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Multimodal meaning-making: Exploring cultural expression through digital storytelling for students with dyslexia

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Abstract

This study examines how digital storytelling (DST) facilitates multimodal composition, enabling students with dyslexia to construct meaning through diverse modes. Framed within the cultural dimension of Green's 3D model and applying a socio-semiotic approach, the study explores how students integrate their perspectives and cultural backgrounds into their narratives. A mixed-methods approach with a single-subject design was employed, incorporating semi-structured interviews, socio-semiotic analysis of multimodal texts and descriptive statistics. Findings indicate that DST provides alternative pathways for self-expression, assisting students to mitigate writing challenges.

KEYWORDS
cultural expression, digital storytelling, dyslexia, multimodal meaning-making

Key points

- DST allows students with dyslexia to express themselves beyond written text, using modes to enhance meaning-making.
- Through DST, students integrate their cultural backgrounds into their narratives, aligning with the cultural dimension of Green's 3D model.
- The study highlights the potential of DST as an inclusive educational approach, advocating for its integration into literacy instruction to support diverse learning needs.

INTRODUCTION

This study explores how the DST approach can support students with dyslexia in expressing their ideas through multimodal narratives, offering an alternative to traditional writing.

Dyslexia presents difficulties with working memory, transcription, and executive functions, which significantly affect students' writing abilities. These challenges often limit students' opportunities for expression and cultural participation in the classroom. By providing a multimodal platform for storytelling, DST offers new pathways for meaning-making that are better aligned with the diverse profiles of students with dyslexia.

Dyslexia and writing difficulties

Frith's (1997, 2002) three-level framework is one of the most widely acclaimed modes of dyslexia (Cline & Frederickson, 2009; Snowling & Hulme, 2012). Its strength lies in integrating biological, cognitive, and behavioural levels, contributing to the fullest possible understanding of dyslexia (Christodoulidis, 2021; Gathercole & Baddeley, 2014). Within this framework, dyslexia is perceived through biological (genetic and neurobiological factors), cognitive (slow processing, difficulties in phonological awareness and working memory), and behavioural (challenges in reading and writing) levels of explanation (Frith, 2002).

This framework aligns with newer research that sees dyslexia as a continuum shaped by genetic, cognitive and environmental factors (Barrett & Heale, 2020; Pennington, 2006). Phonological, working memory and processing deficits are also evident (Melby-Lervåg et al., 2012; Thompson et al., 2015).

Frith's model aligns with the aforementioned approach in terms of approaching dyslexia as a multifaceted condition, while highlighting the need for targeted educational interventions at the behavioural level. For this study, the intervention adopted an asset-based approach at the behavioural level, by activating students' strengths in alternative modes of cultural expression via DST.

The Not-So-Simple View of Writing (NSVW) approach provides a useful framework for understanding the impact of dyslexia on the writing skills of students (Berninger & Winn, 2006). It emphasises the role of working memory in transcription, executive function, and text generation. Here, the text generation's central role underscores the importance of not only possessing transcription skills (spelling, handwriting/keyboarding) but also self-regulation skills operated by executive functions (i.e. goal setting, planning, monitoring, revising, evaluating). Difficulties in transcription skills restrict working memory, as seen in students with dyslexia who may rely heavily on working memory for spelling, limiting resources for higher-order tasks. Similarly, difficulties in executive functions or working memory can affect transcription skills as writers struggle to recall and accurately record their thoughts (Ahmed et al., 2022; Berninger et al., 2002). Within the NSVW framework, children with dyslexia have trouble with spelling, handwriting and executive function behaviours, which results in low overall writing quality. Moreover, high-quality writing depends on good transcription skills, working memory and executive function—all of which can be hard for children with dyslexia (Hebert et al., 2018).

Digital storytelling and multimodal writing

Given these challenges, alternative approaches of expression should be considered to support students with dyslexia. One such approach is DST, which provides a multimodal composition environment that enables students to express themselves through various modes (Tour et al., 2021; Wu & Chen, 2020). Digital storytelling has gained recognition as a powerful educational approach, allowing students to communicate their ideas and reflect their backgrounds in a more accessible and engaging manner (Armstrong, 2003; Lambert, 2010).

As a form of multimodal composition, DST integrates diverse semiotic resources to help students construct meaningful narratives (Tour et al., 2021; Wu & Chen, 2020). Kress (2000, 2003, 2010) conceptualises students as designers who actively shape stories that reflect their cultural backgrounds and intentions (Chen et al., 2023).

By orchestrating multiple modes of communication, DST aligns with the broader shift in composition studies beyond traditional language-based expression (Jewitt, 2009; Kress, 2010). This orchestration with and within modes facilitated by DST aligns with the concept of 'playful tinkering,' where students experiment with and within different modes of expression (Parry & Taylor, 2021). By integrating various modes, students create multisensory narratives that reflect their environments and values. This multimodal approach enables them to communicate in impactful ways that transcend the limitations of written text, reinforcing the importance of diverse expressive channels in meaning-making.

Kress (2000, 2003, 2010) conceptualised multimodal text design as a social and situated process, in which meaning is constructed through the selection and arrangement of available semiotic resources. Learners, conceived of as active designers, shape meaning based on their intentions, interests and cultural backgrounds (Chen et al., 2023). This design process is deeply embedded in social and cultural contexts, as individuals communicate within specific environments and for particular audiences, drawing upon familiar semiotic resources (Kress, 2003).

Cultural affordance plays a crucial role in multimodal design. van Lier (2004), building on the works of Gibson (2014) and Reed (1988), defines cultural affordance as the relationships learners establish with the semiotic resources available to them. The potential of these resources is only realised when learners recognise their cultural significance and repurpose them in meaningful ways. This perspective underscores the importance of context in multimodal communication, as semiotic resources derive their meaning from the cultural and social frameworks in which they are situated.

In this context, DST fosters a deeper connection between students' personal experiences and their written expression, particularly when considering cultural contexts. This aligns with the adaptive cultural dimension of Green's 3D model,[i] which views cultural learning as an integral part of digital literacies development. The cultural dimension considers digital literacies as expressions of meaning shaped by cultural contexts, fostering decision-making based on cultural understanding.

