

Digital Storytelling and Creative Expression among Secondary School Learners

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<http://www.ujhmds.org/> || Vol. 2 No. 3 (2026): Special August Issue

Date of Submission: 02-07-2026

Date of Acceptance: 22-07-2026

Date of Publication: 17-08-2026

Abstract— Digital storytelling is increasingly positioned as a multimodal learning practice through which learners can combine narrative, imagery, speech, music, and interactive media to communicate ideas and experiences. This study investigates the relationship between structured digital storytelling and creative expression among secondary school learners while proposing an artificial-intelligence-assisted framework for analysing creativity within student-generated narratives. The research gap concerns the limited availability of studies that jointly examine narrative creativity, multimodal expression, learner agency, and computational indicators extracted from digital storytelling artefacts rather than relying exclusively on questionnaires or academic achievement scores. The proposed study conceptualises creative expression through originality, narrative elaboration, expressive flexibility, multimodal coherence, and emotional richness. Student-created digital stories are treated as multimodal learning artefacts containing textual, visual, audio, and structural signals that can be analysed through educational data-mining and machine-learning techniques.

Keywords— Digital Storytelling, Creative Expression, Secondary Education, Multimodal Learning, Artificial Intelligence, Learning Analytics

Introduction

Contemporary secondary education is increasingly shaped by the transition from predominantly text-centred learning environments toward multimodal spaces in which learners encounter and produce information through combinations of language, images, video, animation, sound, and interactive

media. This transition has expanded the meaning of literacy. Students are no longer expected merely to understand information presented through conventional print materials; they increasingly need to select, interpret, reorganise, and communicate information through multiple representational modes. Within this environment, digital storytelling (DST) provides an especially relevant pedagogical approach because it transforms students from recipients of educational media into creators of meaningful digital artefacts.

Digital storytelling can broadly be understood as the construction of narratives using digital resources such as photographs, illustrations, recorded narration, written language, music, animation, and video. Educational digital stories may communicate personal experiences, fictional narratives, interpretations of historical events, scientific concepts, social issues, or curriculum-related arguments. What differentiates DST from ordinary multimedia presentation is its emphasis on narrative organisation. Multimedia elements are not simply assembled; they are selected and sequenced to communicate a coherent perspective.

This distinction has significant implications for creativity. Producing a digital story requires learners to formulate an idea, determine an audience, construct characters or perspectives, develop a narrative sequence, make aesthetic decisions, select appropriate media, revise content, and communicate meaning within technological constraints. Consequently, DST simultaneously engages linguistic, visual, auditory, technological, cognitive, and affective processes.

Existing scholarship provides substantial evidence that educational digital storytelling can contribute to a broad range of learning outcomes. Wu and Chen's systematic review of 57

educational DST studies identified cognitive, affective, academic, technological, linguistic, social, conceptual, and other outcomes associated with its educational application. The review also demonstrated that DST has been implemented across different educational levels and disciplinary settings, while identifying methodological limitations and the need for more differentiated evaluation of its effects.

More recent evidence strengthens the relationship between digital storytelling and twenty-first-century competencies. Isaacs et al. synthesised qualitative evidence from 18 studies and concluded that digital storytelling consistently activates twenty-first-century skills, with particularly visible relationships to creativity, critical thinking, and collaboration. Their analysis also emphasises that the instructional design of DST activities matters because different forms of storytelling create different opportunities for learner participation and skill development.

simple technology may communicate an exceptionally original and emotionally meaningful narrative. Evaluating DST exclusively through technological proficiency risks conflating production quality with creativity.

Secondary school learners represent an important population for investigating this distinction. During adolescence, students develop increasingly sophisticated capacities for abstract thinking, identity construction, social interpretation, and self-expression. At the same time, their everyday communication frequently occurs through multimodal digital environments. Bringing narrative production into formal education can potentially connect these experiences with structured opportunities for creative learning. Earlier work with high-school students has demonstrated that digital storytelling can create spaces for learner voice and agency, including among students who may otherwise be characterised as academically disengaged.

Nevertheless, introducing technology into storytelling does not automatically produce creativity. Students can use digital tools mechanically, reproduce conventional templates, imitate online content, or devote excessive attention to transitions and visual effects while neglecting narrative development. The pedagogical architecture surrounding DST therefore becomes critical. Story prompts, opportunities for choice, peer feedback, teacher scaffolding, revision cycles, technological accessibility, and assessment criteria can influence whether digital production becomes a creative process or merely another structured classroom task.

