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Abstract

The transmission of regional cultural heritage to younger generations has become increasingly challenging amid globalization and the limited use of innovative instructional media in primary education. This study examined the effectiveness of Storybird-based digital storytelling in improving elementary school students' folktale narrative writing performance using “The Legend of Lake Toba” as instructional content. A quantitative one-group pretest–posttest design involved 35 elementary school students ($N = 35$, $df = 34$). Writing performance was assessed in terms of characterization, plot organization, and thematic development. Descriptive statistics and a paired-samples t-test were applied after the normality of the paired difference scores had been verified using the Lilliefors test. The mean writing score increased from 5.72 at pretest to 8.13 at posttest on a 10-point scale. This improvement was statistically significant, $t(34) = 8.092$, $p < .001$, 95% CI [1.80, 3.02], with a large paired-samples effect size (Cohen's $d_z = 1.37$). Storybird's visual prompts and sequential structure appeared to scaffold idea generation and narrative organization, with the largest improvement observed in characterization. These findings indicate that integrating local cultural content with multimodal digital storytelling can strengthen elementary students' narrative writing performance; broader claims concerning cultural preservation require direct measurement in future research.

Keywords: Digital Storytelling; Storybird; Folktale Writing; Narrative Writing; Elementary School Students.

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Language,
Technology,
and Social Media



INTRODUCTION

Local culture encompasses the values, beliefs, traditions, customs, and creative expressions that shape a community's identity and are transmitted across generations, including through local folktales. It provides a shared framework for communal life [1], [2], [3]. These values develop through learning, direct experience, social interaction, and everyday practices. Beyond traditions and artistic forms, local culture embodies collective wisdom that shapes a community's worldview [4], [5]. It also serves an educational function by conveying moral lessons, ethical principles, and character values that younger generations need to understand and sustain [6], [7], [8]. Education therefore plays a central role in helping students recognize, appreciate, and preserve local culture from an early age.

However, elementary school students' engagement with local culture has declined in recent years. One contributing factor is the continued use of instructional approaches that are insufficiently engaging or disconnected from children's everyday experiences. Many students struggle to recognize the relevance of local culture when global entertainment and visually appealing digital content are readily available. Foreign cultural influences disseminated through digital devices and social media are often perceived as more practical and contemporary, gradually displacing distinctively Indonesian values [9], [10], [11]. This challenge is compounded by limited and inconsistent efforts to introduce local culture in family and school settings.

Folklore is one form of cultural heritage affected by this shift. Although folktales can connect cultural identity with moral and social values, their intergenerational transmission has become less frequent [12]. Parents tell folktales less often at home, while classroom instruction commonly prioritizes factual textbook content and underuses folklore's educational potential. Narratives such as *The Legend of Lake Toba* communicate values including diligence, honesty, loyalty, and environmental responsibility [13], [14], [15]. Folklore can also support students' thinking, imagination, and academic development. Nevertheless, the decline of oral storytelling traditions has increasingly marginalized folklore amid globalization [16].

Classroom observations in the lower and middle grades indicated that folklore was rarely integrated into writing instruction. Students were generally asked to describe familiar objects or everyday experiences using simple language, whereas creative writing based on folklore received limited attention because engaging reading and visual materials were not readily available. Teachers continued to rely primarily on textbooks and worksheets and made limited use of digital media to support interactive storytelling. Consequently, students had few opportunities to develop fantasy or folklore narratives and limited exposure to their own cultural heritage through writing activities.

Recent advances in educational technology provide opportunities to integrate local folktales into language learning through interactive digital media. Storybird is one platform with considerable educational potential because it enables students to combine illustrated prompts with written narratives [17], [18], [19]. Previous studies have reported that Storybird and related digital storytelling tools can enhance students' motivation and engagement in writing by providing visually rich and interactive learning environments [20], [18], [19]. Its features may support writing through several mechanisms. Visual prompts provide concrete cognitive anchors that help students generate descriptive vocabulary and develop more vivid and consistent characterization. The sequential arrangement of images also functions as a structural scaffold that supports chronological idea development from exposition and rising conflict to climax and resolution. Finally, the platform's

multimodal affordances allow students to connect visual symbols with prior cultural knowledge, supporting idea generation and coherent thematic development in folktale narratives.

