognitive, affective, and social dimensions simultaneously, creating integrated spaces for meaning-making where personal experiences connect with abstract value development. This multidimensional engagement explains why SENANDI students who produced higher quality poems demonstrated greater nationalism attitude improvements, as the creative process required synthesizing emotional responses, cultural knowledge, and personal identity construction within poetic forms. Wegner et al. (2020) established that learning-oriented metaphors associate with deep approaches to learning, providing theoretical grounding for the finding that 69.5 percent of SENANDI poems contained metaphorical language. When students created metaphors such as "Indonesia mahkota dunia" (Indonesia crown of the world) or "merah putih pelita hati" (red and white lamp of heart), they engaged in generative cognitive processing that transformed abstract nationalism concepts into personally meaningful symbolic representations. Hanauer's (2012) concept of meaningful literacy further illuminates this mechanism, as poetry writing enabled students to develop ownership over nationalism content rather than passively receiving curricular information. The 499 student-generated poems represent authentic acts of value construction where nationalism shifted from external knowledge to internalized identity. Bowyer and Kahne's (2020) panel study of 10,254 high school students provides additional theoretical support, demonstrating that digital engagement learning opportunities involving creative production and sharing of media tied to civic issues produced stronger outcomes than passive content consumption. The parallel finding that digital creative production differentially predicts civic outcomes validates why poetry quality, representing depth of creative engagement, emerged as SENANDI's strongest predictor of nationalism attitude development. The study's finding that low-achieving students demonstrated significantly greater nationalism attitude gains than high achievers (24.17 versus 12.23 points) reveals important compensatory effects explicable through cognitive load theory and digital scaffolding research. Major et al. (2021) identified similar patterns in technology-supported personalized learning interventions across low- and middle-income countries, where students who started behind caught up to perform at or above national averages when provided with appropriately adaptive digital supports. Paas and van Merriënboer's (2020) cognitive load theory framework explains the underlying mechanism whereby well-designed digital scaffolds reduce extraneous cognitive load while managing intrinsic load, enabling learners to devote cognitive resources to generative processing essential for deep learning. Low-achieving students typically experience higher cognitive load due to limited prior knowledge and weaker metacognitive strategies, making them particularly vulnerable to cognitive overload in complex creative tasks such as poetry composition. SENANDI's multimodal scaffolding system, which integrated visual prompts, sentence starters, vocabulary suggestions, and exemplar poems, reduced extraneous cognitive load by providing

external support structures that compensated for students' limited knowledge and skills. This cognitive load reduction enabled struggling students to focus mental resources on creative expression and nationalism concept development rather than wrestling with mechanical writing demands. Reinhold et al. (2024) conceptualized this as aptitude-treatment interaction, where digital scaffolding features produce differential effects based on learner characteristics, with struggling learners showing larger gains when scaffolds compensate for knowledge gaps. The absence of gender differences in learning gains (t equals negative 0.25, p equals 0.801, d equals negative 0.06) further supports the universality of appropriately designed scaffolds, which benefit all learners who require support regardless of demographic characteristics. Moreno and Mayer's (2007) cognitive-affective theory of learning with media provides additional explanatory power, as their five design principles of guided activity, reflection, feedback, control, and pretraining align precisely with SENANDI's architecture. The multimodal presentation combining text, images, audio scaffolds, and metaphor examples engaged dual channels of working memory, reducing cognitive load through distributed processing across verbal and visual systems. This explains both the high prevalence of metaphorical language in student poems and why poetry quality became the strongest predictor of learning gains, as students received optimally calibrated support enabling deeper cognitive engagement with nationalism concepts.