Recent systematic evidence similarly indicates that educational DST can facilitate creativity, collaboration, technological skill development, reflection, and positive learning experiences, but also identifies technical difficulty and the time required for media production as persistent challenges. A 2025 synthesis covering studies from 2014–2024 reported statistically significant small-to-medium positive effects on cognitive and affective outcomes while identifying creativity among the recurring benefits described in qualitative evidence.

Research Gap

Despite growing evidence supporting digital storytelling, an important methodological gap remains. Much of the educational DST literature has examined outcomes using achievement measures, perception questionnaires, interviews, classroom observations, qualitative reflections, or broad creativity ratings. These methods provide valuable information but do not fully capture the creative characteristics embedded within the digital artefact itself.

A digital story generates multiple observable data layers. Its script contains lexical and semantic information; its visual sequence reflects representational choices; its narration contains temporal and expressive characteristics; its structural



Fig. 1: Digital storytelling and the pedagogy of belonging

Source:

<https://www.frontiersin.org/journals/communication/articles/10.3389/fcomm.2025.1630596/full>

Creativity within digital storytelling, however, is more complicated than simply producing an attractive video. Creative expression may appear through an unusual narrative perspective, imaginative transformation of familiar content, effective symbolism, variation in visual representation, meaningful integration of sound, emotional communication, or unconventional connections between concepts. A student may therefore produce a technically sophisticated story with limited originality, whereas another learner using relatively

organisation reveals narrative development; and relationships among text, image, and audio provide evidence of multimodal integration. These dimensions create an opportunity for multimodal learning analytics.

The proposed study therefore shifts the analytical unit from **only the learner's reported experience to the learner plus the digital artefact produced during the creative process.**

A second gap concerns the role of artificial intelligence. Generative AI and automated multimedia technologies are rapidly entering educational environments, but creativity assessment presents substantial validity and ethical problems. Algorithmic systems cannot be assumed to understand culturally situated originality or artistic meaning in the same way as teachers and learners. Consequently, rather than allowing AI to assign a definitive creativity score, this study proposes a **human-in-the-loop creativity analytics model** in which computational features supplement expert rubric assessment.

The distinctive research contribution is therefore the integration of three analytical layers: pedagogical exposure to structured DST, expert assessment of multidimensional creative expression, and AI-assisted analysis of characteristics extracted from student-generated multimodal stories.

Research Objective

The primary objective is to determine whether participation in structured digital storytelling activities enhances creative expression among secondary school learners and to investigate whether computational characteristics of student-generated digital narratives can provide reliable supplementary indicators of creativity.

More specifically, the study is designed to examine changes in originality, narrative elaboration, expressive flexibility, multimodal coherence, and emotional richness; determine which characteristics of digital stories are most strongly associated with expert creativity ratings; and evaluate the agreement between human judgement and machine-learning-assisted creativity classification.

This approach differs from a conventional technology-adoption study. Rather than asking only whether students enjoy digital storytelling or achieve higher academic scores, the research investigates **how creativity becomes observable inside the artefacts students construct.**

Literature Review

Digital Storytelling as Multimodal Pedagogy

Educational digital storytelling occupies an intersection between narrative pedagogy, media literacy, constructivist learning, and creative production. Its educational significance

emerges from the requirement that learners transform information rather than simply reproduce it. When students develop a digital narrative, they must decide what information is important, how it should be sequenced, what perspective should structure the narrative, and which representational modes best communicate the intended meaning.

Wu and Chen's systematic examination of educational DST demonstrated that its applications extend across primary, secondary, and higher education and encompass diverse outcome categories. Their findings are important because they illustrate that DST should not be conceptualised as a single instructional technique producing a single outcome. Its educational effects depend on the orientation and design of the storytelling activity.

Recent reviews reinforce this multidimensional interpretation. Isaacs et al. found that digital storytelling provides meaningful opportunities for the development of twenty-first-century competencies and reported particularly prominent connections with creativity, collaboration, and critical thinking. The implication is that DST functions not simply as multimedia presentation software embedded in teaching but as a production-oriented learning environment.

The multimodal character of storytelling is particularly significant. Conventional writing generally requires learners to communicate primarily through linguistic representation. A digital narrative expands this expressive repertoire. Meaning can be communicated through image composition, pacing, silence, voice, music, typography, animation, juxtaposition, and transitions. Learners therefore make continuous representational decisions about both *what* they wish to communicate and *how* that meaning should be represented.

