

Digital storytelling as a dual-purpose pedagogical tool for developing literacy proficiency and creative expression in Indonesian EFL writing classrooms

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ABSTRACT

This study investigates the effects of digital storytelling (DST) on EFL students' writing performance and creative thinking in Indonesian higher education writing classrooms. The topic was selected because Indonesian universities continue to face uneven access to technology, while EFL writing instruction still struggles to balance linguistic accuracy with opportunities for creative development. Using an explanatory sequential mixed-methods design, this study involved 120 students and 10 lecturers from six universities in East Java, Indonesia. The quantitative phase employed a quasi-experimental pretest-posttest design. Students' writing performance was assessed using Jacobs' writing rubric, focusing on grammatical accuracy, lexical diversity, and textual coherence, while creative thinking was evaluated using adapted Torrance-based criteria that measured originality, elaboration, and fluency. The qualitative phase drew on semi-structured interviews, classroom observations, and analysis of students' DST artifacts to explain the quantitative findings. The statistical analysis results showed significant improvements in grammatical accuracy ($d = 0.55$), lexical diversity ($d = 0.62$), and textual coherence ($d = 0.70$). Students also demonstrated substantial gains in originality ($d = 1.02$), elaboration ($d = 0.95$), and fluency ($d = 1.10$). Qualitative evidence further showed that storyboarding, iterative script revision, multimodal design, and peer feedback helped students refine language use while expanding creative responses. The findings also indicate that DST remains applicable across institutions when structured scaffolding is provided. These findings suggest that DST can serve as a meaningful pedagogical approach for strengthening writing performance and creative thinking in resource-diverse EFL contexts.

Keywords: Creative thinking; digital storytelling; EFL writing instruction; Universal Design for Learning (UDL); writing performance

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INTRODUCTION

The field of Computer-Assisted Language Learning (CALL) has undergone a significant transformation in recent years, with technology becoming increasingly vital for addressing diverse learner needs in language education. (Gillespie, 2020; Hafner & Ho, 2020). Contemporary CALL research

moved beyond drill-based and form-focused applications toward process-oriented pedagogical tools that support higher-order language skills across the stages of planning, drafting, and revising. This shift reflects a growing recognition that a technology-mediated learning environment can play a crucial role in supporting complex literacy

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practices, particularly in second- and foreign-language writing instruction. Within this paradigm, CALL is no longer viewed merely as a supplementary resource but as an integral component of pedagogical design that mediates learners' engagement with language, meaning-making, and creative expression.

In Indonesian EFL contexts, where educational resources can be limited, integrating process-oriented technologies into writing instruction presents both challenges and opportunities. Digital storytelling (DST) has emerged as a particularly promising yet underexplored pedagogical tool in EFL writing instruction. (Alnabhan & Aljaraideh, 2014; Fu et al., 2022; Liu et al., 2019). While platforms such as gamified learning applications and collaborative writing tools have been extensively examined (Ivanova et al., 2022; Strobl et al., 2019; Zhang & Zou, 2022), DST's potential to enhance literacy proficiency and creative expression simultaneously remains underexplored, as previous studies have predominantly investigated these outcomes in isolation rather than as interdependent dimensions of EFL writing development. (Dhuli et al., 2023; Effendi et al., 2024; Tuzahra et al., 2021). This gap is particularly noteworthy given the growing recognition of multimodal approaches in language education and their alignment with Universal Design for Learning (UDL) principles.

Digital storytelling (DST) has emerged as a transformative pedagogical tool in English as a Foreign Language (EFL) writing instruction, integrating multimedia elements such as images, audio, and video to create narrative-driven compositions. (Robin, 2016; Smeda et al., 2014; Zarei & Navidinia, 2024). Rather than treating writing as a linear, text-only activity, DST situates writing within a broader multimodal design process that includes storyboarding, scriptwriting, multimedia production, and iterative revision. This approach aligns with contemporary views of literacy as a socially situated, multimodal practice rather than a purely linguistic skill. (Buendgens-Kosten, 2020; Cope & Kalantzis, 2009; Hafour, 2024). In EFL writing contexts, DST offers learners alternative pathways for meaning-making, allowing them to draw on multiple semiotic resources when linguistic proficiency alone may be insufficient to convey complex ideas or emotions.

EFL writing instruction continues to face significant challenges in balancing technical writing skills with creative expression (Ghufron & Nurdianingsih, 2021; Kazazoglu & Bilir, 2021; Paltridge, 2020). Empirical studies consistently report that EFL learners struggle with sentence-level accuracy and cohesion while simultaneously experiencing difficulty expressing original ideas within rigid curricular frameworks. (Shapauov et al., 2023; Weng & Chiu, 2023; Zhang & Zou, 2022). At the same time, teachers find it difficult to foster

creativity within rigid curricular frameworks (Habibi et al., 2019; Pawlak, 2022; Zenouzagh et al., 2023). This dichotomy has resulted in writing being perceived as mechanical rather than expressive. Digital storytelling, integrating text, visuals, and audio, offers a compelling solution that combines linguistic development with creative exploration. (Kasch, 2021; Nguyen et al., 2023). Digital storytelling (DST) supports literacy development through scriptwriting and iterative revision processes that promote grammatical accuracy and lexical elaboration, while its multimodal affordances facilitate creative expression through symbolism, non-linear narrative structures, and multimodal meaning-making.

Within this context, digital storytelling offers a pedagogical response that bridges linguistic development and creative engagement. DST supports literacy development through scriptwriting and iterative revision processes that encourage learners to attend carefully to grammatical accuracy and lexical elaboration, as written scripts must be refined before being transformed into multimodal narratives. At the same time, DST's multimodal affordances facilitate creative expression through symbolism, non-linear narrative structures, and multimodal meaning-making, enabling learners to communicate ideas that extend beyond their current linguistic resources. These features position DST as a pedagogical approach that simultaneously fosters technical writing proficiency and creativity in EFL contexts.

The pedagogical value of DST in EFL writing is grounded in several complementary theoretical frameworks, particularly multimodal literacy theory, Universal Design for Learning (UDL), and sociocultural theory (SCT). From a multimodal literacy perspective, literacy is understood as the ability to design meaning through the orchestration of multiple semiotic modes, including linguistic, visual, auditory, and spatial resources. (Buendgens-Kosten, 2020; Cope & Kalantzis, 2009; Hafour, 2024). Digital storytelling exemplifies this perspective by requiring learners to make deliberate design choices about how text, images, sound, and sequencing interact to convey narrative meaning. Research has shown that such multimodal composing practices can deepen learners' engagement with language structure and vocabulary while simultaneously expanding their expressive repertoires. (Čisar et al., 2016; Klimova & Zamborova, 2020; Yang & Wu, 2012).

Universal Design for Learning further strengthens the pedagogical rationale for DST in EFL writing instruction. Grounded in neuroscience and inclusive pedagogy, UDL emphasizes the importance of providing multiple means of representation, action, and expression, and engagement to accommodate learner variability. (Hey, 2023; Meyer et al., 2014; Rose et al., 2006).

Digital storytelling aligns closely with these principles by offering multiple representational modes through visual narratives. (Blanch, 2022; Stenman & Pettersson, 2020), diverse avenues for expression through multimedia composition (Blanch, 2022; Dreamson, 2019; Grant, 2023; Haleem et al., 2022; Stenman & Pettersson, 2020), and diverse engagement strategies through interactive platforms (Alexander & Murphy, 2024; Shohamy, 2022). Empirical studies indicate that UDL-informed writing environments can reduce anxiety, increase participation, and improve writing outcomes among learners with diverse proficiency levels (Chen, 2022; Dickinson, 2018; Ngo et al., 2024).

In addition to multimodal literacy and UDL, sociocultural theory provides a critical lens for understanding how DST mediates learning through social interaction and collaborative meaning-making. Rooted in Vygotsky's (1978) conception of learning as a socially mediated process, SCT emphasizes the role of cultural tools, scaffolding, and the Zone of Proximal Development (ZPD) in language development. Digital storytelling, particularly when implemented through collaborative workflows, creates opportunities for learners to co-construct narratives, exchange feedback, and support one another's linguistic and creative development (Ajabshir, 2024; Al-Amri, 2020; Arifin et al., 2022; Jones & Brader-Araje, 2002; Maruf & Halyna, 2023). Studies have shown that collaborative DST tasks can enhance rhetorical organization, lexical diversity, and writing motivation by situating learners within socially distributed cognitive processes (Fani & Ghaemi, 2011; Lantolf et al., 2020; Lasmawan & Budiarta, 2020; Shabani et al., 2010).