In this study, *The Legend of Lake Toba* was selected as the learning material because it represents an important element of Indonesian local cultural heritage. Although integrating local folktales into digital storytelling may encourage students' appreciation of local culture, cultural appreciation was not directly measured in this study. Therefore, the primary outcome of this research is elementary school students' folktale narrative writing performance, whereas the use of local cultural content is considered an instructional context and a potential educational implication rather than an empirical research outcome.

Previous research suggests that Storybird can improve narrative writing and increase students' interest in writing [21]. Its visual, interactive, and user-friendly features support idea generation and text construction. When used for folklore writing, Storybird can strengthen literacy skills while introducing students to local cultural content. However, its use in elementary-school folklore instruction, including narratives such as *The Legend of Lake Toba*, remains limited [22], [23], [24]. This situation calls for pedagogical innovation that uses digital tools to help students engage with their cultural heritage [25]. Storybird offers one such approach by enabling students to compose folktales in a visually supported environment. This approach can sharpen writing skills while making local traditions more engaging and relatable for contemporary learners. It also provides a practical way to introduce Batak Toba cultural content through creative writing activities.

This study responds to two pedagogical concerns: elementary school students' limited opportunities to engage with local culture and their low folktale narrative writing performance. By integrating Storybird-based digital storytelling into Indonesian language learning, the study presents *The Legend of Lake Toba* in an engaging digital environment relevant to contemporary learners. The primary objective is to examine the effectiveness of Storybird-based digital storytelling in improving elementary school students' folktale narrative writing performance. Although local folktales may encourage appreciation of cultural heritage, cultural appreciation is treated as a potential educational implication rather than a directly measured outcome. Accordingly, the study addresses the following research question: Does Storybird-based digital storytelling significantly improve elementary school students' folktale narrative writing performance? The directional hypothesis is that Storybird-based digital storytelling significantly improves this performance.

LITERATURE REVIEW

Local Folktales in Education and Language Studies

Within pedagogical and linguistic frameworks, regional folktales are sociocultural resources that can support language learning and cultural literacy. These narratives preserve collective memory, cultural values, and family histories through intergenerational storytelling [26]. In primary education, folktales can provide meaningful contexts for vocabulary development, interpretation, and narrative composition. Indonesian folklore, including *The Legend of Lake Toba*, also conveys ethical and environmental themes that can be used as culturally relevant learning content [13], [14], [15]. Integrating traditional narratives into classroom literacy activities may therefore connect language development with students' awareness of local values [6], [7], [25].

Digital Media and Writing Instruction in Elementary Education

Developments in educational technology underscore the capacity of digital media to enrich learning environments [17], [20], [23]. In writing pedagogy, multimodal tools can integrate text, imagery, and interactive features to support idea generation and narrative organization. Storybird's visual composition environment has been associated with perceived originality and creative text production [18], while classroom applications have reported support for students' environmental and creative writing [19]. Digital storytelling can also strengthen writing practice by requiring learners to plan, sequence, and communicate ideas through coordinated verbal and visual modes [27]. In primary education, these affordances are particularly relevant because visual sequences can reduce the difficulty of initiating and organizing a narrative.

Storybird as a Digital Storytelling Platform

Storybird is a web-based platform that facilitates narrative composition through professional visual illustrations. Research indicates that Storybird can support originality, creative text generation, and the organization of written narratives [18], [19]. Evidence from digital storytelling research also suggests that structured multimedia composition can strengthen writing practice by requiring learners to plan, draft, and sequence ideas [27]. However, previous Storybird research has predominantly examined general narrative writing, learner perceptions, or English as a Foreign or Second Language contexts. An empirical gap therefore remains regarding its use in primary education to support localized heritage narratives in non-EFL settings.

Previous investigations have often relied on qualitative case studies, perception surveys, or broad measures of motivation and creativity rather than objective assessment of specific narrative-writing components [18], [19], [21]. A recurring limitation is the limited quantitative examination of characterization, plot organization, and thematic development in conjunction with local cultural content. The present study addresses this gap by using a quantitative framework to measure targeted folktale-writing skills among elementary school students.

Digital Storytelling and Cultural Preservation

Sociocultural researchers increasingly recognize digital storytelling as a potential mechanism for presenting and transmitting intangible cultural heritage in formats accessible to younger generations [28], [29]. Digital storytelling activities can encourage learners to interpret ethical and cultural themes rather than merely reproduce traditional narratives [30], [31]. Incorporating folktales into digital writing environments may therefore create a complementary framework in which literacy development and cultural learning support one another. Nevertheless, any claim that such activities preserve culture requires direct evidence concerning cultural knowledge, attitudes, or long-term participation; those outcomes were not measured in the present study [32].