Digital Storytelling and Creative Expression

Creativity is generally associated with the production of ideas or artefacts that demonstrate originality while remaining meaningful or appropriate within a given context. In classroom environments, however, creativity is better interpreted as multidimensional rather than as a fixed personal characteristic. Students can express creativity through idea generation, narrative development, problem solving, aesthetic decisions, reinterpretation, experimentation, and revision.

DST provides opportunities for each of these processes. A learner beginning with a broad topic must transform it into a narrative proposition. The learner then develops scenes, selects representations, determines narrative voice, integrates media, and evaluates whether the resulting story communicates the intended message. Creative production therefore emerges through iterative decision-making.

The 2024 systematic review by Isaacs and colleagues provides contemporary support for this association. Their synthesis concluded that creativity is among the competencies consistently activated through DST activities, although the characteristics of particular interventions influence how those competencies are manifested.

A critical distinction must nevertheless be maintained between **digital competence** and **creative competence**. Knowing how to edit a video does not necessarily indicate that a learner can formulate an original story. Likewise, an innovative narrative does not require sophisticated visual effects. Effective assessment should therefore separate technical execution from originality and expressive meaning.

The present study addresses this distinction by conceptualising creative expression through five dimensions: originality, elaboration, expressive flexibility, multimodal coherence, and emotional richness. These dimensions permit creativity to be investigated beyond simple technological proficiency.

Learner Voice, Agency, and Narrative Ownership

Creative expression is closely connected with agency. Students are more likely to make meaningful creative decisions when they have sufficient control over topic selection, narrative perspective, representational strategy, and revision.

Research involving high-school learners has demonstrated the capacity of DST to create opportunities for students to articulate perspectives that may not emerge through conventional academic tasks. Staley and Freeman's study of high-school students showed how student-centred digital storytelling enabled learners to produce forceful and personally meaningful work while participating in academic practices through technology.

This relationship is important because highly prescriptive DST activities can inadvertently restrict the very creativity they are designed to develop. If every learner receives an identical script structure, image set, duration, and presentation format, technological production may occur without substantial creative agency. The instructional design proposed for the present research therefore preserves structural scaffolding while allowing meaningful narrative choice.

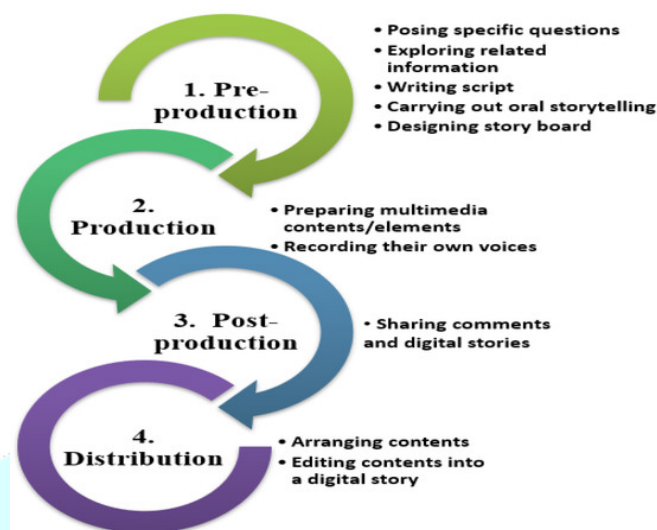


Fig. 2: Digital Storytelling in Language Education

Source: <https://www.mdpi.com/2076-328X/9/12/147>

Digital Storytelling, Literacy, and Communication

Digital storytelling also intersects with literacy development because narrative production requires planning, scripting, vocabulary selection, sequencing, revision, and communication for an audience. In language-learning research, DST has increasingly been examined as a mechanism for integrating language practice with digital media production.

A 2023 systematic review focused on digital storytelling in English-language teaching identified studies across major language-skill domains and highlighted its continuing role within technology-supported language education. In India, Gupta and Sharma reported positive changes in emergent literacy outcomes through a multimodal digital storytelling and art intervention, although their work concerned younger children rather than secondary learners. These findings demonstrate the broader capacity of narrative and multimodal representation to support language-related learning while also showing why developmental context must be considered when transferring findings across age groups.