DST also aligns with task-based language teaching (TBLT) principles, which emphasize meaningful, goal-oriented tasks that integrate multiple language skills (Chong & Reinders, 2020; Chun et al., 2016; González-Lloret, 2020; Smith & González-Lloret, 2021). Creating a digital story requires learners to engage in planning, drafting, revising, and presenting, processes that mirror the recursive nature of writing development (Chong & Reinders, 2020; González-Lloret, 2020). Research indicates that such task-based, multimodal writing activities can enhance learners' self-efficacy, motivation, and engagement, particularly when supported by teacher scaffolding and peer collaboration (Alemi et al., 2022; Hava, 2021; Kohnke et al., 2023).

Despite the growing body of research on technology-enhanced language learning, significant gaps remain in our understanding of the comprehensive impact of digital storytelling (DST). Previous studies have predominantly examined either literacy gains or creative engagement in isolation. (Vanbecelaere et al., 2020; Yang & Wu,

2012). As a result, the interdependence between technical writing proficiency and creative expression has received limited empirical attention, particularly in higher education EFL contexts. This gap is especially evident in resource-constrained settings, where the scalability and adaptability of multimodal pedagogies remain underexplored (Dhuli et al., 2023; Effendi et al., 2024; Tuzahra et al., 2021).

Furthermore, while mixed-methods approaches are increasingly recommended for capturing the complexity of CALL-mediated learning environments, many DST studies rely primarily on either quantitative performance measures or qualitative reflections, rather than integrating both strands to provide a holistic account of learning processes and outcomes. Addressing this gap requires methodological designs that examine not only whether DST improves writing and creativity, but also how and why such improvements occur across diverse institutional contexts.

In response to these gaps, the present study aims to explore the comprehensive impact of digital storytelling on EFL writing instruction in Indonesian higher education. Drawing on multimodal literacy theory, Universal Design for Learning, and sociocultural theory, this study adopts a mixed-methods approach to examine DST's dual pedagogical value for enhancing both literacy proficiency and creative expression. Specifically, the study seeks to answer two key research questions: (1) How does digital storytelling (DST) affect EFL students' literacy proficiency, particularly in terms of grammatical accuracy, textual coherence, and lexical diversity? (2) In what ways does DST influence students' creative expression in their writing? By addressing these research questions, the study aims to contribute empirical evidence on the integrated role of DST in EFL writing development and to offer pedagogical insights for implementing multimodal, process-oriented writing instruction in resource-diverse educational settings.

METHOD

Research Design

This study adopts a mixed-methods design to holistically investigate the dual impact of digital storytelling on EFL writing development. The quantitative aspect employs quasi-experimental pre-test/post-test measures to objectively assess gains in literacy proficiency across three key dimensions: grammatical accuracy, lexical diversity, and textual coherence. Concurrently, the qualitative aspect conducts thematic analysis of student-generated DST artifacts, semi-structured interviews, and classroom observations to examine emergent patterns in creative expression and pedagogical implementation.

Participants and Settings

This study involved 120 EFL students from six universities across East Java, Indonesia, a region known for its diverse cultural and educational landscapes. The selected universities were carefully chosen to represent a wide range of educational environments, each facing unique challenges and resource limitations. The classrooms were equipped with basic technological infrastructure, including computers and multimedia tools, which were essential for the digital storytelling activities. These resources, though basic, reflect typical higher education settings in East Java, where resource constraints often influence the implementation of technology-enhanced learning. This context provided valuable insights into how digital storytelling can be effectively integrated into EFL writing instruction despite limited resources.

The students were selected based on their enrollment in various English language courses at

these universities. They represented a wide range of language proficiency levels, from intermediate to advanced, as assessed by standardized English-language tests administered by their respective institutions. Additionally, 10 EFL lecturers (7 females, 3 males) with at least 3 years of teaching experience volunteered to facilitate the intervention. These teachers represented a spectrum of familiarity with CALL tools, from novice to intermediate.

Research Procedure

The research procedure was systematically structured into six key phases, integrating quantitative measurement with qualitative explorations to provide comprehensive insights. Table 1 presents a detailed breakdown of the research procedure, highlighting key activities, tools, and outcomes at each stage.

Table 1
Components of the Research Procedure

Phase	Key Steps	Tools/Rubrics Used	Output
1. Recruitment	✓ Purposive sampling of 120 EFL students (CEFR A2-B1). ✓ Lecturers' selection via snowball sampling.	✓ Institutional enrollment records. ✓ CEFR proficiency tests.	✓ Consent forms. ✓ Demographic profiles.
2. Pre-Test	✓ Timed argumentative essays (45 minutes). ✓ Semi-structured interviews.	✓ Quantitative: Jacobs' (1981) Writing Rubric (grammar, lexis, coherence). ✓ CLAN software (VocD lexical diversity). ✓ Qualitative: Interview protocol (funnel-structured questions).	✓ Pre-test scores. ✓ Interview transcripts.
3. DST Training (2 weeks)	✓ Lecturers' workshops: DST pedagogy & tools. ✓ Student orientation: Storyboarding techniques.	✓ Tools: Canva, Adobe Spark. ✓ Rubrics: Torrance Creativity Criteria (adapted).	✓ Workshop attendance ✓ Pilot DST artifacts (20 samples).
4. Intervention (8 weeks: 16 sessions)	Tasks: 1. Storyboarding (visual-textual integration). 2. Scriptwriting (grammar focus). 3. Multimedia assembly (creativity). 4. Peer/ Lecturers feedback loops.	Scaffolding Tools: ✓ Sentence starters (low-proficiency). ✓ Advanced editing checklists (high proficiency). UDL Strategies: - Multiple representation options (text/audio/visual).	✓ 120 DST artifacts. ✓ Reflective journals. ✓ Observation field notes.
5. Post-Test	✓ Repeat timed essays (parallel prompts). ✓ DST artifact evaluation. ✓ Exit interviews.	✓ Quantitative: Jacobs' Rubric (repeated). ✓ Qualitative: Torrance Criteria (originality, elaboration, fluency). ✓ NVivo-coded interview themes.	✓ Post-test scores. ✓ Creativity scores (0-4 scales). ✓ Interview themes.
6. Data Analysis	Quantitative: ✓ Paired t-tests (SPSS 28). - Effect sizes (Cohen's d). ✓ ANOVA for subgroup comparisons Qualitative: ✓ Thematic analysis (NVivo 14). ✓ Inter-rater reliability checks ($\kappa \geq 0.82$).	Software: ✓ SPSS 28. ✓ NVivo 14. Validation: ✓ Member-checking (interview transcripts). ✓ Peer debriefing (CALL experts).	✓ Statistical tables (e.g., pre/post-test comparisons). ✓ Thematic frameworks (e.g., "narrative risk-taking").

Data Collection

Pilot Testing and Instrument Validation

Before the main data collection, we conducted a two-phase pilot study in the Indonesian context to refine our instruments and procedures. In Phase 1, 20 EFL students (non-participants meeting the same CEFR criteria) from a local university in East Java completed prototype versions of the writing tests and DST tasks. Their compositions were scored by three raters using the Jacob rubric, revealing the need for adjustment to our T-unit analysis guidelines (inter-rater reliability improved from $k=0.72$ to 0.86 after clarification). Phase 2 involved trial interviews with five students and two teachers from the same region, which led to restructuring questions about creative processes to avoid leading language. Pilot DST artifacts demonstrated the need for clearer technical instructions, prompting us to add screenshot guides for Canva and Adobe Spark interfaces.

Quantitative Data Collection

This study employed a rigorous quantitative approach to measure the impact of digital storytelling (DST) on students' writing proficiency. All 120 participants completed timed argumentative essays (45 minutes) under standardized testing conditions before and after the 8-week intervention. These writing samples were evaluated using Jacobs (1981) validated a rubric that assessed three critical dimensions: grammatical accuracy (calculated through error-free T-unit ratios), lexical diversity (measured via VocD indices using CLAN software), and textual coherence (scored on a 5-point scale for logical flow and cohesion). To minimize practice effects, three parallel writing prompts were systematically rotated across testing sessions. Additionally, participants completed brief DST proficiency quizzes assessing their technical competencies in using multimedia tools, including audio synchronization and layer management. This multi-metric approach provided robust, standardized data for comparing pre-intervention and post-intervention writing performance across all six university sites.