Digital storytelling and cultural expression among diverse learners and students with dyslexia

Prior research shows that DST supports cultural expression among diverse students. Choi and Yi (2016) found multilingual students used multimodal texts to assert hybrid identities. Vasudevan et al. (2010) showed DST helped underrepresented students challenge stereotypes through culturally resonant media. Jiang (2025) examined the emotional landscapes of translingualism

among multilingual students and illustrated how digital multimodal practices allowed them to express cultural identities.

Regarding DST and students with dyslexia, there is a limited body of research, particularly in the context of cultural learning as framed by Green's 3D model. In a pilot study we conducted (Kritsotaki et al., 2024), a single-subject pre-experimental A-B design was implemented. The findings indicated that the DST process facilitated a more diverse range of expressive modes for conveying meanings and emotions related to cultural behaviours. This, in turn, enabled students to better articulate their past experiences and reflect on their cultural backgrounds.

Another relevant study by Sylvester and Greenidge (2009) found that the multimedia elements of DST provided an alternative means of self-expression, allowing struggling writers to convey their voices and interests in a meaningful way.

To the best of our knowledge, no other study has specifically investigated the cultural dimension of multimodal DST among primary students with dyslexia while adapting socio-semiotic analysis in accordance with Green's 3D framework. Consequently, the links made in this study are also drawn from prior research conducted on typically developing primary school students. This approach is justified given the broader applicability of findings in similar educational contexts and the absence of direct empirical evidence in the target group.

METHODS

Research design

A mixed methods approach was adopted (Creswell & Plano Clark, 2011; Plano Clark, 2017) via a convergent parallel design. Qualitative and quantitative data were collected, analysed independently and integrated at the interpretation phase. Qualitative data derived from semi-structured group interviews and socio-semiotic analysis of students' multimodal texts, while quantitative data included descriptive statistics from multimodal texts.

Within this mixed methods approach, a single-subject design was adopted, which has been widely employed in special and inclusive education (Maggin et al., 2011) particularly for investigating dyslexia (Lim & Oei, 2015; Wery & Diliberto, 2017). This was an A-B pre-experimental design, in which A stands for baseline assessment and B for intervention. During Phase A, all students created paper-based stories over multiple sessions. In Phase B, the same students developed digital stories across multiple sessions. Throughout both phases, the first author engaged in informal interactions with the students, gathering insights into their design decisions. These insights were recorded and incorporated

into the socio-semiotic analysis templates used to interpret the multimodal texts. Based on the final texts, a socio-semiotic analysis was conducted, and descriptive statistics were generated to summarise the prevalence of design processes and features. Additionally, the semi-structured group interviews explored students' reflections on their design choices and the cultural meanings embedded in their digital stories.

Under the above research design, the following research question is addressed: *To what extent does digital storytelling enable students with dyslexia to bring their own perspectives into the multimodal writing process, considering the cultural context as framed by Green's 3D model?*

Sampling

A non-probability purposive sampling technique was adopted in this study, conducted in a town in Southern Greece. This sampling technique enabled the selection of participants with a specific profile operating on the principle that researchers 'can get the best information through focusing on a relatively small number of instances deliberately selected on the basis of their known attributes' (Denscombe, 2014, p 41). Thirteen primary school students (ages 11–12) participated in the study (Table 1). Inclusion criteria were: (a) diagnosed with dyslexia or specific learning difficulties in phonological processing or decoding, based on independent evaluations, and (b) no overlapping diagnoses. Dyslexia diagnoses were documented in school records, accessible with parental permission. Participants were recruited through convenience sampling, with the first author contacting parents and children within her professional network.

Procedure

The study was conducted over 17 weeks both in the computer classroom and the general classroom during the school day. Baseline measurements (Phase A) were conducted over an eight-week period, totalling 29 h. Intervention sessions (Phase B) were conducted over 9 weeks, totalling 42 h.

Table 2 presents the activities that took place in phase A and phase B. It should be mentioned that consent from both the students and their parents had already been obtained.

Measures and tools

Semi-structured interviews were conducted with the students to enable a more in-depth understanding of their experience (Adeoye-Olatunde & Olenik, 2021; Smith, 2018). Interviews were conducted with students

TABLE 1 Participants' details.

Participants' ID	Gender	Age (years)	Grade	Diagnosis
P1	Male	12	6th	Specific learning difficulties—dyslexia
P2	Male	12		
P3	Female	12		
P4	Male	12		
P5	Male	12		
P6	Female	11		
P7	Male	12		
P8	Male	12		
P9	Female	12		
P10	Female	11		
P11	Female	12		
P12	Female	12		
P13	Male	11		

as a group after the intervention, which lasted approximately 35–40 min and were audio recorded. Recorded interviews were transcribed verbatim. Group interviews present a valuable approach to data collection, resembling one-to-one interviews while leveraging the dynamic of social interaction among participants (Denscombe, 2014; Smithson, 2019). The interview questions were designed to explore cultural behaviours in relation to the modes used, drawing on the cultural dimension of Green's 3D model. Students were encouraged to reflect on whether and how DST modes facilitated expression and meaning-making in comparison to traditional writing. Additionally, they were asked to comment on the stories they created, providing insights into their own work. Interviews for children with dyslexia were adapted by using child-friendly language, fostering a supportive atmosphere for participation, and employing open-ended questions to stimulate conversation.

The final multimodal texts produced during the baseline assessment, along with the final digital multimodal texts developed during the intervention, were analysed using socio-semiotic analysis (Kress, 2010). Commonalities and differences were examined through descriptive statistics. Each participant created two final texts—one in Phase A and one in Phase B.

The digital storytelling platform used was StoryJumper (https://www.storyjumper.com/), which supports various genres (i.e. narrative writing, dialogue text) and integrates multiple modes. Damavandi et al. (2018) found that primary English as a Foreign Language learners responded positively, valuing its child-friendly design. The platform's word processing features facilitated grammar and spelling revisions, and ready-made images aided idea generation. Similarly, Karakuş et al. (2020) reported increased engagement and creativity in primary second-grade students, linked to the platform's layout and multimedia features.