Synthesis, Research Gaps, and Study Positioning

The literature reveals theoretical, contextual, and methodological gaps that the present study addresses. Theoretically, although digital storytelling is widely associated with writing engagement, the mechanisms through which Storybird's multimodal affordances support the core narrative structures of local folktales remain underexplored. Contextually, previous research has focused largely on secondary or higher education students in EFL settings, leaving limited evidence concerning elementary school students' use of digital platforms to engage with local cultural

heritage. Methodologically, many studies have relied on perceptions, qualitative evidence, or holistic rubrics. The present study addresses these gaps through a quantitative one-group pretest-posttest design that measures specific folktale narrative components in an Indonesian elementary education context.

Cultural Synchronization as an Analytical Lens

The intersection of digital instructional technology and heritage education can be interpreted through cultural synchronization as an analytical lens rather than as a directly tested theory. Media can synchronize social practices and communication across time and settings [33], while communication across cultural contexts depends on accessible channels and relevant competencies [34]. In globalized educational environments, print-based and oral storytelling may compete with the multimodal media practices familiar to young learners [17], [35]. In this study, cultural synchronization refers to presenting local heritage through a contemporary digital format so that traditional narrative content remains accessible within current literacy practices. This lens informs the interpretation of the intervention but is not treated as an empirically measured construct.

Conceptual Affordances of Multimodal Storytelling

To explain Storybird's instructional utility, its influence can be considered through its visual, narrative, and multimodal affordances. Constructing a cohesive text requires young learners to manage multiple cognitive demands, from writing mechanics to conceptual planning. Storybird's illustrations can function as external prompts that activate semantic associations and support descriptive language [18], [19]. Its sequential, multipage layout can also support narrative organization by encouraging writers to arrange ideas into orientation, complication, climax, and resolution. More broadly, digital storytelling requires learners to coordinate verbal and visual modes during planning and composition [27], while interactive digital platforms may provide additional support for narrative experimentation [23].

Construct Delineation: Writing Performance versus Cultural Preservation

In evaluating the outcomes of this digital intervention, a rigorous distinction must be maintained between the direct enhancement of language skills and the broader concept of regional cultural preservation. Student narrative writing performance is conceptualized here as an empirically measurable behavioral outcome, operationally verified through standardized assessments of characterization, plot, and theme. Conversely, cultural preservation and transmission represent wider socio-educational phenomena that involve shifting attitudes, community-wide knowledge retention, and long-term societal engagement. Recognizing this methodological boundary, this study explicitly isolates student text-generation performance as its sole quantified empirical construct. While the integration of "The Legend of Lake Toba" provides the vital localized context through which synchronization occurs, the study does not claim to statistically measure broader systemic changes in students' internal motivation, behavioral engagement, or long-term cultural preservation. Instead, cultural heritage serves as the instructional schema, ensuring that the descriptive and inferential conclusions remain strictly tethered to the direct evidence captured by the literacy evaluation instruments.

METHODS

Research Design

This study employed a quantitative approach using a pre-experimental one-group pretest-posttest design. The design enabled the researchers to examine changes associated with the Storybird intervention by comparing learning outcomes before and after instruction within a single group [36], [37], [38]. The research process, from data collection and processing to interpretation, relied on numerical data and objective statistical procedures [39]. Consistent with the principles described in [39], the quantitative approach was used to assess changes in elementary school students' folktale narrative writing performance from pretest to posttest.

The primary assessment tool was a writing performance test designed to measure students' ability to compose local folktales. The instrument was organized around key indicators of creative narrative writing. Before administration, it underwent content-validity review to determine whether the prompts aligned with the intended skills. The validation framework followed [40] and focused on three indicators: (1) characterization, (2) plot structure, and (3) theme. These components were selected because they constitute the structural foundation of coherent narrative and folktale writing. Experienced classroom practitioners also reviewed the instrument for suitability to the students' cognitive levels and learning characteristics.