Qualitative Data Collection

Complementing the quantitative measures, the study gathered rich qualitative data through three primary methods. Semi-structured interviews were conducted with 24 strategically selected students representing varying levels of engagement, as well as with all 10 participating lecturers. The interview protocol followed a carefully designed funnel structure, beginning with broad questions about challenges and creative processes. All interviews were audio-recorded and transcribed verbatim for analysis. The research team also conducted in-depth evaluations of all 120 DST artifacts using adapted Torrance creativity criteria, assessing originality (scored 0-4), elaboration (scored 0-3), and fluency

of multimodal expression. Classroom observations provided additional contextual data, with researchers documenting the teacher's scaffolding techniques, students' collaboration patterns, and problem-solving behaviors during DST creation. These qualitative streams collectively captured the experiential dimension of DST integration that standardized tests alone could not reveal.

Data Analysis

Data analysis followed a mixed-methods approach integrating quantitative and qualitative procedures to capture both outcome-based changes and process-oriented insights into students' writing and creative development. Quantitative and qualitative data were analyzed sequentially and integrated at the interpretive stage to provide a comprehensive account of the effects of the digital storytelling (DST) intervention.

Quantitative Analysis

Quantitative data were analyzed using SPSS version 28 to examine changes in students' literacy proficiency and creative expression following the DST intervention. For literacy outcomes, paired-samples t-tests were conducted to compare pre-test and post-test scores across three key dimensions: grammatical accuracy, lexical diversity, and textual coherence. Statistical significance was determined at $p < .05$. To examine potential differences across institutional contexts, one-way ANOVA tests with Bonferroni post hoc corrections were applied based on university location. Effect sizes (Cohen's d) were calculated to assess the magnitude of observed gains, and reliability analyses confirmed acceptable internal consistency across literacy rubric dimensions (Cronbach's $\alpha > .79$).

Creative expression was assessed quantitatively using adapted Torrance-based creativity criteria. Students' digital storytelling artifacts were scored on three dimensions, originality (0-4), elaboration (0-3), and fluency (0-4), using anchored rating scales. The resulting scores were entered into SPSS and analyzed to examine changes in creative expression and to calculate effect sizes, following prior studies that have employed TTCT-inspired scoring as quantitative indicators of creativity (Parikh et al., 2020). To ensure scoring consistency, two independent raters evaluated all artifacts. Inter-rater reliability was calculated using Cohen's kappa, yielding coefficients of $\kappa \geq .82$ across dimensions, indicating substantial agreement. Any scoring discrepancies were resolved through discussion before final analysis.

Qualitative Analysis

Qualitative data analysis was conducted to explore students' creative processes, engagement patterns, and pedagogical experiences during the DST intervention. Interview transcripts, classroom

observation notes, open-ended survey responses, and digital storytelling artifacts were imported into NVivo 14 for systematic coding and thematic development.

The analysis of digital storytelling artifacts employed a dual qualitative strategy. First, deductive coding was guided by the same Torrance-based creativity dimensions, originality, elaboration, and fluency, which functioned as sensitizing categories to support alignment between quantitative creativity scores and qualitative interpretation. These dimensions informed the identification of themes such as narrative risk-taking, multimodal symbolism, depth of visual-textual integration, and the strategic use of multimedia elements. Second, inductive open coding was conducted to capture emergent patterns in students' design choices, narrative structures, and meaning-making strategies that extended beyond predefined categories.

To enhance trustworthiness, approximately 20% of the artifacts and qualitative transcripts were independently coded by a second coder, resulting in strong inter-coder agreement ($\kappa = .82$). Classroom observation data were analyzed using content analysis, with particular attention to teacher scaffolding practices, peer collaboration, and interactional dynamics during DST production. Throughout the qualitative analysis, detailed audit trails were maintained in NVivo to document analytical decisions and ensure transparency.

This integrated qualitative approach provided nuanced insights into how digital storytelling shaped students' creative engagement and learning experiences, complementing the quantitative findings on gains in literacy and creativity. By examining both creative products (through artifact analysis) and creative processes (through interviews and observations), the study offers a holistic understanding of how DST functions as a dual-purpose pedagogical tool in EFL writing contexts.

Validity and Reliability Tests

Quantitative Validity & Reliability

The inter-rater reliability of the writing assessment scoring was ensured through dual independent

evaluations of 30% of the randomly selected pre-test and post-test essays. Using Cohen's kappa (k), the agreement between raters reached $k \geq 0.85$ for all rubric dimensions (grammatical accuracy, lexical diversity, and coherence), confirming strong consistency in scoring. Additionally, all quantitative instruments, including the writing prompts, VocD lexical analysis, and T-unit coherence metrics, were pilot-tested with 20 non-participant EFL students who met the same proficiency criteria (CEFR A2-B1). This pilot phase helped refine the assessment tools, ensuring clarity and appropriate difficulty levels before full-scale implementation.

Qualitative Validity and Reliability

To enhance the credibility of the qualitative findings, member checking was conducted, in which participants reviewed their interview transcripts for accuracy and provided clarifications when necessary. This process helped minimize misinterpretations and strengthen the authenticity of the data. Furthermore, peer debriefing was performed, in which two independent CALL experts audited the thematic coding framework and NVivo-coded data extracts. Their critical feedback ensured that the emerging themes (narrative risk-taking, multimodal experimentation) were grounded in the data and analytically sound.

FINDING AND DISCUSSION

The Effect of DST on EFL Students' Literacy Proficiency (Grammatical Accuracy, Textual Coherence, and Lexical Diversity)

This study employed a pre-experimental design to assess the impact of digital storytelling (DST) on EFL students' literacy proficiency. The pre-test and post-test scores were analyzed using a paired-samples t-test to determine the statistical significance of the improvement. The results indicated significant gains across all three dimensions of literacy proficiency: grammatical accuracy (Table 2), lexical diversity (Table 3), and textual coherence (Table 4).

Table 2

Pre-test and Post-test Scores for Grammatical Accuracy

Measure	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value	Cohen's d
Grammatical Accuracy	0.65 (0.15)	0.80 (0.12)	6.23	<.001	0.55

As shown in Table 2, the DST intervention had a notable impact on students' grammatical accuracy. The mean score for grammatical accuracy in the pre-test was 0.65 (SD=0.150), indicating a certain level of grammatical errors in performance. After the DST intervention, the mean score improved to 0.80 (SD=0.12), suggesting fewer grammatical errors and more consistent improvement across the group. The paired-samples t-test results, with a t-

value of 6.23 and $p < 0.001$, indicate statistical significance, as the low p-value confirms that this difference is highly unlikely to occur by chance. Additionally, the effect size, calculated as Cohen's d, is 0.55, indicating a moderate and meaningful impact of the DST intervention on students' grammatical accuracy.

The statistically significant improvement in grammatical accuracy observed after the DST

intervention can be understood through the process-oriented nature of digital storytelling as a CALL-based writing pedagogy. Unlike conventional writing tasks that often emphasize final products, DST required students to repeatedly script, revise, and refine their texts before integrating them into multimodal narratives. This recursive process appears to have heightened learners' attention to grammatical form, as scripts needed to be sufficiently accurate and intelligible for narration and audience comprehension. Similar studies have shown that technology-mediated writing tasks that emphasize iterative revision contribute to greater grammatical control in EFL contexts (Hafner & Ho, 2020; Robin, 2016).

Qualitative evidence from classroom observations and student reflections further explains why these grammatical gains occurred. During the scripting phase, students frequently revised sentence structures in response to peer and instructor feedback, suggesting that grammatical improvement was socially mediated rather than solely the result of individual practice. From a sociocultural theory perspective, these interactions functioned as scaffolding within learners' Zones of Proximal Development, enabling students to notice grammatical inaccuracies, test alternative forms, and gradually internalize more accurate language use

(Lantolf et al., 2020; Sun, 2023; Vygotsky, 1978). Peer collaboration thus played a critical role in transforming grammatical feedback into learning opportunities.

In addition, the multimodal nature of DST aligns with Universal Design for Learning principles by allowing students to distribute meaning across textual, visual, and auditory modes. This flexibility may have reduced the cognitive and affective load typically associated with form-focused writing, enabling learners to sustain engagement while revising grammatical structures. Prior research suggests that such multimodal environments can lower writing anxiety and promote sustained attention to linguistic form, indirectly supporting improvements in grammatical accuracy (Chen, 2022; Dickinson, 2018; Meyer et al., 2014; Rose et al., 2006).