Data analysis

Interviews

The qualitative data collected through interviews were analysed using Reflexive Thematic Analysis (RTA), following Braun and Clarke's (2019) framework. This approach is valuable when exploring unknown perspectives and understanding meanings shaped by participants' cultural and social backgrounds. The analysis followed six stages: (1) familiarising with the data through transcription and repeated reading, (2) generating initial codes systematically, (3) identifying potential themes, (4) reviewing themes in relation to the dataset, (5) defining and naming themes[ii] and (6) producing a report aligned with research questions and existing literature.

Final multimodal texts

The final multimodal texts produced in both phases were subjected to socio-semiotic analysis based on the transformation and transduction design processes (Kress, 2000, 2003, 2010) as well as the 'grammar of visual design' as proposed by Kress and Van Leeuwen (2006, 2021). Informed by the cultural dimension of Green's 3D model, our analysis focused on how students with dyslexia conveyed their cultural backgrounds, beliefs, and experiences through the design and content of their multimodal stories.

Transformation and transduction design processes

According to Kress (2000, 2003, 2010), in the multimodal design approach, the construction of meaning is understood as the processes of transformation and transduction of modes. Through transformation, designers take actions to reorganise and rearrange elements (semiotic resources) within a mode to create new meanings. In the process of transduction, designers reshape semiotic resources across modes, shifting from one mode to another for the intended meaning to be delivered. These processes offer students with dyslexia alternative pathways for meaning-making and communication beyond traditional text-based methods to align with the cultural context and their background.

Visual grammar

In addition to transformation and transduction, visual grammar is key in analysing digital texts within a multimodal framework. It offers a structured framework to examine how visual elements contribute to meaning, especially in digital contexts where visuals interact with other modes. Visual grammar also helps understand how socio-cultural backgrounds shape these visuals. Kress and van Leeuwen (Kress & Van Leeuwen, 2006, 2021) applied linguistic

TABLE 2 Description of the activities in phases A and B.

Weeks	Days	Phases of writing / digital writing process	Type of activities	Duration	Description
Baseline assessment (phase A)					
1st week	Tuesday	Pre-writing phase	Collaborative activity	2h–90min	Participating students were informed about the activities via treasure hunt. Clues were hidden in different spots at the school. Each clue revealed where the next was hidden, while the last one led to the treasure, an information sheet, including text and images, and describing the story-writing tasks.
	Wednesday		Collaborative activity	2h–90min	Small group discussion was carried out, aiming to answer potential questions and provided further information. Researcher guided the conversation, ensuring that everyone has an opportunity to participate. As students shared their thoughts and questions, researcher actively listened to them and summarised or paraphrased their points to ensure understanding.
2nd week	Tuesday		Individual/ Collaborative activity	2h–90min	Students chose their topic between two suggested, justifying their choice. Groups were split up based on their choice of topic with students who chose the same topic being in the same group. Seven students chose the topic 'Role of Refugees,' and were divided into two groups: one with four students and another with three. For 'Role of Women,' six students selected this option, forming two groups of three students each.
3rd week	Wednesday Tuesday		Individual/ Collaborative activity	4h–180min	Students identified the purpose of their stories and their target audience. Through brainstorming, students first shared their knowledge about the topic within their groups and then with the entire class, while the researcher recorded their ideas on the blackboard.
	Wednesday		Individual/ Collaborative activity	2h–90min	Students questioned what else they wanted to know about the topic prompted by the researcher who motivated them to think more deeply about it and discuss within their group. Researcher recorded students' ideas on the blackboard.
4th week	Tuesday		Collaborative activity	2h–90min	Students conducted follow-up research on the topic in the school library, aiming to explore additional information aligned with their expressed ideas/queries in the previous activity.
	Wednesday		Individual activity	2h–90min	Students created story maps on paper to organise story elements and ideas.
5th week	Tuesday Wednesday	Writing phase	Individual activity	4h–180min	Students created their story on paper. Sentence fragments were provided as scaffolding.
6th week	Tuesday	Post-writing phase	Individual activity	2h–90min	Students revised their work based on a self-assessment checklist given by the researcher. They focused on areas, such as sentence meaning, paragraph development, spelling, use of linking words and comparability of selected modes.
7th week	Wednesday Tuesday		Collaborative activity	4h–180min	Students received feedback and comments mainly from their peers and secondly from the researcher. These comments addressed various aspects of their work, including mainly clarity of meaning, and sometimes spelling and semantic errors. Feedback also covered both written and visual modes of communication used to convey their messages.
	Wednesday		Individual activity	2h–90min	Students made final edits to their work based on their peers' and researcher's comments, while making any additional changes identified.
8th week	Friday	Sharing phase	Individual/ Collaborative activity	2h–90min	Students discussed in their group and found means for their story dissemination. Having done this, each of them selected the means which was closer to their audience and preferences. Students disseminated their stories by providing the required number of copies to other students at school and posting them on the school bulletin boards.

(Continues)

TABLE 2 (Continued)