Population and Sample

The participants were 35 elementary school students enrolled in one intact folktale-writing class at the research site. Purposive sampling was used because the class followed the relevant Indonesian-language instructional schedule and met the study criteria. Eligible students had previously studied basic narrative texts, had not used Storybird for writing activities, and completed the pretest, four intervention sessions, and posttest. The final analytic sample was $N = 35$ ($df = 34$ for the paired-samples analysis). The available research records did not specify the school's name or location, the students' exact grade level or age range, or the calendar period of data collection; these details were therefore not inferred.

Research Instrument

The study used a writing performance test designed to evaluate elementary school students' ability to construct local folktales. Students' narratives were assessed across three dimensions: characterization, plot, and theme. Characterization concerned the clarity and behavioral consistency of characters throughout the story. Plot concerned the logical organization of orientation, conflict, climax, and resolution. Theme concerned the integration of local cultural and moral values into the narrative.

To ensure comparability across assessment occasions, the same writing prompt, "The Legend of Lake Toba," was administered at pretest and posttest. To reduce potential practice effects, students did not receive corrective feedback, model essays, or prompt-specific instruction after the pretest. Instead, the intervention focused on general narrative-writing skills through Storybird-based learning activities. Improvements were therefore expected to reflect the instructional experience more plausibly than simple familiarity with the assessment prompt.

Students' written compositions were scored using an analytic rubric with a four-point scale ranging from 1 (poor) to 4 (excellent) for each dimension. The raw scores were converted into a standardized quantitative dataset for inferential analysis. Before field implementation, experts in

Indonesian language education and experienced elementary school practitioners reviewed the instrument and confirmed its suitability for assessing local folktale-writing competencies. All pretest and posttest compositions were scored by one trained rater using the same rubric and scoring criteria. No second independent rater was used; therefore, inter-rater reliability was not estimated.

Data Collection Procedure

Data were collected through sequential pretest and posttest writing assessments. In the initial session, the classroom teacher introduced the definitions, structures, elements, and characteristics of traditional local folktales. Students then completed the pretest by independently writing a folktale titled "The Legend of Lake Toba" within the allotted time and without assistance from digital tools. This assessment established their baseline writing performance before the intervention.

After the pretest, students participated in four structured Storybird-based instructional sessions, each lasting approximately 70 minutes. The teacher introduced the platform, demonstrated its features, clarified the learning objectives, and guided students as they navigated the digital storytelling environment. The instructional sequence comprised five steps: (1) introducing the Storybird interface and technical functions; (2) presenting a digitized version of "The Legend of Lake Toba" using illustrations and visual narratives; (3) facilitating discussion of characterization, plot development, narrative structure, and local cultural values; (4) guiding students to identify the criteria of an effective folktale; and (5) supporting students as they brainstormed, developed, and organized ideas before writing. Students used Storybird individually for approximately 40 minutes in each session. The teacher monitored participation, resolved procedural and technical difficulties, and ensured equitable platform access, but did not provide corrective linguistic feedback, distribute model essays, or directly revise students' drafts.

At the end of the intervention, students independently produced a final written version of The Legend of Lake Toba by applying the narrative-writing skills developed during the treatment. The same prompt was used at pretest and posttest to preserve direct comparability. To minimize practice effects, students did not receive corrective feedback, model essays, or opportunities to revise their pretest drafts. The instruction emphasized transferable narrative-writing skills rather than prompt-specific drilling. Both pretest and posttest compositions were evaluated by the same trained rater using the same analytic rubric. Because no second independent rater was involved, no inter-rater reliability coefficient was calculated.

Data Analysis

Quantitative data from the pretest and posttest writing assessments were analyzed using descriptive and inferential statistics. Each narrative was evaluated with the validated analytic rubric, and the total raw score was converted to a ten-point scale by dividing the obtained score by the maximum possible score and multiplying by ten. The converted scores were classified into predefined mastery categories to describe proficiency levels. Group means were calculated for the pretest and posttest. Means, frequencies, percentages, and a box-and-whisker plot were used to summarize and visualize the score distributions.

Before hypothesis testing, the normality of the paired difference scores (posttest minus pretest) was examined using the Lilliefors test. The calculated statistic (L_0) was compared with the critical value (L_{table}) at $\alpha = .05$. The paired differences were considered sufficiently normal when $L_0 < L_{table}$. If this assumption was satisfied, a paired-samples t-test was used; otherwise, a

Wilcoxon signed-rank test was specified as the nonparametric alternative. Because the same participants completed both assessments, a homogeneity-of-variance test was not required for the paired analysis. These procedures were consistent with the study's quantitative and pretest-posttest design [37], [38], [39].