Taken together, these findings suggest that the moderate effect size observed for grammatical accuracy reflects not only statistical improvement but also meaningful pedagogical change. DST appears to enhance grammatical accuracy by combining recursive writing practices, socially mediated feedback, and multimodal support, thereby positioning it as an effective CALL-based approach for strengthening grammatical control in EFL writing classrooms.

Table 3
Pre-Test and Post-Test Scores for Lexical Diversity

Measure	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value	Cohen's d
Lexical Diversity	3.2 (0.8)	4.1 (0.7)	7.14	<.001	0.62

Table 3 presents the pre-test and post-test scores for lexical diversity. The pre-test mean score for lexical diversity was 3.2 (SD=0.8), indicating that, on average, students used a certain range of vocabulary in their writing before the DST intervention, with some variability in performance. After the intervention, the mean score improved to 4.1 (SD=0.7), suggesting that students used a wider range of vocabulary and that performance variability decreased, resulting in more consistent improvement across the group. The paired samples t-test yielded a t-value of 7.14, indicating a significant difference between the pre-test and post-test means. The p-value obtained from the t-test is $p < .001$, confirming that the observed improvement in lexical diversity is statistically significant. The effect size calculated using Cohen's d is 0.62, indicating a moderate impact of the DST intervention on students' lexical diversity. In summary, Table 2 provides a detailed overview of the impact of the DST intervention on students' lexical diversity, showing a clear improvement in mean scores from pre-test to post-test, supported by statistical measures that confirm the significance and magnitude of the observed changes.

The narrative-driven, elaborative nature of digital storytelling tasks can explain the increase in lexical diversity following the DST intervention. The requirement to develop story scripts encouraged students to expand and refine their vocabulary to convey characters, settings, and events more precisely. From a CALL perspective, DST situates vocabulary development within meaningful writing processes rather than isolated practice, prompting learners to make deliberate lexical choices during drafting and revision. This finding is consistent with previous studies reporting that narrative-based and technology-mediated writing activities support vocabulary expansion through contextualized use (Hafner & Ho, 2020; Kasch, 2021; Nguyen et al., 2023).

Qualitative findings further illuminate how lexical gains emerged during the DST process. Students reported actively revising word choices after peer feedback and during multimedia alignment, replacing repetitive or vague vocabulary with more expressive alternatives to match visual and auditory elements. This process reflects sociocultural theory's emphasis on mediated learning, where interaction and feedback facilitate lexical refinement (Lantolf et al., 2020; Vygotsky,

1978). In addition, the multimodal affordances of DST align with Universal Design for Learning principles by sustaining engagement and reducing the cognitive burden of lexical experimentation,

thereby enabling students to explore a wider range of vocabulary while maintaining narrative coherence (Dickinson, 2018; Hackett et al., 2023).

Table 4
Pre-Test and Post-Test Scores for Textual Coherence

Measure	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value	Cohen's d
Textual Coherence	2.8 (0.6)	3.6 (0.5)	8.05	<.001	0.70

Note: Coherence scored on a 5-point scale (1 = fragmented; 5 = highly cohesive).

Table 4 presents the pre-test and post-test scores for textual coherence, highlighting the impact of the DST intervention on students' writing. Initially, the mean score for textual coherence in the pre-test was 2.8 (SD=0.6), indicating a moderate level of coherence in students' writing. After the DST intervention, the mean score improved to 3.6 (SD=0.5), reflecting a significant enhancement in the logical flow and organization of ideas. The paired samples t-test results, with a t-value of 8.05 and $p < .001$, confirm that the observed improvement is highly significant. The effect size, calculated using Cohen's d, is 0.70, indicating a moderate-to-large impact of the DST intervention on textual coherence. This suggests that the DST activities had a meaningful and substantial effect on enhancing the coherence of students' writing.

Collectively, these results demonstrate that DST significantly enhances grammatical accuracy, lexical diversity, and textual coherence through iterative audio-visual feedback, multimodal contexts, and explicit visual-textual mapping. The consistently moderate-to-large effect sizes ($d = 0.55$ – 0.70) highlight the unique pedagogical value of DST, surpassing those reported for non-DST interventions. While the aggregate results demonstrated significant improvements in literacy proficiency, the study's multi-site design enabled further investigation into how institutional contexts moderated DST's efficacy. Recognizing that East Java's universities vary markedly in technological resources and pedagogical support, we conducted subgroup analyses to explore whether these differences influenced outcomes.

In conducting subgroup analyses, the universities were categorized into three tiers (high, moderate, and low resource) based on pre-study surveys that assessed: (1) technology access (e.g., availability of DST software and stable Wi-Fi); (2) teacher training in CALL tools; (3) students-to-computer ratios in language labs. The following table and subsequent analysis reveal how these variables shaped outcomes, offering actionable insights for policymakers seeking to address equity in CALL implementation.

The observed improvement in textual coherence can be attributed to the multimodal planning and organizational demands inherent in digital storytelling. Unlike conventional writing

tasks, DST required students to align written scripts with visual sequences, audio narration, and temporal flow, encouraging clearer structuring of ideas and a more logical progression across sentences and paragraphs. From a CALL perspective, this multimodal design process transformed writing into an integrated meaning-making activity, prompting learners to attend not only to sentence-level accuracy but also to discourse-level organization. Similar findings have been reported in studies indicating that multimodal composing supports coherence by requiring writers to explicitly plan connections among narrative elements (Buendgens-Kosten, 2020; Cope & Kalantzis, 2009).

Qualitative evidence further explains how coherence developed during the DST intervention. Students frequently engaged in storyboarding and script sequencing to ensure alignment between text and multimedia elements, which promoted clearer thematic development and smoother transitions. This process aligns with Universal Design for Learning principles by offering multiple means of representation that support learners in organizing ideas, while sociocultural theory highlights the role of collaborative planning and feedback in refining textual flow (Lantolf et al., 2020; Rose et al., 2006; Vygotsky, 1978). Variations in coherence gains across universities may reflect differences in institutional support and prior exposure to multimodal writing; however, the overall pattern suggests that DST fosters discourse-level coherence across diverse EFL contexts by embedding organizational scaffolds directly into the writing process.

Table 5 reveals that high-resource universities (U1-U2) achieved the most pronounced gains, with lexical diversity increasing by $\Delta M = 1.05$ (SD=0.3) and coherence by $\Delta M = 0.85$ (SD=0.15), significantly outperforming low-resource institutions (U6: lexical $\Delta M = 0.45$, coherence $\Delta M = 0.45$; $p < .05$). These disparities align with student reports; learners at U1-U2 frequently cited "editing visuals and audio iteratively" as key refining vocabulary and narrative flow, while those at U6 noted technical constraints. Notably, grammatical accuracy improved consistently across all tiers ($\Delta M = 0.10$ – 0.18), with no significant inter-group differences ($p = .12$). This universal gain underscores DST's structured workflows as resource-agnostic scaffolds.

Observations revealed that, even in low-resource settings, students engaged deeply with grammar during the storyboarding phase, a finding echoed by a U5 lecturer who stated, “The storyboard template

forced them to focus on sentence structure before adding media.” While the overall results demonstrated a clear resource-dependent pattern, two notable exceptions emerged from the data.

Table 5
Differential Improvements in Literacy Proficiency by University

University	Resource Tier	N	Grammatical Accuracy ΔM (SD)	Lexical Diversity ΔM (SD)	Textual Coherence ΔM (SD)	ANOVA (p)
U1	High	20	+0.18 (0.05)	+1.1 (0.3)	+0.9 (0.2)	p = .021
U2	High	20	+0.16 (0.04)	+1.0 (0.3)	+0.8 (0.1)	p = .018
U3	Moderate	20	+0.14 (0.05)	+0.7 (0.2)	+0.7 (0.1)	p = .045
U4	Moderate	20	+0.13 (0.06)	+0.6 (0.3)	+0.6 (0.2)	p = .052
U5	Moderate	20	+0.13 (0.06)	+0.7 (0.3)	+0.6 (0.2)	p = .053
U6	Low	20	+0.10 (0.06)	+0.4 (0.2)	+0.4 (0.1)	p = .110

As depicted in Table 5, first, U3, a moderated-resource institution, achieved coherence gains ($\Delta M=0.7$) comparable to high-resource universities, a finding attributed to its robust program of intensive, teacher-led feedback sessions that compensated for technological limitations. Second, U6, the lowest-resource setting, recorded the smallest lexical improvements ($\Delta M=0.4$). This apparent contradiction suggests that students in resource-constrained environments may develop compensatory creative strategies when working with limited tools, potentially leveraging narrative innovation to overcome technological barriers. These exceptions importantly qualify the resource-dependency narrative, revealing how pedagogical approaches and adaptive student behaviors can mediate technological limitations in CALL environments.