Weeks	Days	Phases of writing / digital writing process	Type of activities	Duration	Description
Intervention (phase B)					
1st week	Tuesday	Pre-production phase	Collaborative activity	2h–90min	Students were introduced to Storyjumber via tutorial videos and platform navigation. Exemplar digital stories created on this platform were presented.
	Friday		Individual/ Collaborative activity	2h–90min	Students chose their topic between two suggested, justifying their choice. Groups were split up based on their choice of topic with students who chose the same topic being in the same group. Two students chose the topic 'Isolated villages,' forming one group, while eleven students selected the topic 'Peace and War', forming two groups of four students each and one group of three students.
2nd week	Tuesday Friday		Collaborative activity	4h–180min	Students identified the purpose of their stories and their target audience. Through brainstorming, students first shared their knowledge about the topic within their groups and then with the entire class, while the researcher recorded their ideas on the blackboard.
3rd week	Tuesday		Individual/ Collaborative activity	2h–90min	Students questioned what else they wanted to know about the topic prompted by the researcher who motivated them to think more deeply about it and discuss within their group. Researcher recorded students' ideas on the blackboard.
	Friday		Collaborative activity	2h–90min	Students conducted follow-up research on online resources working in their group and aiming to explore new information.
4th week	Tuesday Friday		Individual activity	4h–180min	Students organised the key elements of story plot, such as key words, images and figures in the boxes of the digital storyboard.
5th week 6th week 7th week	Tuesday Friday Tuesday Friday Monday	Production phase	Individual activity	10h–450min	Students started typing the script in the boxes of the digital storyboard, while arranging images and figures. They added sound effects and, in most cases, recorded their voices. Each student followed a different authoring digital practice based on their own design style. For instance, some students started by placing images before adding text, while others wrote the text first and then incorporated images
	Wednesday Friday	Post-Production phase	Individual activity	4h–180min	Students revised their work using a self-assessment checklist and spellchecker as supportive tools. The self-assessment checklist focused on areas, including sentence meaning, paragraph development, spelling, the use of linking words, and the coherence of selected modes. Meanwhile, the spellchecker facilitated the identification of spelling and semantic errors. Students engaged in these revisions either during the writing or upon completing their stories.
8th week	Monday Wednesday		Collaborative activity	4h–180min	Students received feedback and comments mainly from their peers and secondly from the researcher through group discussions. These comments addressed various aspects of their work, including clarity of meaning and the combination of selected modes.
9th week	Friday Monday		Individual activity	4h–180min	Students made final edits to their work based on their peers' and researcher's comments as well as any additional changes they identified.
	Wednesday	Dissemination phase	Individual/ Collaborative activity	4h–90min	Students discussed in their group and found means for their story dissemination. Having done this, each of them selected the means which was closer to their audience and preferences. They shared their stories by either uploading the links on the school's online platform or emailing them to other schools.

metafunctions—representational, interactional and compositional—to analyse visual texts.

The representational metafunction examines how communication constructs participants and events, whether people, things, places or ideas. It assesses if students depict the world narratively, showing actions or conceptually, classifying phenomena (Kress & Van Leeuwen, 2006, 2021). This is important for analysing how students with dyslexia use multiple modes to narrate their personal experiences or classify phenomena,

bringing their own perspectives into the storytelling process.

Narrative patterns feature a vector—an oblique line, such as an arrow or body, linking participants to show actions or events. Participants are identified as Actors (vector origin) and Goals (vector target) in a transactional process. In contrast, conceptual patterns present participants as static, conveying general meanings through classification, analytical, or symbolic processes. Classification symmetrically groups elements within a category (Jewitt & Oyama, 2001). Analytical processes depict part-whole relationships with a Carrier (whole) and its Possessive Attributes (parts). Symbolic processes assign meaning or identity to a Carrier via a Symbolic Attribute (Kress & Van Leeuwen, 2006, 2021).

The interactional metafunction examines how visual elements like gaze, distance, and camera angles mediate communication between depicted participants and viewers. It highlights how cultural contexts shape dyslexic students' narratives, as choices in angles and distances reflect attitudes toward relationships and emotions (Kress & Van Leeuwen, 2021). 'Demand' images, where participants make eye contact, invite viewer interaction, while 'offer' images, lacking eye contact, encourage contemplation. The horizontal angle influences involvement; a frontal angle suggests engagement, while an oblique angle implies detachment. Vertical angles convey power dynamics: a high angle grants the viewer power, a low angle empowers the participant and eye-level signifies equality. Distance also matters; close-ups imply intimacy, while distant shots suggest social or public interaction (Kress & Van Leeuwen, 2006, 2021).

The compositional metafunction examines how visual elements are arranged, focusing on information value, salience and framing. Information value relates to placement: in Western cultures, the left represents 'given' information, the right 'new,' the top 'ideal' and the bottom 'real' (Kress & Van Leeuwen, 2006, 2021). Core information often appears at the centre, with secondary details in the margins. Salience determines what draws attention, influenced by size, colour contrast or overlap. Framing connects or separates elements using lines, spaces or contrasts—framed areas signify separation, while shared colours or shapes imply connection. These elements reveal how dyslexic students use design to reflect cultural and personal perspectives.

At this point, it is important to acknowledge the limitations of Kress's visual grammar. As Kress and Van Leeuwen (2021) acknowledge, their visual analysis focuses primarily on Western visual communication and is not universal. Their work, grounded in examples from Western cultures, reflects a visual resource shaped by European languages and spread globally through media and design.

This study focuses on Greece, part of Western culture due to its contributions to Western thought, with minor Eastern influences (Kallimopoulou, 2016). To address potential variations, we supplemented the analysis with participants interviews and informal interactions during phases A and B.

Steps followed for the socio-semiotic analysis

For the analysis, we adapted a template by Moses and Serafini (2022), who organised multimodal text analyses by pairing student story pages with corresponding interview transcriptions. They categorised findings under text, illustration, and design, with subcategories like salience and position.

We customised this approach for the digital stories in this study (Appendix S1). Each template included an image of the digital story page alongside interview transcriptions or field notes, where available. Analysis was organised into three main categories: modes used, visual grammar (subdivided into representational, interactional, and compositional dimensions) and design processes (transformation and transduction).

For each page, we identified semiotic modes and representational, interactional and compositional elements contributing to meaning-making. We also examined instances of transformation and transduction across modes. Once all templates were completed, we reviewed them to identify recurring patterns, integrating students' opinions from interviews and informal interactions. This means that transcripts were integrated into the information from the templates.

Findings were presented in tables summarising semiotic processes and elements. Commonalities and differences were analysed by calculating percentages of participants using specific elements or processes, rounded to the nearest whole number for clarity and comparability.[iii]

RESULTS

This study explores how DST enables students with dyslexia to integrate their perspectives into multimodal writing through various modes, using Green's 3D model and a socio-semiotic approach. The socio-semiotic analysis of the final multimodal texts follows, combined with interview responses and informal interactions.

Baseline multimodal texts

In the students' stories, written text was the main mode of expression, with six focusing on women's position in society and seven on refugees. The texts were mostly conceptual and the tone was formal, often using emotional language through collective pronouns like 'we' and 'our.' As P11 explained: 'We should not just hear about the discrimination. We should do something.'

Visually, P8's drawing of a refugee highlighted the interactional aspect, with a direct gaze creating an intimate connection. The frontal and eye-level angles created a sense of involvement, suggesting that all—including the writer—should take action to assist refugees. P8 explained: 'I am drawing the man looking at us, to feel sorry for him and help him.' The refugee drawing was placed centrally and depicted in full length, creating a sense of social distance while inviting the viewer to engage with the refugee.