After the prerequisite analysis, a directional one-tailed paired-samples t-test was conducted at $\alpha = .05$ to determine whether Storybird-based digital storytelling significantly improved students' folktale narrative writing performance. A two-sided 95% confidence interval was reported for the paired mean difference. The paired-samples effect size was expressed as Cohen's d_z , calculated from the t statistic and sample size. The statistical findings were interpreted in relation to the measured writing outcomes; broader claims about cultural preservation were not treated as directly tested outcomes.

RESULTS AND DISCUSSION

Results

Proficiency Level in Writing Folktales among Elementary School Students

Students' posttest mastery scores across the three writing indicators ranged from 66.67% to 88.89%. After the Storybird-based intervention, 6 students (17.14%) achieved 66.67%, 12 students (34.28%) achieved 77.78%, and 17 students (48.57%) achieved 88.89%. The distribution is summarized in Table 1.

Table 1. Frequency Distribution of Folktale Writing Proficiency Using Storybird-Based Media Across Three Indicators

X	F	FX
66.67	6	400.02
77.78	12	933.36
88.89	17	1511.13
N = 35	$\Sigma FX = 2844.51$	

Source: Primary data processed by the researchers.

As shown in Table 1, the mean mastery score was 81.27%, which falls within the good category (76–85%). Six students (17.14%) were classified as more than adequate, 12 students (34.29%) as good, and 17 students (48.57%) as very good.

The Influence of Storybird-Based Media Use on Folktale Writing Performance in Elementary School Students

Table 2 compares the mastery categories of the 35 students at pretest and posttest. At pretest, 3 students were classified as very good, 2 as good, 8 as more than adequate, 10 as adequate, 8 as inadequate, 2 as very inadequate, and 2 as very poor. At posttest, 6 students were classified as more than adequate, 12 as good, and 17 as very good. All category frequencies sum to 35 at each assessment, indicating an overall shift toward higher mastery levels after the use of Storybird.

Table 2. Comparison of Students' Folktale-Writing Mastery Levels at Pretest and Posttest

No.	Qualification	Proficiency Level	Scale	Pretest	Posttest
1	Excellent	96–100%	10	0	0
2	Very Good	86–95%	9	3	17
3	Good	76–85%	8	2	12
4	More Than Adequate	66–75%	7	8	6
5	Adequate	56–65%	6	10	0
6	Almost Adequate	46–55%	5	0	0
7	Inadequate	36–45%	4	8	0
8	Very Inadequate	26–35%	3	2	0
9	Poor	16–25%	2	0	0
10	Very Poor	0–15%	1	2	0
Total				35	35

Source: Primary data processed by the researchers.

Overall, the categorical distribution shifted toward higher proficiency levels after the intervention, with most posttest scores concentrated in the more-than-adequate, good, and very-good categories.

Data Normality Testing

Before the primary hypothesis test, the distribution of the paired difference scores (posttest minus pretest) was examined using the Lilliefors method. For $N = 35$ at $\alpha = .05$, the critical value was 0.1498. Table 3 presents the test result.

Table 3. Lilliefors Normality Test for Paired Difference Scores

No	Variable Group	Sample Size (N)	Significance Level (α)	Test Statistic (L0)	Critical Value (Ltable)	Statistical Assessment
1	Paired Score Differences (Posttest - Pretest)	35	0.05	0.1242	0.1498	Normally Distributed

Source: Primary data processed by researchers, 2026.

As shown in Table 3, the calculated Lilliefors statistic was lower than the critical value ($L0 = 0.1242 < Ltable = 0.1498$). The null hypothesis of normality was therefore not rejected, indicating that the paired difference scores were sufficiently consistent with a normal distribution for the paired-samples t-test.

Descriptive Statistics Analysis

Descriptive statistics were calculated to summarize the students' performance before and after the intervention. All scores were reported on a ten-point scale. Table 4 presents the mean, standard deviation, median, interquartile range, minimum, and maximum for the pretest and posttest.