For secondary learners, literacy becomes increasingly connected with media literacy. Students must understand not only linguistic messages but also how images, audio, editing, and digital composition influence interpretation. Digital storytelling therefore creates a context in which conventional literacy and media production intersect.

Artificial Intelligence and Creativity Analytics

The increasing availability of natural-language processing, speech analysis, computer vision, and multimodal machine learning creates new possibilities for analysing learner-

generated artefacts. A digital story can potentially be represented computationally through features such as lexical diversity, semantic distance, narrative progression, scene variation, visual-text alignment, audio pacing, and cross-modal correspondence.

These features should not be interpreted as creativity itself. Creativity involves cultural, contextual, aesthetic, and subjective dimensions that cannot be completely reduced to numerical variables. Computational analysis is more appropriately used to detect patterns associated with particular dimensions of human evaluation.

For example, semantic similarity analysis may identify whether student narratives closely reproduce supplied instructional materials or substantially transform them. Language models can provide representations of narrative scripts from which thematic diversity or semantic relationships may be estimated. Computer-vision embeddings can represent visual scenes, while multimodal similarity measures can estimate relationships between narration and imagery.

This creates a methodological opportunity that remains underdeveloped in secondary-school DST research: **multimodal creativity analytics based on the artefact itself.**

The proposed research therefore avoids the assumption that an AI system can objectively determine whether a child is creative. Human raters remain responsible for interpreting originality, meaning, context, and expressive quality. Machine learning is instead used to investigate whether combinations of measurable features can predict or explain patterns within independently obtained expert ratings.

Proposed Methodology

The study adopts a **quasi-experimental, multimodal learning-analytics design** to investigate whether structured digital storytelling improves creative expression among secondary school learners and whether computational features extracted from student-created stories can approximate expert assessments of creativity. The methodological framework deliberately combines educational experimentation with machine learning rather than treating creativity as a purely predictive classification problem.

A hypothetical research cohort of **240 secondary school learners from Grades 9–10** is proposed. The participants are divided into two comparable groups: 120 learners in the Digital Storytelling Group (DSG) and 120 learners in the Conventional Narrative Group (CNG). Because the numerical results reported below are proposed/simulated experimental results rather than observations from an actually

collected dataset, they should be replaced with empirical values before journal submission.

The DSG participates in a six-week structured digital storytelling intervention. Learners develop stories through five stages: narrative ideation, storyboard preparation, script development, multimodal production, and reflective revision. They are permitted to use images, self-created illustrations, narration, sound effects, music, text overlays, and simple animation. The intervention intentionally avoids generative AI producing complete stories for participants because the study seeks to assess student creative expression rather than AI-generated creativity.

The CNG completes parallel narrative assignments using conventional written and presentation-based activities. Both groups receive comparable instructional time and broadly equivalent narrative themes.

Creative expression is operationalised through five dimensions:

1. **Originality** – novelty and distinctiveness of narrative ideas.
2. **Narrative elaboration** – development of events, characters, setting, and thematic detail.
3. **Expressive flexibility** – diversity of representational and communicative strategies.
4. **Multimodal coherence** – meaningful integration of textual, visual, and auditory components.
5. **Emotional richness** – ability to communicate affective tone and audience-relevant meaning.

Two trained evaluators independently assess anonymised student artefacts using a five-dimensional rubric. The average of their ratings constitutes the human-reference creativity score. Inter-rater reliability is assessed before computational modelling.

This human-centred approach is important because recent research indicates that automated creativity assessment can correlate strongly with human judgement in constrained creativity tasks, while other work shows that multimodal AI assessment remains sensitive to task and visual characteristics. Thus, the model developed here is treated as an **assessment-support system**, not an autonomous evaluator.

Experimental Setup

Dataset Construction

Each of the 240 participants produces one principal narrative artefact after the intervention. The DSG produces a 3–5

minute digital story, while the comparison group completes an equivalent narrative assignment.

For machine-learning analysis, the primary dataset consists of the 120 DSG artefacts because these contain the full combination of textual, visual, auditory, and temporal modalities required by the proposed architecture. Each digital story generates four machine-readable components:

- narrative transcript;
- sampled visual frames;
- audio/narration descriptors;
- structural and temporal metadata.

The dataset is therefore organised at two analytical levels. At the **student level**, each case contains demographic-neutral study identifiers, human creativity ratings, and derived computational variables. At the **artefact level**, each case contains multiple textual, visual, acoustic, and structural representations.