Considering the compositional metafunction and specifically the information value, in twelve out of thirteen stories, most students placed key information—like story titles—centrally or at the top, highlighting their importance. P10 stated: 'We should say how important this topic is. We are not inferior to men.' In contrast, details and supporting arguments were usually placed lower on the page, following a conventional top–bottom reading order.

Salience was enhanced through colours and visuals. P3, P6, P10, P11 and P12 used coloured titles to stress the importance of women's roles. P10 said: 'We should say how important this topic is. We are not inferior to men.' P3, P6, and P11 also used different colours for letters within paragraphs to visually distinguish different sections of the text. Only P8 included a central drawing—depicting a refugee using black and brown to show sadness and the cultural background of the refugee, who originated from Syria. P8 noted: 'Refugees have abandoned their countries due to war… They feel sad. They have lost their jobs and their loved ones.'

Framing also varied: all except P2, P4, P8, P10 and P12 used paragraphing to structure their texts. Coloured titles and paragraphing created clear visual separation. In P8's story, the drawing was framed by text, linking the narrative to the image and emphasising its central role.

Transformation appeared in shifts from formal to emotional language, especially in texts on gender equality. P7, P11, P12 and P13 transformed their language from formal to more emotional, moving from general statements to personal appeals, like P12's 'We should help abused women.' Visual transformation was seen in P3, P6, P10, P11 and P12, who used varied colours of the titles and specific sections drawing attention to different parts of the text without altering the medium itself. Only P8 showed transduction, expressing the refugee's struggles both textually and visually — through dark colours, a direct gaze and tears.

Multimodal texts at intervention phase

In phase B, the participants P3 and P13 decided to write about the isolated villages. Both created narrative stories to inform about the difficulties and positive aspects of living in these villages. P13 included measurements to help the people living there.

The Table 3 summarises the elements involved in the three metafunctions along with the transformation and transduction processes.

P3's narrative emphasises challenges and tranquillity in remote villages. Roads act as vectors of journeys, while natural landscapes and architecture symbolise timelessness (Figure 1). P3 said: 'The roads are lengthy. Residents have to travel for hours to reach the city.' Nature becomes a symbolic attribute of calm. P13 contrasts rural danger and peace and rural and urban life. The wolf, an 'Actor,' targets villages as 'Goals,' symbolising cultural fears. The dove symbolises freedom, while urban birds, flying through pollution, suggest risk. This reflects a tension between innocence and threat, shaped by personal associations. Rural self-sufficiency appears through farms as 'Carriers' of prosperity, tied to P13's memory of their grandfather's vanilla farm. A final image of two people climbing a mountain shows cooperation. The village, as a 'Carrier,' with farms, sheep and houses as 'Possessive Attributes,' highlights its unity.
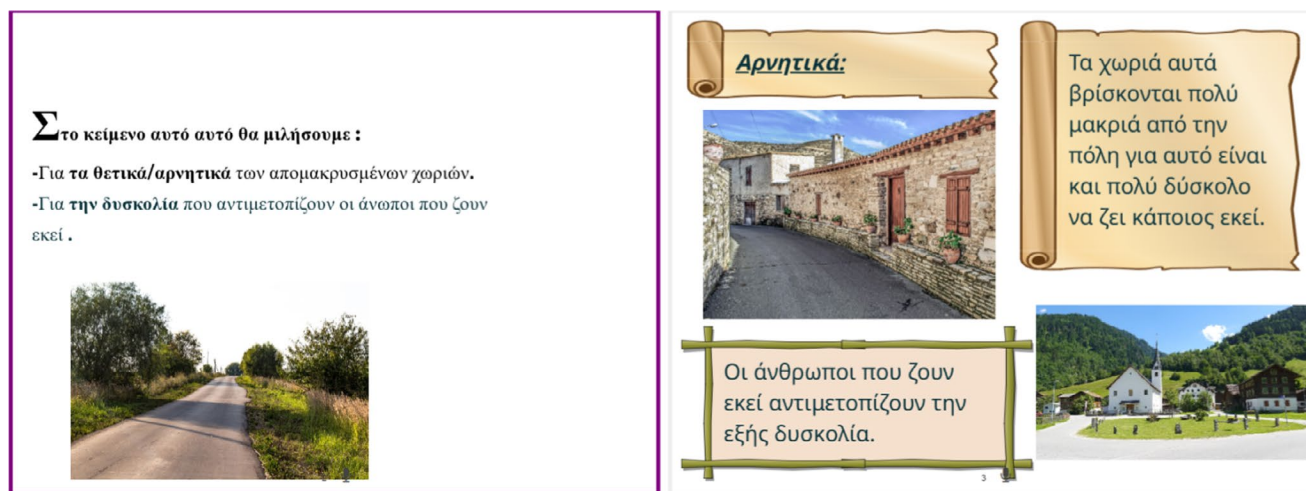
Considering the interactional dimension, P3 uses impersonal perspectives and middle-distance shots to convey village isolation, reinforced by the absence of people. P3 said: 'I prefer not to use pictures with people because the villages are isolated. Only a few people live there'. P13 shows urban police scenes suggesting interaction, and sheep imagery reflecting personal connection: 'In my grandfather's village I can usually see sheep; this is why I used such a big image' (Figure 2). Frontal and eye-level angles in both stories promote empathy, while side or oblique views create emotional distance. These visual choices reflect how each student positions the viewer—either as an observer or a participant in shared experience.

Considering the compositional dimension P3 uses 'given-new' and 'ideal-real' structures, with salience created through bold headings and large images. A solitary tree symbolises rural calm. P3: 'I chose this picture because everything in it shows calmness. People in villages live without anxiety, like my grandparents.' P13 emphasises key visuals like the wolf and polluted cloud by placing them centrally or at the top (Figure 2). Text is positioned below or within image borders for clarity, with salience achieved through varied sizes and placements of elements. Clear text-image framing is evident in both stories.