These patterns collectively underscore the context-dependent yet adaptable nature of digital storytelling in EFL instruction. While institutional resources mediate its multimodal efficacy, DST’s structured workflows demonstrate inherent scalability across diverse settings. The observed exceptions, where pedagogical intensity and learner creativity mitigated resource limitations, reveal critical boundary conditions for CALL implementations and affirm the need to account for both technological and human factors in technology-enhanced language learning. The differential literacy gains across universities highlight the context-sensitive nature of digital storytelling implementation in EFL writing instruction. The stronger improvements observed in high-resource institutions can be attributed to greater access to technological tools that enabled iterative, multimodal refinement, particularly in terms of lexical diversity and textual coherence. From a CALL perspective, richer technological environments appear to amplify DST’s affordances by facilitating repeated cycles of editing, revising, and aligning written scripts with visual and auditory elements. This iterative multimodal engagement likely encouraged more precise vocabulary selection and clearer discourse organization, consistent with

findings that technology-enhanced composing environments support higher-level writing processes when adequate resources are available (Cope & Kalantzis, 2009; Hafner & Ho, 2020).

At the same time, the relatively consistent improvement in grammatical accuracy across all resource tiers suggests that certain pedagogical benefits of DST are less dependent on technological abundance. The structured workflows embedded in DST, such as storyboarding, scripting, and sequencing, functioned as resource-agnostic scaffolds that directed learners’ attention to sentence-level form regardless of institutional context. This pattern aligns with sociocultural theory, which emphasizes the role of mediated activity and guided practice over material resources alone (Lantolf et al., 2020; Vygotsky, 1978). Qualitative observations indicated that even in low-resource settings, students engaged deeply with grammatical refinement during the storyboarding phase, supporting the view that pedagogical design can compensate for technological constraints in CALL environments.

Importantly, the exceptions observed in moderate- and low-resource institutions complicate a purely resource-based interpretation of the findings. The coherence gains achieved by a moderate-resource university comparable to those of high-resource institutions suggest that intensive teacher-led feedback and structured peer interaction can offset technological limitations. Similarly, the smaller lexical gains in the lowest-resource setting may reflect students’ reliance on compensatory strategies, such as focusing on narrative originality rather than lexical expansion when multimedia options were limited. These patterns resonate with Universal Design for Learning principles, which stress that learning outcomes are shaped by the interaction of tools, instructional strategies, and learner agency rather than by resources alone (Rose et al., 2006). Collectively, these findings underscore that while institutional resources mediate the extent of DST’s multimodal impact, pedagogical intensity and adaptive learner behavior play a critical role in determining literacy outcomes, reinforcing the need

to consider both technological and human factors in CALL-based EFL instruction.

Influence of DST on Students' Creative Expression in Their Writing

The study's quantitative assessment of creative expression, measured through Torrance's criteria (originality, elaboration, fluency), revealed substantial improvements across all dimensions following the DST intervention. These metrics, derived from a systematic evaluation of 120 student

artifacts, demonstrate how digital storytelling transcends the constraints of traditional writing by fostering nonlinear narrative construction, multimodal depth, and technical experimentation. Preliminary analyses indicated particularly pronounced shifts in students' willingness to deviate from conventional structures, a trend corroborated by interview data emphasizing DST's liberating effect on composition. Table 6 details these gains with effect sizes underscoring DST's transformative potential for EFL creativity.

Table 6
Pre-Post Comparison of Creativity Dimensions

Dimension	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	p-value	Cohen's d
Originality	2.4 (0.7)	3.6 (0.5)	8.21	<.001	1.02 (large)
Elaboration	1.8 (0.6)	3.1 (0.4)	7.89	<.001	0.95 (large)
Fluency	2.1 (0.5)	3.4 (0.6)	9.12	<.001	1.10 (large)

The data in Table 6 revealed striking improvements in narrative originality, with post-intervention scores ($M=3.6$, $SD=0.5$) showing a statistically significant increase from pre-test levels ($M=2.4$, $SD=0.7$; $t=8.21$, $p<.001$, $d=1.02$). This large effect size reflected substantive behavioral changes: five times as many students employed non-linear storytelling structures (62% vs. 12% pre-intervention), while nearly half of high-scoring artifacts demonstrated genre subversion. Particularly noteworthy was students' sophisticated use of symbolic visuals, such as depicting isolation through strategically empty frames, indicating deeper engagement with metaphorical expression. These findings suggest DST's multimodal nature effectively liberates EFL writers from conventional narrative constraints.

For elaboration development, students' capacity for detailed elaboration showed significant growth ($\Delta M=1.3$, $p<.001$), manifesting in sophisticated multimodal integration. Where only 32% of pre-test artifacts demonstrated deliberate visual-text alignment, this figure rose to 78% post-intervention. The complexity of audio narration nearly tripled (from 1.2 to 3.1 per story), with many students employing strategic soundscapes to reinforce thematic elements. Lecturer evaluations consistently noted enhanced ability to "support abstract concepts with concrete media choices" (lecturer at U4), particularly through what one assessor described as 'purposeful repetition of key visual motifs.'

Additionally, for fluency expansion, the most substantial improvement occurred in expressive fluency ($d=1.10$), evidenced by students' expanded multimodal repertoires. Average media type utilization grew from 2.1 to 3.4 per artifact, with particularly creative adaptations in resource-constrained environments. At U5 and U6, 67% of submissions employed strategic visual repetition, while others developed distinctive approaches, such

as symbolic color minimalism, to convey emotional tone. These compensatory strategies proved equally effective, as reflected in statistically equivalent originality scores across resource tiers. The interventions' success in standardizing creative quality is further evidenced by reduced score variability, suggesting DST provides reliably effective scaffolding regardless of initial proficiency.

The findings above collectively demonstrate digital storytelling's transformative impact on EFL students' creative expression, with statistically significant gains across all measured dimensions. The substantial improvement in originality ($d=1.02$) reflects DST's unique capacity to liberate students from conventional narrative constraints, empowering innovative storytelling through symbolic visuals and non-linear structures. Enhanced elaboration abilities ($\Delta M=1.3$) reveal sophisticated multimodal craftsmanship, as students strategically layered media to convey meaning beyond their L2 lexical limitations. Notably, the robust fluency expansion ($d=1.10$) highlights DST's adaptability across resource levels, with technological constraints often sparking compensatory creative innovations. These quantitative patterns, enriched by participants' reports of increased creative confidence, position DST as both a pedagogical tool and a catalyst for developing authentic writing identities, successfully bridging the traditional divide between linguistic development and artistic expression in EFL contexts. The intervention's consistent effects across diverse institutional settings further underscore its potential as a scalable approach to fostering creativity within language learning frameworks.

The substantial gains observed across all dimensions of creative expression indicate that digital storytelling fundamentally reshaped how students approached writing tasks in EFL contexts. The large effect sizes for originality, elaboration,

and fluency suggest that DST functioned not merely as a motivational tool but as a transformative composing environment that expanded students' expressive repertoires. From a multimodal literacy perspective, DST enabled learners to design meaning through the orchestration of linguistic, visual, and auditory modes, thereby reducing reliance on linear, text-bound narratives and encouraging experimentation with symbolism, non-linear structures, and genre hybridity (Buendgens-Kosten, 2020; Cope & Kalantzis, 2009; Hafner & Ho, 2020; Potter, 2013). This shift helps explain why students demonstrated greater willingness to deviate from conventional narrative patterns and engage in metaphorical and symbolic representation, even when their linguistic resources were still developing.