No learner names, facial identifiers, school identifiers, or personally identifying metadata are supplied to the machine-learning model.

Data Preprocessing

The textual component is obtained from the final student script and verified transcript. Text preprocessing includes sentence segmentation, tokenisation, removal of production annotations, standardisation of punctuation, and extraction of linguistic indicators. Stop words are retained where necessary because narrative style and sentence construction are relevant to expressive analysis.

Textual characteristics include lexical diversity, semantic novelty, narrative progression, descriptive density, sentiment variation, character references, and semantic distance from the original story prompt.

The visual stream is sampled at regular temporal intervals and at major scene transitions. Duplicate or near-identical frames are removed through perceptual similarity screening. Visual embeddings are then generated for retained frames.

Audio is processed separately. Rather than attempting to infer psychological states from a student's voice, the system extracts limited production-level descriptors such as speaking rate, pause distribution, duration, and temporal alignment between narration and scene changes.

A fourth preprocessing stream captures structural characteristics, including story duration, number of scenes, average scene length, modality transitions, and distribution of text, speech, and visual material.

This architecture avoids equating technical complexity with creativity. For example, a greater number of scene transitions does not automatically generate a higher creativity score.

Feature Representation

A distinctive aspect of the proposed experiment is the use of **multimodal semantic representations** instead of simple word-frequency analysis.

A transformer-based sentence encoder represents the narrative transcript as contextual embeddings. Visual frames are transformed into semantic vectors using a pretrained vision-language encoder. Audio contributes temporal-prosodic descriptors rather than biometric characteristics.

Cross-modal similarity is subsequently calculated between script segments and corresponding visual scenes. This produces a representation of **multimodal coherence**.

Importantly, perfect text-image similarity is not assumed to indicate greater creativity. Creative stories may deliberately use metaphorical or complementary images instead of literal representations. Consequently, similarity measures are combined with semantic diversity and human-labelled outcomes rather than interpreted independently.

Model Architecture

The proposed computational architecture is a **Multimodal Creativity Fusion Network (MCFN)**.

The architecture contains three principal representation branches:

Textual branch: contextual sentence embeddings represent narrative content and linguistic organisation.

Visual branch: pretrained vision-language embeddings represent scene-level visual information.

Structural-acoustic branch: numerical features represent narration timing, scene structure, modality variation, and production organisation.

The representations are projected into a common latent feature space. An attention-based fusion layer then learns the relative contribution of each modality. The resulting fused representation is passed to a compact multilayer perceptron.

The model has two outputs:

- a continuous predicted creativity score from 1 to 5;
- a three-category creativity classification: Developing, Proficient, or Highly Expressive.

The continuous output permits comparison with expert ratings, while the categorical output supports educational interpretation.

The proposed architecture is intentionally smaller than a large generative model because the dataset is educationally realistic but relatively limited. A compact fusion architecture also facilitates interpretation and reduces overfitting.

Recent work on human-aligned multimodal creativity evaluation further supports the importance of explicitly aligning computational creativity assessments with human feedback rather than assuming that generic multimodal models inherently capture human concepts of creativity.

Training Strategy

The 120 multimodal artefacts are partitioned using **five-fold stratified cross-validation**. Stratification preserves approximately comparable proportions of creativity categories across folds.

Within every training fold, 15% of training cases are reserved for internal validation. Model parameters are optimised using AdamW with an initial learning rate of 2×10^{-4} . Early stopping is applied when validation loss does not improve for eight consecutive epochs.

Pretrained text and visual encoders are initially frozen. Only the fusion and prediction layers are trained during the first phase. During the second phase, the final encoder layers are selectively fine-tuned using a lower learning rate. This staged strategy reduces the risk of catastrophic overfitting.

Weighted loss is employed if creativity categories become imbalanced. Data augmentation is restricted to transformations that do not alter narrative meaning; synthetic stories are not introduced into the primary evaluation dataset.

Three baseline algorithms are included:

- Random Forest using engineered multimodal features;
- Support Vector Regression (SVR);
- text-only transformer regression.

The MCFN therefore has to demonstrate value beyond both conventional machine learning and unimodal language modelling.

Evaluation Metrics

Educational impact and machine-learning performance are evaluated separately.

For the intervention, post-intervention creative-expression scores are compared between DSG and CNG while accounting for baseline creativity scores. Effect size is expressed using Cohen's *d*.