The P3 and P13 stories illustrate transduction through a blend of text, visuals, and audio elements. In P3, the narrative shifts from the challenges of rural village life to its positive aspects, while accompanying by bold headings, emotional music changes and visuals transitioning from traditional villages to cityscapes. The participant adapts their tone to match the content. P13 transitions

TABLE 3 Metafunctions and design processes in stories about isolated villages.

| | Participants' stories | |
	P3	P13
Metafunctions		
Representational metafunction	Narrative aspect • Vectors in images of roads leading to cities Conceptual aspect • Villages as peaceful, healthy places (classification) • Villages as entities with inherent characteristics • Nature symbolises purity and tranquillity • Imagery of expansive landscapes as continuity	Narrative aspect • Wolf as a threat to villages (Actor—vector—Goal) • Flight paths of birds as vectors Conceptual aspect • Wolf symbolises danger • Farm represents prosperity • Dove represents freedom in rural life • People holding hands represent solidarity • Village as an entity made up of parts
Interactional metafunction	Impersonal perspective Frontal angles and some slight side views Indirect gaze	Social distance More personal connection with nature Frontal, oblique and eye-level angles Indirect gaze
Compositional metafunction	Given-new, ideal-real structure Bold headings, large images Clear framing	Important images centered or upper part of page Large key images Text placed at bottom or within images Borders used for clarity
Design processes		
Transformation process	Text transformation from discussing negatives to positives Image size changes to reflect shifts in text tone Bold headings Guitar and violin music shifts Voice tone shifts	Change from depiction of wolves to rural settlements Size of birds reflects their health in different environments Comic-style images mixed with realistic photos
Transduction process	Textual descriptions transformed to visuals Music changes based on the text	Visual to textual and vice verca Tranquil music for rural scenes Sad sound effects for described challenges

FIGURE 1 Roads as vectors and architecture as timeless.

from an isolated rural environment to a peaceful village life. Visuals, such as birds' sizes, reflecting environmental health and auditory shifts from sad to calm music, reinforce the transformation.

The Table 4 summarises the elements involved in the three metafunctions along with the transformation and transduction processes among students who chose the same topic—peace and war.

Visual grammar/metafunctions

The representational metafunction consists of the narrative and the conceptual dimension. Based on Table 4, in the narrative dimension, children often emerge as central 'Actors' in their stories moving toward 'Goals' that reflect their visions of peace. These 'Goals'— such as writing anti-war messages, releasing doves, or
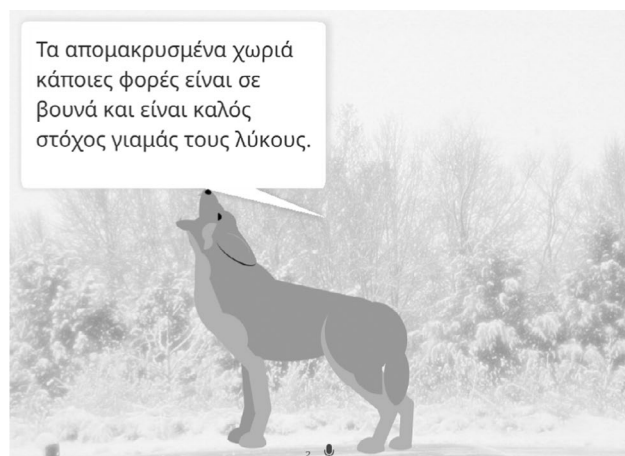
FIGURE 2   Central placement of the wolf as key visual.

interacting with peace symbols—are expressions of how students understand hope. For example, in P1's story, children writing anti-war messages symbolise a collective act of resistance against conflict, highlighting their active role in shaping messages of peace. Similarly, P2's story portrays a boy and a monk in a relational vector, where the monk becomes the 'Goal' responding with wisdom to the boy's question and reinforcing the learning about peace (Figure 3).

The conceptual aspect is also evident. Symbols carry culturally meanings, acting as students' interpretations of peace and war. Peace signs, such as yellow flowers and doves, appear repeatedly across participants' stories, representing harmony and hope. Conversely, objects, such as helmets and bullets, are symbolic attributes of war, reflecting its destructiveness. Classification processes categorise visual elements into representations of peace and symbols of war, highlighting the contrast between these opposing realities. For instance, P8 emphasises the contradiction between the tranquillity of a peaceful community and the destruction of war-ravaged landscapes- revealing their discomfort with violence and a desire for safety.

The interactional metafunction focuses on the dynamics of viewer engagement with the depicted scenes, achieved through gaze, distance and angles. In several stories, such as P8's depiction of Jesus, direct gaze is employed to create a shared emotional connection, while suggesting that the student wanted Jesus to feel present (Figure 4). Conversely, indirect gazes, as seen in military scenes, foster a sense of detachment or reflection, allowing viewers to observe the destructiveness of war from a more objective perspective. Distance also plays a critical role in shaping connections. Scenes involving children and monks are rendered with a sense of intimacy, often using close-up perspectives that draw viewers into the moment, while reflecting students' efforts to personalise peaceful scenes. In contrast, depictions of military machinery or destruction maintain a social or public distance, emphasising their impersonal

and overwhelming nature. Angles enhance the impact of these interactions. While frontal and eye-level angles dominate, offering a balanced viewpoint, occasional shifts to oblique or low angles dramatised key moments, particularly those involving war imagery. For instance, P7 employs low angles in scenes of destruction to underscore the power of conflict—suggesting a feeling of fear in the face of it.

Considering the compositional mentafunction and specifically the narrative flow, most participants adopt a left-to-right or top-to-bottom flow, reflecting their understanding of how stories unfold. For instance, P3 organises their visuals with a sequential progression that moves from scenes of peaceful harmony to the devastation of war. However, in certain stories, such as P11's depiction of war scenes, this flow is not followed, perhaps mirroring how war feels chaotic from the student's perspective. Framing also plays a significant role, with many participants separating text from images using distinct borders or spatial segmentation. For example, P7 integrates clear boundaries between text and visuals (Figure 5). Colour and contrast are also present. Peaceful scenes are often in warm colours, evoking feelings of hope. In contrast, dark war imagery reflects its destructiveness. P8, for instance, places colourful depictions of peaceful visuals alongside dark landscapes of war. Central placement of symbolic elements, such as peace signs and doves, further reinforces their thematic importance. Additionally, key figures and symbols in peace scenes are often larger, attracting attention to what matters most to the storyteller. For instance, in P7's story, the children and their grandmother are larger and centrally placed in peaceful scenes, emphasising the importance of this connection.