Table 4. Descriptive Statistics for Folktale-Writing Scores

Descriptive Statistical Metric	Pretest Baseline	Posttest Outcome
Mean	5.72	8.13
Standard Deviation (SD)	1.15	0.90
Median	5.80	8.30
Interquartile Range (IQR)	1.70	1.45
Minimum Score	3.30	5.80
Maximum Score	7.50	9.20

Source: Primary data processed by researchers, 2026.

The mean score increased by 2.41 points, from 5.72 at pretest to 8.13 at posttest. The median also increased from 5.80 to 8.30, indicating an upward shift in the center of the score distribution. The standard deviation decreased from 1.15 to 0.90, while the interquartile range decreased from 1.70 to 1.45. These changes indicate that posttest scores were less dispersed around a higher central value. The minimum score increased from 3.30 to 5.80, and the maximum increased from 7.50 to 9.20, showing improvement across the observed score range.

Analysis of Narrative Writing Component Scores

Student performance was also examined across three components of folktale writing: characterization, plot structure, and thematic development. Component-level analysis provides a more specific account of the dimensions that changed after the intervention. All component scores were standardized to a ten-point scale, as presented in [Table 5](#).

Table 5. Narrative-Writing Component Scores at Pretest and Posttest

No	Narrative Writing Indicator	Pretest Mean	Posttest Mean	Mean Gain	Performance Shift (%)
1	Characterization	5.48	7.95	+2.47	45.07%
2	Plot Structure	5.62	8.08	+2.46	43.77%
3	Thematic Development	6.05	8.35	+2.30	38.01%

Source: Primary data processed by researchers, 2026.

[Table 5](#) shows improvement across all three narrative dimensions, with the largest mean gain in characterization. The mean characterization score increased from 5.48 at pretest to 7.95 at posttest, a gain of 2.47 points (45.07%). This increase suggests that Storybird's visual and interactive features supported students in developing more detailed and consistent character descriptions. Plot-structure scores also increased substantially, from a pretest mean of 5.62 to a posttest mean of 8.08, representing a gain of 2.46 points. The platform's sequential narrative format may have helped students organize their folktales into more coherent stages and reduce fragmented timelines. The theme score increased from 6.05 to 8.35, a gain of 2.30 points (38.01%). Although this was the smallest relative increase among the three components, the posttest mean indicates stronger integration of moral values and cultural themes. Overall, the component-level results show improvement across the principal dimensions of narrative writing.

Hypothesis Testing

After the normality assumption had been examined, a directional one-tailed paired-samples t-test was conducted at $\alpha = .05$ using IBM SPSS Statistics Version 26. The analysis tested whether Storybird-based digital storytelling was associated with a statistically significant improvement in elementary school students' folktale narrative writing performance. The directional test was specified a priori because the hypothesis predicted improvement.

The analysis indicated a statistically significant increase from pretest to posttest, $t(34) = 8.092$, $p < .001$. The 95% confidence interval for the paired mean difference was [1.80, 3.02], and the paired-samples effect size was large (Cohen's $d_z = 1.37$). The statistical result is summarized below.

$$t(34) = 8.092, p < .001, 95\% CI [1.80, 3.02], d_z = 1.37.$$

These results indicate a large and educationally meaningful improvement in students' narrative writing performance after the Storybird-based intervention. The null hypothesis (H_0) was rejected. Table 6 summarizes the reported inferential statistics.

Table 6. Summary of Paired-Samples t-Test and Inferential Parameters

No	Statistical Parameter	Operational Value / Result	Methodological Interpretation
1	Sample Size (N) and Degrees of Freedom (df)	$N = 35$; $df = 34$	Standard single-group sample constraints
2	Pretest-to-Posttest Mean-Score Shift	Pretest = 5.72; Posttest = 8.13	Post-intervention descriptive increase
3	Paired-Samples t-Test Statistic	$t(34) = 8.092$	Consistent with the reported mean difference and confidence interval
4	Significance Level (p Value)	$p < .001$ (one-tailed)	Statistically significant at $\alpha = .05$
5	95% Confidence Interval for the Mean Difference	[1.80, 3.02]	Reported interval does not include zero
6	Effect-Size Measure (Cohen's d_z)	$d_z = 1.37$	Large paired-samples effect

Source: Primary data processed by researchers, 2026.

The statistical decision was based on the null hypothesis (H_0), which stated that Storybird-based digital storytelling would produce no significant change in students' folktale writing performance. The directional alternative hypothesis (H_1) predicted higher posttest scores.