Qualitative evidence further clarifies the mechanisms underlying these gains in creativity. Students' increased use of symbolic visuals, layered audio narration, and purposeful visual repetition reflects a move toward intentional multimodal design rather than decorative media use (Blanch, 2022; Stenman & Pettersson, 2020). This pattern aligns with Universal Design for Learning principles, which emphasize providing multiple means of expression to accommodate learner variability and sustain engagement (Rose et al., 2006). By allowing students to express abstract ideas through concrete media choices, DST lowered linguistic barriers while simultaneously demanding higher-level design decisions. As a result, students were able to elaborate ideas more fully and fluently, supporting the observed improvements in elaboration and expressive fluency (Partridge, 2015). Similar findings in prior DST research suggest that multimodal composition can promote depth of expression by enabling learners to compensate for lexical limitations through strategic media integration (Kasch, 2021; Nguyen et al., 2023; Sun, 2023).

From a sociocultural perspective, the expansion of creative fluency can also be attributed to the socially mediated nature of the DST process. Collaborative planning, peer feedback, and iterative revision created supportive environments in which students felt legitimized to take creative risks and refine their ideas over time (Lantolf et al., 2020; Sun, 2023; Vanbecelaere et al., 2020; Vygotsky, 1978). Notably, students in resource-constrained contexts demonstrated compensatory creative strategies, such as symbolic minimalism and visual repetition, yielding originality scores comparable to those in better-resourced settings. This finding underscores that creativity development within DST is shaped not only by technological availability but also by pedagogical design and learner agency (Robin, 2016; Rong, 2023). Collectively, these results position DST as a CALL-based pedagogical approach capable of fostering robust creative

expression while bridging the traditional divide between linguistic development and artistic exploration in EFL writing.

Qualitative Themes in Creative Engagement

Three dominant themes emerged from the analysis of interviews and artifacts, revealing how digital storytelling transformed students' creative processes:

Narrative Risk-Taking

The digital storytelling approach empowered students to push creative boundaries and challenge conventional writing norms. Analysis revealed that 58% of participants experimented with innovative narrative techniques they would typically avoid in traditional essays. Students consciously manipulated linguistic and structural elements to enhance their storytelling, as exemplified by one learner's strategic use of grammar.

I intentionally used fragmented sentences during my character's panic attack; the disjointed text mirrored her chaotic mental state and the shaky camera effects. (S7, U3)

This creative liberation manifested in various forms across proficiency levels. Some students opted for unconventional narrative structures, such as a U4 participant who deliberately crafted an ambiguous ending.

I concluded with an unanswered question rather than resolving the plot-visual made the open ending feel intentional rather than incomplete. (S4, U2)

Others employed technical effects, such as glitch transitions, to convey thematic complexity beyond their current language capabilities. Lecturers observed significant development in students' narrative sophistication, with one lecturer noting that:

The digital format permitted them to take risks that consistently resulted in more nuanced thematic exploration than their conventional essays demonstrated. (U2 lecturer)

This shift was particularly notable among intermediate learners, who showed the greatest increase in creative confidence metrics. The multimodal nature of DST appeared to lower psychological barriers to experimentation, providing alternative avenues for expression when linguistic resources proved limiting.

Multimodal Synergy

The findings demonstrate how students skilfully combined different media formats to compensate for language limitations, with 73% of participants using this strategy effectively. When faced with challenging vocabulary or complex ideas, learners developed creative workarounds by substituting

visual and auditory elements for written text. A student from a low-resource institution explained,

I couldn't find the right English words to describe my grandfather's house, so I used an old photo with a warm filter instead; the image said everything. (S34, U5)

Similarly, others employed technical effects, such as animated text, to convey emotions that might have required advanced vocabulary; a student stated:

Making the words shake showed fear better than I could describe it. (S78, U2)

This approach proved especially valuable for intermediate learners, with 68% reporting that multimedia tools allowed them to express more sophisticated ideas than their current English proficiency would normally permit. The specific strategies varied significantly across resource levels: students at well-equipped institutions typically incorporated an average of 3.4 media types per project, while those in low-resource environments achieved comparable communicative impact through thoughtful simplification and symbolic minimalism. A lecturer observed,

Some of our most powerful stories came from students who had to be extra creative with basic tools; they mastered the art of suggesting rather than showing everything explicitly. (U6 lecturer)

These adaptive techniques not only overcome linguistic barriers but also often result in more conceptually nuanced and emotionally resonant storytelling.

Collaborative Creativity

The study revealed that peer collaboration played a significant role in enhancing students' creative output, with group work contributing to a measurable 30% increase in elaboration scores. Students frequently engaged in thoughtful discussions to refine their symbolic choices, as illustrated by one participant's account that:

Our group spent nearly an hour debating whether a broken mirror or shattered glass would better represent failure in our stories; this deep discussion ultimately improved everyone's final projects. (S12, U3)

These collaborative sessions often led to more sophisticated narrative elements and thematic development. Beyond conceptual improvements, students also shared practical technical skills. Many reported learning new multimedia techniques through peer interaction, such as adding auditory cues to mark transitions. As one student explained,

I never would have thought to include footstep sounds for time jumps until my groupmate suggested it; this small addition made my story much more professional. (S90, U6)

These exchanges were particularly valuable for lower-proficiency students, who benefit from observing how their peers solve various narrative challenges. Teachers noted that students often incorporated these learned techniques into their own work, demonstrating the cascading benefits of collaborative learning. The iterative nature of this creative process proved especially impactful. Analysis showed that 82% of the most improved artifacts underwent at least three rounds of story refinement across multiple drafts. This collaborative cycle not only produced stronger final products but also fostered a classroom culture where students actively sought and valued each other's input. The combination of conceptual discussions, technical sharing, and iterative refinement created an environment where students' creative work flourished through mutual support and collective problem-solving.

These qualitative insights, grounded in student and lecturer voices, provide a nuanced understanding of how and why DST's multimodal nature resonates so profoundly with EFL learners. The qualitative themes help explain the substantial quantitative gains in creative expression observed following the DST intervention. Narrative risk-taking, multimodal synergy, and collaborative creativity functioned as key mechanisms through which students enhanced originality, elaboration, and fluency. From a multimodal literacy perspective, these findings demonstrate how creativity in EFL writing emerged through the strategic design of meaning across linguistic, visual, and auditory modes, rather than through language use alone (Buendgens-Kosten, 2020; Cope & Kalantzis, 2009).

Narrative risk-taking provides insight into the substantial gains in originality, as DST reduced the psychological constraints associated with conventional academic writing and encouraged experimentation with nonlinear structures and symbolic representation. This aligns with Universal Design for Learning principles, which emphasize flexible modes of expression to sustain engagement and confidence (Rose et al., 2006). Similarly, multimodal synergy explains improvements in elaboration and fluency, as students used visual and auditory elements to elaborate ideas and maintain narrative flow when linguistic resources were limited, supporting previous findings on multimodal composition in EFL contexts (Kasch, 2021; Nguyen et al., 2023).

Collaborative creativity further accounts for the expansion of expressive fluency, as peer interaction facilitated the exchange of narrative ideas and technical strategies through iterative feedback and shared problem-solving. Consistent with sociocultural theory, these interactions functioned as mediational processes that enabled students to internalize creative strategies and apply

them independently (Lantolf et al., 2020; Vanbecelaere et al., 2020; Vygotsky, 1978). Together, these qualitative insights clarify how DST fostered creative development by integrating multimodal design, learner agency, and social interaction, thereby substantiating the quantitative evidence of creativity gains.

CONCLUSION

This study examined the impact of digital storytelling (DST) on EFL students' writing development by addressing two research questions: literacy proficiency and creative expression. The findings demonstrate that DST significantly enhances students' grammatical accuracy, lexical diversity, and textual coherence. These improvements suggest that DST functions as a process-oriented CALL pedagogy that supports core writing skills through recursive scripting, revision, and socially mediated feedback, even across varied institutional contexts.

This study also reveals substantial gains in students' creative expression, as reflected in increased originality, elaboration, and fluency. The integration of multimodal resources enables learners to experiment with non-linear narratives, symbolic representation, and adaptive creative strategies, allowing them to express complex ideas beyond their immediate linguistic capacities. Together, the results indicate that DST effectively bridges the longstanding divide between technical writing proficiency and creative engagement in EFL instruction.

The findings contribute theoretically and pedagogically to the field of technology-enhanced language learning. Grounded in CALL, Universal Design for Learning, and sociocultural theory, this study demonstrates how a pedagogically designed multimodal environment can simultaneously support linguistic accuracy and creative meaning-making. Importantly, the results show that while institutional resources influence the extent of multimodal affordances, DST remains adaptable and scalable, with structured workflows and collaborative practices enabling meaningful learning even in resource-constrained settings.