Design processes of transformation and transduction

Considering the transformation, stories often engaged in visual shifts—for instance, transitioning from peaceful to warlike imagery—. Changes are also present in musical tone, tonal variations in voice recordings, and alterations in the size of images, with the most important elements depicted as the largest. P5, for instance, transitions from serene landscapes to depictions of war, accompanied by changes in music that underscore the emotional gravity of these moments. Similarly, textual shifts such as the progression from general pleas for peace to personalised messages add depth to the narratives.

Transduction is also evident throughout the stories. Participants consistently combine visual, textual, and auditory modes to create a multisensory experience. Visuals are paired with impactful textual messages, while auditory components such as music and voice

TABLE 4 Metafunctions and design processes in stories about war and peace.

Metafunctions		Participants' stories											
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Representational metafunction	Narrative aspect	• Children (Actors) engage in writing anti-war message (Goal) Conceptual aspect • Peace sign as the 'Carrier' with yellow flowers as the 'Symbolic Attribute'. • Military vehicles and soldiers are engaged in classification process • Peace sign as a symbol of piece	Narrative aspect • Boy as the Actor and the monk as the Goal • Girl as the Actor and the man as the Goal Conceptual aspect • Helmet and chainmail as Possessive Attributes and the war as Carrier • Dove, as the Symbolic Attribute, and peace as the Carrier. • Monk's closed eyes symbolise tranquilly • Bullets symbolise the danger of war • Black girl symbolises the universal impact of war • Helmet and chainmail as symbols of loss and timeliness of war	Narrative aspect • Children as the Actors, and the text they inscribe as the Goal • The hand as the Actor, and the doves as the Goals of release • The hand as the Actor, and the word 'Solution' as the Goal Conceptual aspect • The sea, the sky, and the horizon suggest a classification process • The oil rig as a Carrier, and the empty surrounding environment as the Possessive Attributes	Narrative aspect • Girls as the Actors and the message as the Goal Conceptual aspect • Peace symbol as the Carrier and the yellow flowers as Symbolic Attributes. • The imagery with two elderly people identifies a classification process	Narrative aspect • The hand as the Actor, while the doves and butterflies as the Goals. • The hands as the Actors, and the rails as the Goals Conceptual aspect • The symbols of peace identify a classification process. • The images of explosions, military machinery, and destruction identify a classification process. • The depiction of peaceful community as a Carrier, with individual elements as Possessive Attributes. • Jesus as a Carrier, while the cross and the outstretched hand as Symbolic Attributes	Narrative aspect • Children as the Actors, while the grandmother as the Goal. • The hand as the Actor, while the doves as the Goals. Conceptual aspect • Grandmother as a Carrier, while the yellow flowers as the Symbolic Attribute is her role as the source of knowledge. • Elements as part of the human experience or the collective impact of war. • Destroyed imagery as Possessive Attributes and the aftermath of war as Carrier.	Narrative aspect • The boy as the Actor, and the divine as the Goal. • A man as the Actor and the surrounding environment as the Goal. Conceptual aspect • Peace symbol as the Carrier and the yellow flowers as Symbolic Attributes. • The fiery explosion and destruction symbolise chaos while the bare tree symbolises the war destruction.	Narrative aspect • Hands as the Actors, while freedom and harmonious connection with nature as the Goals. • Image of a child by the train shows a vector in the body language. • The two girls as Actors and the message as the Goal Conceptual aspect • The child's face with eyes symbolises the innocent lives devastated by war.	Narrative aspect • Girl from Ukraine as the Actor and her arrival in Thessaloniki as the Goal Conceptual aspect • Children are engaged in a classification process. • The devastated city as a Carrier and the parts as the Possessive Attributes.	Narrative aspect • Soldiers and military equipment as the Actors and the battlefield or the adversary as the Goals. Conceptual aspect • Peaceful and war elements war are evolved in classification process. • Peace symbolises the ideal state of harmony and security. • Peaceful elements as Possessive Attributes and peace as the Carrier. • Participants in the scenes as the Carrier and the heart as Symbolic Attribute.	Narrative aspect • The girls as the Actors and the message as the Goal. • Fleeing families or soldiers as the Actors and the horizon as the Goal. Conceptual aspect • Classification in scenes where various participants are brought together in shared experiences. • Images with devastated cityscape as the Carrier and individual elements as the Possessive Attributes • Peace symbol as the Carrier and the yellow flowers as Symbolic Attributes. • Dove and the broken heart as Symbolic Attributes. • Black figure symbolises the universality of war's impact.

TABLE 4 (Continued)