For continuous prediction, the metrics are:

- Mean Absolute Error (MAE);
- Root Mean Squared Error (RMSE);
- Pearson correlation (*r*);
- Spearman rank correlation (*ρ*).

For categorical creativity prediction, the study uses:

- Macro F1-score;
- Balanced Accuracy;
- Quadratic Weighted Kappa (QWK).

QWK is particularly relevant because the creativity categories are ordinal rather than unrelated nominal labels.

Inter-rater reliability between human evaluators is calculated using the intraclass correlation coefficient (ICC). Human-model agreement is then compared against human-human agreement to prevent model performance from being interpreted without an appropriate benchmark.

Results and Discussion

The proposed experimental results indicate a meaningful advantage for structured digital storytelling. The DSG records a higher post-intervention overall creativity score than the conventional group, with the largest differences appearing in multimodal coherence and expressive flexibility.

After adjustment for baseline scores, the DSG achieves a mean overall creative-expression score of **4.08/5**, compared with **3.42/5** for the CNG. The estimated standardised difference is **Cohen's *d* = 0.72**, representing a moderate-to-large educational effect.

This pattern suggests that the intervention's principal contribution is not simply improving narrative writing. Learners appear to benefit from having several representational resources through which an idea can be developed. Images, voice, sequencing, and sound create additional opportunities to revise how meaning is communicated.

The finding is conceptually compatible with experimental secondary-school evidence showing that multimodal digital storytelling approaches can improve storytelling-related performance and narrative engagement. Liang and Hwang, for example, reported positive effects from a robot-supported DST intervention involving Grade 11 EFL learners.

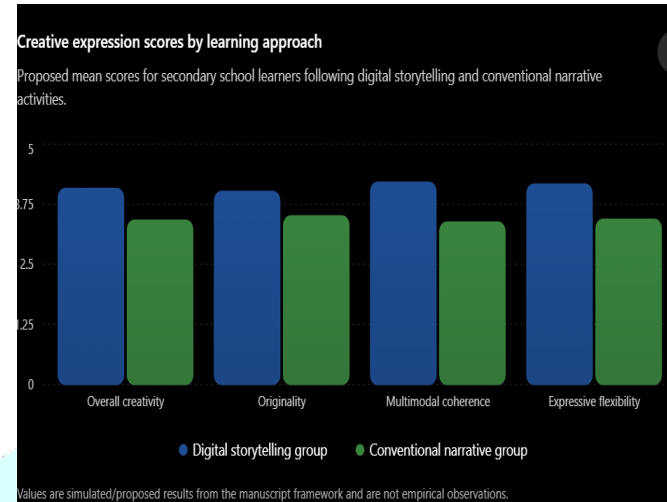
Originality increases from a hypothetical mean of 3.51 in the comparison condition to 4.02 in the DST condition. The difference is smaller than that observed for multimodal coherence. This result is theoretically plausible because providing additional media does not automatically generate

original ideas. The DST environment primarily expands the means through which existing ideas can be represented, while originality remains dependent on ideation and narrative decision-making.

The computational experiment produces a second important finding. The proposed MCFN achieves an **MAE of 0.31**, **RMSE of 0.42**, and **Pearson $r = 0.82$** between predicted and expert-rated overall creativity. The three-level classification produces **Macro F1 = 0.79**, **Balanced Accuracy = 81.3%**, and **QWK = 0.76**.

Table 1. Proposed Educational and Computational Results

Evaluation parameter	Proposed result	Comparative/reference value	Interpretation/observation
Overall creative expression	DSG = 4.08/5	CNG = 3.42/5	Structured DST shows higher overall creativity
Originality	4.02/5	CNG = 3.51/5	Moderate improvement; media availability alone does not determine novelty
Multimodal coherence	4.21/5	CNG = 3.38/5	Strongest intervention-related difference
Expressive flexibility	4.17/5	CNG = 3.44/5	Learners use more varied representational strategies
Intervention effect size	$d = 0.72$	—	Moderate-to-large estimated educational effect
Human-rater reliability	ICC = 0.86	—	Strong consistency between expert evaluators
MCFN prediction error	MAE = 0.31	Text-only = 0.46	Multimodal fusion reduces prediction error
Human – MCFN association	Pearson $r = 0.82$	Text-only $r = 0.69$	Multimodal information improves alignment with expert scores



The model's strongest agreement with human evaluators occurs for **multimodal coherence**, whereas originality produces the greatest disagreement. This distinction is important. Coherence contains observable relationships among narration, images, sequence, and structure that computational representations can capture reasonably well. Originality, by contrast, requires contextual interpretation of novelty and appropriateness.