Despite these contributions, several limitations should be acknowledged. The study was conducted within a single regional context, which may limit the generalizability of the findings to other educational settings. In addition, the intervention was implemented over a relatively short period, and longer-term effects on writing development and creative identity were not examined. Future research could explore longitudinal implementations of DST, investigate its impact across different proficiency levels and cultural contexts, and examine how teacher training and institutional support mediate its effectiveness.

REFERENCES

- Ajabshir, Z. F. (2024). Empowering EFL writing through digital storytelling: A quasi-experimental assessment of CALF measures and multidimensional engagement. *Acta Psychologica*, 250, 104564. <https://doi.org/10.1016/j.actpsy.2024.104564>
- Al-Amri, H. (2020). Digital storytelling as a communicative language teaching based method in EFL classrooms. *Arab World English Journal*, 11(1), 270–281. <https://doi.org/10.24093/awej/vol11no1.20>
- Alemi, M., Salmani Givi, S., & Rezanejad, A. (2022). The role of digital storytelling in EFL students' writing skill and motivation. *Language Teaching Research Quarterly*, 32, 16–35. <https://doi.org/10.32038/ltrq.2022.32.02>
- Alexander, P. A., & Murphy, P. K. (2024). Evolution of a learning theory: In praise of scientific speculation. *Educational Psychology Review*, 36(1), Article 21. <https://doi.org/10.1007/s10648-024-09865-2>
- Alnabhan, M. M., & Aljaraideh, Y. (2014). Collaborative M-learning adoption model: A case study for Jordan. *International Journal of Emerging Technologies in Learning*, 9(8), 4–10. <https://doi.org/10.3991/ijet.v9i8.3639>
- Arifin, S., Arifani, Y., Maruf, N., & Helingo, A. (2022). A case study of EFL teacher scaffolding of an ASD learner's shared reading with a storybook app. *Journal of Asia TEFL*, 19(4), 1234–1249. <https://doi.org/10.18823/asiatefl.2022.19.4.6.1234>
- Blanch, A. (2022). Chess instruction improves cognitive abilities and academic performance: Real effects or wishful thinking? *Educational Psychology Review*, 34(3), 1371–1398. <https://doi.org/10.1007/s10648-022-09670-9>
- Buendgens-Kosten, J. (2020). The monolingual problem of computer-assisted language learning. *ReCALL*, 32(3), 307–322. <https://doi.org/10.1017/S095834402000004X>
- Chen, M. (2022). Research on English teaching of postgraduate intercultural communicative competence cultivation. *Journal of International Education and Development*, 6(3), 173–177. <https://doi.org/10.47297/wspiedwsp2516-250030.20220603>
- Chong, S. W., & Reinders, H. (2020). Technology-mediated task-based language teaching: A qualitative research synthesis. *Language Learning and Technology*, 24(3), 70–86. <https://doi.org/10.64152/10125/44739>
- Chun, D., Smith, B., & Kern, R. (2016). Technology in language use, language teaching, and language learning. *Modern Language Journal*, 100, 64–80. <https://doi.org/10.1111/modl.12302>

- Čisar, S., Čisar, P., & Pinter, R. (2016). Evaluation of knowledge in Object Oriented Programming course with computer adaptive tests. *Computers and Education*, 92–93, 142–160. <https://doi.org/10.1016/j.compedu.2015.10.016>
- Cope, B., & Kalantzis, M. (2009). “Multiliteracies”: New literacies, new learning. *Pedagogies: An International Journal*, 4(3), 164–195. <https://doi.org/10.1080/15544800903076044>
- Dhuli, R., Lamo, P., & Larsari, V. N. (2023). An Analysis of the significance of vocabulary in fostering ESL/EFL students’ writing skills: An empirical study. *International Journal of Contemporary Studies in Education (IJ-CSE)*, 2(1), 26–33. <https://doi.org/10.56855/ijcse.v2i1.252>
- Dickinson, P. (2018). Addressing current and future challenges in EAL writing with Universal Design for Learning. In *Future-proof CALL: language learning as exploration and encounters – short papers from EUROCALL 2018*. <https://doi.org/10.14705/rpnet.2018.26.810>
- Dreamson, N. (2019). *Critical understandings of digital technology in education: Meta-connective pedagogy*. Routledge.. <https://doi.org/10.4324/9780429277528>
- Effendi, T., Thurston, A., & MacKenzie, A. (2024). A systematic evidence synthesis of disability and inclusive pedagogy in initial teacher training in English as a Foreign Language. *International Journal of Educational Research Open*, 7, 100350. <https://doi.org/10.1016/j.ijedro.2024.100350>
- Fani, T., & Ghaemi, F. (2011). Implications of Vygotsky’s zone of proximal development (ZPD) in teacher education: ZPTD and self-scaffolding. *Procedia - Social and Behavioral Sciences*, 29, 1549–1554. <https://doi.org/10.1016/j.sbspro.2011.11.396>
- Fu, J. S., Yang, S. H., & Yeh, H. C. (2022). Exploring the impacts of digital storytelling on English as a foreign language learners’ speaking competence. *Journal of Research on Technology in Education*, 54(5), 679–694. <https://doi.org/10.1080/15391523.2021.1911008>
- Ghufron, M., & Nurdianingsih, F. (2021). Flipped classroom method with computer-assisted language learning (CALL) in EFL writing class. *International Journal of Learning, Teaching and Educational Research*, 20(1), 120–141. <https://doi.org/10.26803/ijlter.20.1.7>
- Gillespie, J. (2020). CALL research: Where are we now? *ReCALL*, 32(2), 127–144. <https://doi.org/10.1017/S0958344020000051>
- González-Lloret, M. (2020). Collaborative tasks for online language teaching. *Foreign Language Annals*, 53(2), 260–269. <https://doi.org/10.1111/flan.12466>
- Grant, D. (2023). “Or is that just your opinion?”: Incorporating faculty of color into the foundational literature on learner-centered classrooms, A review. *Educational Research Review*, 39, 100512. <https://doi.org/10.1016/j.edurev.2023.100512>
- Habibi, A., Yusop, F. D., Razak, R. A., & Mukminin, A. (2019). Preparing future EFL teachers for effective technology integration: What do teacher educators say? *Asian EFL Journal*, 21(2), 9–30.
- Hackett, S., Janssen, J., Beach, P., Perreault, M., Beelen, J., & van Tartwijk, J. (2023). The effectiveness of Collaborative Online International Learning (COIL) on intercultural competence development in higher education. *International Journal of Educational Technology in Higher Education*, 20(1), Article 5. <https://doi.org/10.1186/s41239-022-00373-3>
- Hafner, C. A., & Ho, W. Y. J. (2020). Assessing digital multimodal composing in second language writing: Towards a process-based model. *Journal of Second Language Writing*, 47, 100710. <https://doi.org/10.1016/j.jslw.2020.100710>
- Hafour, M. F. (2024). Interactive digital media assignments: effects on EFL learners’ overall and micro-level oral language skills. *Computer Assisted Language Learning*, 37(4), 986–1018. <https://doi.org/10.1080/09588221.2022.2067180>
- Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, 3, 275–285. <https://doi.org/10.1016/j.susoc.2022.05.004>
- Hava, K. (2021). Exploring the role of digital storytelling in student motivation and satisfaction in EFL education. *Computer Assisted Language Learning*, 34(7), 958–978. <https://doi.org/10.1080/09588221.2019.1650071>
- Hey, M. (2023). Universal Design for Learning practices: Contextual difference and the difference it makes. In K L. Armstrong, L A. Genova, J W. Greenlee, & D S. Samuel (Eds.). *Teaching gradually: Practical pedagogy for graduate students* (pp. 170–176). Routledge. <https://doi.org/10.4324/9781003447382-36>
- Ivanova, M., Arupova, N., & Mekeko, N. (2022). Digital Support for Teaching Punctuation in Academic Writing in English. *Journal of Language and Education*, 8(3), 81–96. <https://doi.org/10.17323/jle.2022.13608>
- Jacobs, H. L. (1981). *Testing ESL composition : A practical approach*. Newbury House Publisher.
- Jones, M. G., & Brader-Araje, L. (2002). The