The paired-samples t-test yielded $t(34) = 8.092$ with $p < .001$. The 95% confidence interval [1.80, 3.02] did not include zero, and the paired-samples effect size was large (Cohen's $d_z = 1.37$). On this basis, H_0 was rejected. These findings indicate that the observed score increase was unlikely to reflect sampling variation alone; however, causal attribution remains limited by the one-group pretest-posttest design.

Visual Distribution of Score Changes

Figure 1 presents the reported five-number summaries of the pretest and posttest score distributions in a side-by-side box-and-whisker plot, including the minimum, first quartile, median, third quartile, and maximum.

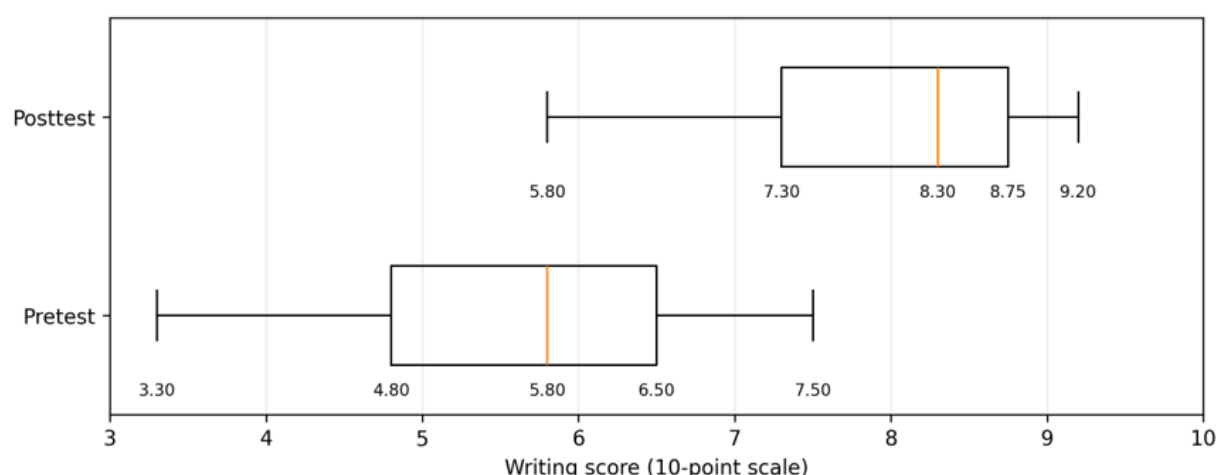


Figure 1. Distribution of Pretest and Posttest Folktales-Writing Scores (N = 35)

Figure 1 shows a clear upward shift in the posttest distribution. The posttest median and quartiles are higher than their pretest counterparts, and the posttest scores are more tightly concentrated. The posttest first quartile is above the pretest third quartile, indicating separation between the middle portions of the two distributions. Because the figure summarizes reported distributional statistics rather than individual raw scores, it should be interpreted as descriptive evidence of a broad class-level shift.

Empirical Boundaries of the Findings

The findings in this section are limited to the quantified measures of narrative writing performance. Psychological and cultural variables, including motivation, behavioral engagement, and broader cultural preservation, were not operationalized or assessed with standardized instruments. Accordingly, the evidence for the Storybird intervention rests on the measured changes in characterization, plot organization, and thematic development. Conclusions and implications should remain aligned with these assessed writing outcomes.

Discussion

The mean writing score increased from 5.72 at pretest to 8.13 at posttest, demonstrating a substantial improvement after the Storybird-based intervention. Storybird may have supported this improvement through visual, sequential, and multimodal scaffolds related to characterization, plot, and theme. Characterization showed the largest mean gain (+2.47), which may reflect the role of visual prompts in helping students translate observable details into written descriptions. Plot organization increased by 2.46 points, consistent with the platform's sequential page structure, which can support orientation, complication, and resolution. The thematic-development mean reached 8.35 at posttest, suggesting that combining images with text helped students articulate moral and cultural ideas within their narratives.

These findings can be interpreted through cognitive scaffolding and the analytical lens of cultural synchronization. Media can coordinate social practices across time and settings [33], while culturally relevant communication depends on accessible channels and competencies [34]. Traditional storytelling may receive less attention when learners' everyday literacy practices are increasingly multimodal and digitally mediated [17], [35].