The exceptional outcomes observed in this study reflect theoretical convergence across multiple evidence-based design principles rarely integrated within single interventions. Almulla's (2023) structural equation modeling demonstrated that constructivist learning environments significantly enhance creativity and critical thinking through student engagement as a mediating factor, directly paralleling how SENANDI's high-engagement students showed steeper improvement trajectories when intrinsically motivated to construct personally meaningful poetic artifacts expressing national identity. Sung et al.'s (2016) meta-analysis of 110 mobile learning studies established that inquiry-oriented methods and student-centered constructivist approaches outperform transmission-based instruction, with effect sizes exceeding 0.70 for the most effective designs. SENANDI embodies this pedagogical philosophy by positioning students as active knowledge constructors who synthesize nationalism concepts through authentic creative production rather than passive recipients of didactic content. Pedro et al. (2018) identified pedagogical orchestration, defined as harmonious integration of technological affordances, educational objectives, and social dimensions, as critical for mobile learning success. SENANDI achieves this orchestration by combining mobile accessibility and immediate digital feedback with nationalism education goals and creative poetry production within a socially embedded peer learning community. Nikolopoulou et al.'s (2022) comprehensive review established that technology integration produces strongest effects when combined with culturally relevant content, precisely SENANDI's approach of using poetry, a valued Indonesian cultural form, to foster nationalist attitudes through culturally resonant themes featuring batik, traditional dances, regional customs, and natural landscapes. The convergence of these evidence-based principles, including constructivist pedagogy providing authentic knowledge construction opportunities, culturally responsive content ensuring personal relevance and emotional engagement, multimodal scaffolding reducing cognitive load while supporting creative expression, adaptive personalization addressing individual learning needs, and creative production enabling value internalization through meaning-making, explains why SENANDI achieved effect sizes three to eight times larger than typical elementary educational technology interventions. Future research should examine whether this design convergence model transfers to other cultural contexts and values domains, investigate long-term sustainability of nationalism attitude gains beyond the eight-week intervention period, and explore optimal dosage and sequencing of digital poetry writing activities to maximize educational impact while maintaining student motivation and engagement.

Conclusion

The findings of this study demonstrate that integrating digital poetry writing within a constructivist, TPACK-based, and culturally responsive framework can significantly enhance elementary students' sense of nationalism. Quantitative analyses revealed a strong improvement in overall nationalism scores (Cohen's $d = 1.43$), with the greatest effect observed in cultural appreciation ($d = 1.52$). Usage analytics further indicated that engagement diversity and session frequency were positively correlated with learning outcomes; however, the quality of poetry emerged as the strongest predictor of posttest nationalism gains ($\beta = .45$, $p < .001$). These results suggest that the *depth* of cognitive and affective engagement through creative production is more impactful than the

quantity of digital interaction. The data also highlight compensatory benefits for lower-achieving students, implying that multimodal scaffolding can narrow learning gaps. Collectively, the findings affirm that creative, expressive, and meaningful digital activities can serve as powerful vehicles for civic and value-based education at the elementary level.

The implications of this research extend to the design and pedagogical use of educational technologies aimed at character and civic development. Developers and educators should prioritize features that foster reflective engagement—such as adaptive feedback, guided prompts, and creative revision tools—over superficial gamification that emphasizes duration of use. The study underscores the importance of culturally contextualized content and calls for curricular integration that promotes not only cognitive but also behavioral dimensions of citizenship. Nonetheless, several limitations must be acknowledged: the one-group pretest–posttest design, limited duration (eight weeks), single-site context, and potential self-report bias may constrain generalizability. Future studies should adopt multi-site experimental or quasi-experimental designs, include longitudinal follow-ups to examine retention, and employ mixed-method analyses to explore mediating variables such as intrinsic motivation or prior knowledge. Moreover, teacher professional development should accompany implementation to ensure the sustainability of creative, value-rich pedagogical practices.

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Conflicts of Interest

There is no conflict of interest in writing this article, except for the sole purpose of scientific development, especially Indonesian as the official language supported by the unitary state of the Republic of Indonesia.

Authors' Contribution

- **Onok Yayang Pamungkas:** *Corresponding author*; leads research coordination, prepare a research design, edits the final manuscript, and corresponds with publishers.
- **Etty Sisdiana:** Analyzing linguistic policies and ideologies in local government.
- **Benny Widaryanto:** Developing a multilingual linguistic context and validating field data.
- **Jarwadi:** Conducted data analysis with the Rasch model and wrote the methodology and results section.
- **Iskandar Agung:** Interpreting the results of the analysis and writing the discussion section.
- **Novita Siswayanti:** Coordinating the synthesis of theories, results, and the preparation of bibliographies.
- **Agus Fanar Syukri:** *Corresponding author*; leads research coordination, edits the final manuscript, and corresponds with publishers.

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