- impact of constructivism on education: Language, discourse, and meaning. *American Communication Journal*, 5(3), 1-10. <http://acjournal.org/journal/vol5/iss3/special/jones.pdf>
- Kasch, H. (2021). Inclusive multimodal designs in language classroom: Three empirical studies. In C. Busch, M. Steinicke, R. Frieß, & T. Wendler (Eds.), *Proceedings of the 20th European Conference on e-Learning* (pp. 240–247). <https://n9.cl/gu86t>
- Kazazoglu, S., & Bilir, S. (2021). Digital storytelling in L2 writing: The effectiveness of “Storybird Web 2.0 Tool.” *Turkish Online Journal of Educational Technology - TOJET*, 20(2), 44-50. <https://www.tojet.net/articles/v20i2/2025.pdf>
- Klimova, B., & Zamborova, K. (2020). Use of mobile applications in developing reading comprehension in second language acquisition, A review study. *Education sciences*, 10(12), 391. <https://doi.org/10.3390/educsci10120391>
- Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for language teaching and learning. *RELC Journal*, 54(2), 537–550. <https://doi.org/10.1177/00336882231162868>
- Lantolf, J. P., Poehner, M. E., & Thorne, S. L. (2020). Sociocultural theory and L2 development. In B. VanPatten, G. Keating, & S. Wulff (Eds.), *Theories in second language acquisition* (pp. 223-247). Routledge. <https://doi.org/10.4324/9780429503986-10>
- Lasmawan, I. W., & Budiarta, I. W. (2020). Vygotsky’s Zone of Proximal Development and the students’ progress in learning (A heutagogical bibliographical review). *Jurnal Pendidikan Indonesia*, 9(4), 545-552. <https://doi.org/10.23887/jpi-undiksha.v9i4.29915>
- Liu, C. C., Yang, C. Y., & Chao, P. Y. (2019). A longitudinal analysis of student participation in a digital collaborative storytelling activity. *Educational Technology Research and Development*, 67(4), 907-929. <https://doi.org/10.1007/s11423-019-09666-3>
- Maruf, N., & Halyna, K. (2023). Investigating EFL teachers’ perceptions and meanings on digital storytelling in language learning: A narrative approach. *JEELS (Journal of English Education and Linguistics Studies)*, 10(2), 357-378. <https://doi.org/10.30762/jeels.v10i2.912>
- Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal design for learning: Theory and practice*. CAST Professional Publishing.
- Ngo, T. T. N., Chen, H. H. J., & Lai, K. K. W. (2024). The effectiveness of automated writing evaluation in EFL/ESL writing: A three-level meta-analysis. *Interactive Learning Environments*, 32(2), 727-744. <https://doi.org/10.1080/10494820.2022.2096642>
- Nguyen, M. H., Turner, M., & Premier, J. (2023). The distributed knowledge base: Preservice language teachers’ positioning in language–content teacher collaboration. *System*, 114, 103022. <https://doi.org/10.1016/j.system.2023.103022>
- Paltridge, B. (2020). Writing for academic journals in the digital era. *RELC Journal*, 51(1), 147-157. <https://doi.org/10.1177/0033688219890359>
- Parikh, C., Maddulety, K., & Meadows, C. J. (2020). Improving creative ability of base of pyramid (BOP) students in India. *Thinking Skills and Creativity*, 36. <https://doi.org/10.1016/j.tsc.2020.100652>
- Partridge, R. S. (2015). Book review: Digital storytelling in the classroom: New media pathways to literacy, learning, and creativity. *International Journal of Business Communication*, 52(4), 479–480. <https://doi.org/10.1177/2329488415598431>
- Pawlak, M. (2022). Research into individual differences in SLA and CALL: Looking for intersections. *Language Teaching Research Quarterly*, 31, 200-233. <https://doi.org/10.32038/LTRQ.2022.31.14>
- Potter, J. (2013). Discursive psychology and discourse analysis. In J. P. Gee and M. Handford (Eds.), *The Routledge handbook of discourse analysis* (pp. 104-119). Routledge.
- Robin, B. R. (2016). The power of digital storytelling to support teaching and learning. *Digital Education Review*, 30, 17-29. <https://files.eric.ed.gov/fulltext/EJ1125504.pdf>
- Rose, D. H., Harbour, W. S., Johnston, C. S., Daley, S. G., & Abarbanell, L. (2006). Universal design for learning in postsecondary education: Reflections on principles and their application. *Journal of Postsecondary Education and Disability*, 19(2), 135-151. <https://files.eric.ed.gov/fulltext/EJ844630.pdf>
- Shabani, K., Khatib, M., & Ebadi, S. (2010). Vygotsky’s Zone of Proximal Development: Instructional implications and teachers’ professional development. *English Language Teaching*, 3(4), 237-248. <https://doi.org/10.5539/elt.v3n4p237>
- Shapauov, A., Kabyken, M., Kozachek, A., Tikhonova, I., Kolganov, S., Kortunov, V., ... & Khodjaliev, S. (2023). Optimization of independent work in foreign language learning: Experience with using moodle. *Journal of Language Teaching and Research*, 14(6), 1484-1491. <https://doi.org/10.17507/jltr.1406.06>
- Shohamy, E. (2022). Critical language testing, multilingualism and social justice. *TESOL Quarterly*, 56(4), 1445–1457. <https://doi.org/10.1002/tesq.3185>

- Smeda, N., Dakich, E., & Sharda, N. (2014). The effectiveness of digital storytelling in the classrooms: A comprehensive study. *Smart Learning Environments*, 1, Article 6. <https://doi.org/10.1186/s40561-014-0006-3>
- Smith, B., & González-Lloret, M. (2021). Technology-mediated task-based language teaching: A research agenda. *Language Teaching*, 54(4), 518-534. <https://doi.org/10.1017/S0261444820000233>
- Stenman, S., & Pettersson, F. (2020). Remote teaching for equal and inclusive education in rural areas? An analysis of teachers' perspectives on remote teaching. *The International Journal of Information and Learning Technology*, 37(3), 87-98. <https://doi.org/10.1108/IJILT-10-2019-0096>
- Strobl, C., Ailhaud, E., Benetos, K., Devitt, A., Kruse, O., Proske, A., & Rapp, C. (2019). Digital support for academic writing: A review of technologies and pedagogies. *Computers & Education*, 131, 33-48. <https://doi.org/10.1016/j.compedu.2018.12.005>
- Sun, W. (2023). The impact of automatic speech recognition technology on second language pronunciation and speaking skills of EFL learners: A mixed methods investigation. *Frontiers in Psychology*, 14, 1210187. <https://doi.org/10.3389/fpsyg.2023.1210187>
- Tuzahra, F., Sofendi, S., & Vianty, M. (2021). Technology integration of the in-service EFL teachers: A study at a teacher profession education program. *Indonesian Journal of EFL and Linguistics*, 6(1), 317-339. <https://doi.org/10.21462/ijefl.v6i1.396>
- Vanbecelaere, S., Berghe, K. Van Den, Cornillie, F., Sasanguie, D., Reynvoet, B., & Depaepe, F. (2020). The effects of two digital educational games on cognitive and non- cognitive math and reading outcomes. *Computers & Education*, 143, 103680. <https://doi.org/10.1016/j.compedu.2019.103680>
- Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes* (M. Cole, V. Jolm-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press. <https://doi.org/10.2307/j.ctvjf9vz4>
- Weng, X., & Chiu, T. K. (2023). Instructional design and learning outcomes of intelligent computer assisted language learning: Systematic review in the field. *Computers and Education: Artificial Intelligence*, 4, 100117. <https://doi.org/10.1016/j.caeai.2022.100117>
- Yang, Y.-T. C., & Wu, W.-C. I. (2012). Digital storytelling for enhancing student academic achievement, critical thinking, and learning motivation: A year-long experimental study. *Computers and Education*, 59(2), 339-352. <https://doi.org/10.1016/j.compedu.2011.12.012>
- Zarei, M. J., & Navidinia, H. (2024). Improving EFL students' writing skills through digital storytelling. *Computer-Assisted Language Learning Electronic Journal*, 25(1), 108-128. <https://callej.org/index.php/journal/article/view/103>
- Zhang, R., & Zou, D. (2022). Types, features, and effectiveness of technologies in collaborative writing for second language learning. *Computer Assisted Language Learning*, 35(9), 2391-2422. <https://doi.org/10.1080/09588221.2021.1880441>
- Zenouzagh, Z., Admiraal, W., & Saab, N. (2023). Learner autonomy, learner engagement and learner satisfaction in text-based and multimodal computer mediated writing environments. *Education and Information Technologies*, 28(11), 14283-14323. <https://doi.org/10.1007/s10639-023-11615-w>