The intervention can be interpreted as an example of cultural synchronization because it presented Batak cultural content through a digital environment familiar to elementary school students. This alignment connected traditional heritage with digital literacy and allowed students to engage with images, written text, and illustrations while composing narratives. Prior research indicates that digital storytelling can provide contemporary channels for communicating cultural values and heritage [28], [29], [30], [31], [32]. In the present study, however, this interpretation remains an educational implication rather than a directly measured cultural outcome.

Although the statistical result ($t(34) = 8.092$, $p < .001$, $d_z = 1.37$) supports rejection of the null hypothesis, alternative explanations must be considered because the study used a one-group pretest-posttest design. First, improvement may partly reflect practice effects arising from repeated administration of the same writing prompt. Second, the outcome cannot be attributed to the software alone because teacher scaffolding, prompts, and technical guidance were integral to the intervention. Third, students' familiarity with The Legend of Lake Toba may have facilitated idea generation. Finally, initial enthusiasm for Storybird may represent a short-term novelty effect. Longitudinal and controlled studies are needed to distinguish these possibilities.

A clear distinction must be maintained between the measured writing outcomes and the broader discussion of cultural heritage. Local culture can support identity, character education, and educational development [6], [7], [41], [32], while Storybird and digital storytelling have been used to support creativity and writing practice in other contexts [18], [19], [27]. However, this study did not directly measure motivation, engagement, or long-term cultural preservation. Pedagogical recommendations should therefore focus on using multimodal platforms to scaffold character description, plot sequencing, and thematic development. Digital tools should be integrated with explicit teacher guidance rather than used as unguided activities.

CONCLUSION

This study found that Storybird-based digital storytelling was associated with improved elementary school students' folktale narrative writing performance. On the 10-point scale, the mean score increased from 5.72 at pretest to 8.13 at posttest, and the paired-samples analysis was statistically significant, $t(34) = 8.092$, $p < .001$, 95% CI [1.80, 3.02], with a large paired-samples effect size (Cohen's $d_z = 1.37$). Storybird's visual, narrative, and multimodal features may have supported idea generation, plot organization, characterization, and thematic coherence. Because the study used a one-group pretest-posttest design, the result should be interpreted as improvement associated with the intervention rather than definitive evidence of causality. Although The Legend of Lake Toba provided a culturally relevant instructional context, cultural appreciation was not directly measured and should be interpreted only as a potential educational implication. Future research should use stronger experimental designs and direct measures of cultural appreciation.

LIMITATIONS

Several methodological limitations should be considered. First, the one-group pretest-posttest design did not include a randomized control group, limiting the ability to separate the intervention effect from practice, teacher guidance, or short-term novelty. Second, the sample was relatively small ($N = 35$), drawn from one primary school, and focused on a familiar regional story, limiting generalizability to other populations and cultural contexts. The available research records also did not specify the school location, exact grade level or age range, or calendar period of data collection, which limits contextual replication. Third, the short intervention did not permit assessment of long-term retention. Finally, all compositions were scored by a single rater; consequently, inter-rater reliability could not be established. Future research should employ randomized controlled designs with active comparison groups and larger multisite samples to strengthen internal and external validity. Independent raters and appropriate inter-rater reliability estimates should be used, and delayed posttests should assess the retention of writing skills. Studies examining broader socioeducational outcomes should also use validated instruments to measure cultural literacy, motivation, and behavioral engagement as distinct constructs.

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AUTHOR CONTRIBUTION

H. conceptualized the study, developed the research framework, coordinated the project, and drafted the manuscript. F.Y.P. contributed to the research design, instrument development, statistical analysis, and interpretation of the findings. N. coordinated data collection, supported instrument validation, and contributed to the methodological refinement. L.M.P. contributed to the implementation of the Storybird-based intervention, data interpretation, and critical revision of the results and discussion. N.A. supported data organization, preparation of tables and figures, and reference verification. S.M.S. contributed to manuscript proofreading, IEEE reference formatting, and technical editing. All authors reviewed and approved the final manuscript and accept responsibility for the integrity and accuracy of the work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

The authors used ChatGPT and Grammarly during the preparation of this manuscript to assist with language editing, academic clarity, and consistency of expression. All generated or edited content was carefully reviewed, verified, and revised by the authors, who take full responsibility for the final content of the manuscript.

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