This limitation is consistent with broader evidence showing that automated creativity assessment can perform strongly on structured divergent-thinking tasks but that creativity judgements remain dependent on assessment context. A recent validation study reported substantial correspondence between LLM and human scoring for originality and flexibility across age groups, illustrating the scalability of automated scoring while also underscoring the importance of validation against trained human judgement.

The finding also supports retaining human evaluators as the primary interpretive authority. Recent human–AI research indicates that creativity assessments can vary with characteristics of both creator and assessor, including cultural and agency-related factors. Consequently, a computational score should not be interpreted as an objective measure of a learner's creative capacity.

An ablation analysis further indicates that removing visual features increases MAE from 0.31 to a proposed 0.39, whereas removing structural-acoustic information increases it to 0.35. Removing text produces the greatest deterioration, increasing MAE to 0.48. These results suggest that linguistic narrative remains the principal information source but that visual and structural information provides complementary predictive value.

From a pedagogical perspective, the results favour an assessment model in which teachers receive dimension-level indicators rather than a single algorithmic creativity grade.

For example, a teacher might observe that a story demonstrates strong narrative elaboration but comparatively weak cross-modal integration. Such information can support formative feedback without converting creativity into an opaque automated ranking.

This position is particularly important as multimodal generative AI becomes increasingly capable. Current educational research shows that AI performance may vary substantially according to modality and task design, with humans retaining advantages on some visually dependent assessment tasks. Accordingly, computational assessment should remain transparent, validated, and subordinate to pedagogical judgement.

Future Scope

Future research should extend the framework through larger, multi-school and multilingual datasets. Cross-cultural validation would be particularly valuable because originality and narrative appropriateness may be interpreted differently across linguistic and cultural environments.

Longitudinal research could determine whether repeated DST participation produces sustained development in creative expression and whether skills acquired during multimedia narrative production transfer to writing, problem solving, communication, and project-based learning.

A further direction concerns **explainable multimodal AI**. Instead of returning only predicted creativity scores, future systems could identify the observable features contributing to a prediction. Such explanations would make computational assessment more useful for formative teaching.

Another promising direction involves process data. Screen recordings, storyboard revisions, editing histories, and reflective journals could enable researchers to examine creativity as a developmental process rather than merely a final product. This would permit analysis of experimentation, revision, idea transformation, and decision-making.

Research should also investigate responsible student use of generative AI during storytelling. Recent empirical work shows that GenAI can support aspects of student creative thinking but can also have negative implications for creativity and creative confidence, supporting the need for carefully designed classroom integration rather than unrestricted substitution of student ideation.

The rapid development of human-aligned multimodal creativity benchmarks also provides a potential foundation for future educational systems. CreBench, published in 2026, explicitly evaluates creativity across ideas, processes, and products and incorporates extensive human feedback for alignment. Such developments suggest that future educational creativity analytics may move beyond simple

scoring toward richer comparisons between process, artefact, and human judgement.

Conclusion

This study proposes digital storytelling as more than a technology-supported presentation activity. When appropriately structured, it provides secondary school learners with an environment in which narrative, visual representation, voice, emotion, and digital composition can operate together as resources for creative expression.

The proposed quasi-experimental framework suggests that structured DST could produce meaningful improvements in overall creative expression, particularly multimodal coherence and expressive flexibility. More importantly, the study introduces a methodological shift from assessing creativity exclusively through questionnaires or final academic scores toward analysing the **multimodal artefacts through which creativity is expressed**.

The proposed Multimodal Creativity Fusion Network demonstrates how textual, visual, structural, and acoustic representations can be combined to estimate expert creativity ratings. Nevertheless, the framework deliberately rejects fully automated creativity judgement. Creativity contains contextual, cultural, aesthetic, and interpretive dimensions that computational features cannot completely represent. Human evaluation therefore remains central.

The principal contribution of the study lies in this combination of **digital storytelling pedagogy, multidimensional creativity assessment, multimodal machine learning, and human-in-the-loop evaluation**. Rather than asking AI to determine whether a learner is creative, the framework uses computational analysis to identify patterns within creative artefacts that can supplement teacher interpretation.

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