Participants' stories

	P1	P2	P4	P5	P6	P7	P8	P9	P10	P11	P12
Interactional metafunction	Social connection with images of children; Public distance in military scenes; Frontal, oblique, eye-level and slight high-angle; Indirect gaze	Personal connection with the monk; Social connection with some figures; Frontal angles and eye-level shots; Direct gaze	Public perspective; Children depicted in social distance; Frontal and eye-level angles; Indirect gaze	Social distance; Frontal, slightly oblique and eye-level angles; Indirect gaze	Personal connection with the concept of peace; Close-up perspective; Oblique and eye-level angles; Jesus' direct gaze	Social distance; Frontal, high oblique, and eye level angles; Direct gaze	Personal and social distance; Frontal, oblique, eye level and low angles; Indirect gaze	Intimate connection with the boy; Social scenes/connection; Frontal, low, and eye level angles; Direct and indirect gaze	Social distance; Frontal and eye level angles; Direct gaze	First-person plural/direct communication; Social distance; Frontal, eye level and low angles	Social distance; Jesus' complete depiction; Frontal, low and eye level angles; Indirect and direct gaze
Compositional metafunction	Left-to-right flow; Peace symbols and children dominate the visual space; Minimal framing with images and text integrated. Visuals are connected through thematic repetition and colour scheme.	Top-to-bottom structure; Peace and war imagery stand out. Clear framing	Left-to-right flow; Symbolic images are placed on the centre; Use of contrasting images; Subtle framing	Left to right and top to bottom flow; Use of contrasting colours; Prominent image of peace symbol; Elements are connected visually and contextually	Left to right and top to bottom flow; Central placement of key images; Use of vibrant colours and contrasting images; Text is presented within distinct frames	Left to right flow; Serene scenes are depicted in vibrant colours and war scenes in dark ones. Key figures are larger in peace scenes and smaller in war ones. Graffiti with red colour; Larger key images; Clear framing	Left to right flow; Larger and centred key images; Clear separation of text and image	Not a consistent left to right flow; Essential images are centred; Bright, centred images of peace against darker battle visuals of war; Framing distinguishes between war and peace imagery.	Not a consistent left to right flow; Top to bottom flow; Essential images are centred; Colour contrast; Each scene represents a different part of the story. Clear framing	Left to right and top to bottom flow; Bold letters and contrasting colours; Larger size of core images; Clear framing	Left to right flow; Bold texts; Sad figures' faces; Colour contrast between peaceful and war images; Clear framing
Design processes											
Transformation process	Shifts from simple questions to complex discussions; Shift from narrative to dialogue; Music changes	Peaceful nature transforms into war imagery. Shift from dialogue to narrative; Music changes	Differentiation in visuals for the same concept; Music changes	Text changes from general pleas to personalised messages; Images transition from stark graffiti to serene landscapes; Adjustment of voice tone	Hearts appear in different forms; Soft, warm colours are turned into harsh, fiery colours; Narrative text transformed into monologue; Music changes	Transformation of the background environment; Alternation of comic and realistic visuals; Dialogues become more complex; Changes in voice tone by 3 participants	Visual transformation of war pictures to those of peace; Initial letter of each paragraph is bolded	Reorder of images; Titles of pages with bold and highlighted letters; Changes in music tone	Transformation on visual backgrounds; Dialogue transformation; Transformation from dialogue to narrative and vice versa	Changes in colour letters; Capitalised words; Changes in music tone; Changes in size of images	Narrative is converted into dialogues; Changes in the characteristics of figures; Changes in voice tone
Transduction process	Visual, textual and auditory transduction	Visual, textual and auditory transduction	Interaction of visual elements, text and auditory components	Visual, textual and auditory transduction	Visual, textual and auditory transduction	Visual, textual and auditory transduction	Visual, textual and auditory transduction	Interaction of visual elements, text and auditory components	-Visual and textual transduction	Visual, textual and auditory transduction	Visual, textual and auditory transduction

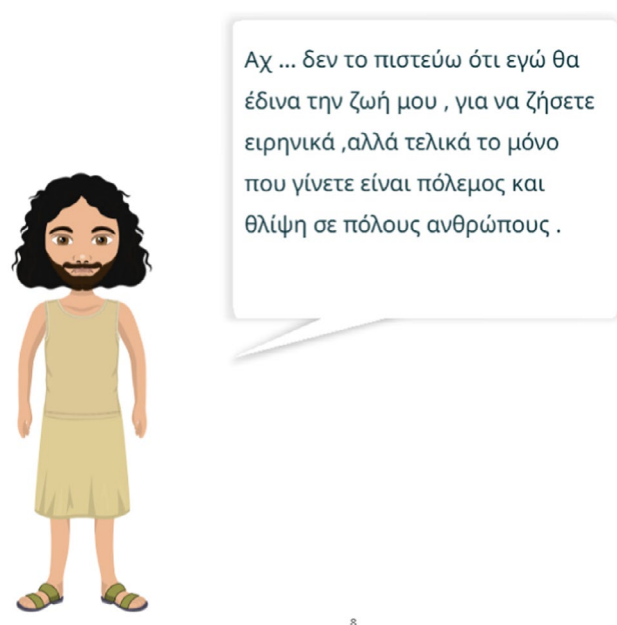**FIGURE 3**   Relational vector between boy and monk.
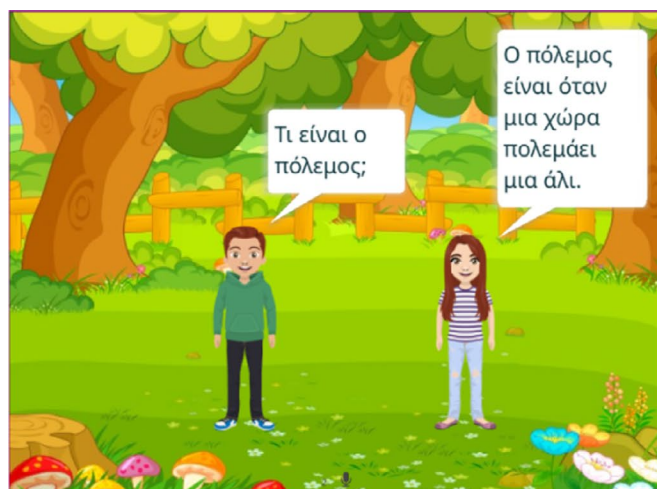

FIGURE 4   Direct gaze of Jesus.

FIGURE 5   Clear framing between text and visuals.

modulation amplify the emotional resonance. P12, for instance, integrates these elements, using the interplay of graffiti, relevant text, and calm music to create an immersive narrative.

Commonalities and differences in the digital stories

The Table 5 presents a quantitative summary of the key processes and elements used and categorised across the three metafunctional dimensions. For each dimension, it shows the number of participants who employed specific elements and expresses this as both a raw count and a percentage of the total participants.

Representational metafunction

Based on the Table 5, a common feature across all 13 digital narratives was the use of vectors that guided the flow of actions and events. This ensured a coherent progression, directing readers through key developments and reinforcing thematic connections. For instance, the image, with hands as 'Actors' and rails as 'Goals', creates a vector of struggle, showing the designer's empathy, as P6 explains: 'I chose this image to show that people in war are entrapped by enemies and slavery.' Additionally, classification processes appeared in most participants' stories, 10 out of 13, helping to organise contrasting themes such as war versus peace or rural versus urban life. This method allowed authors to highlight key distinctions and reinforce central messages. Analytical processes were also widely used by 9 out of 13 participants, particularly in stories addressing complex themes like the effects of war.

Symbolic processes, though slightly less common (8 out of 13), added deeper layers of meaning to the narratives. The use of symbols such as doves, crosses, or other
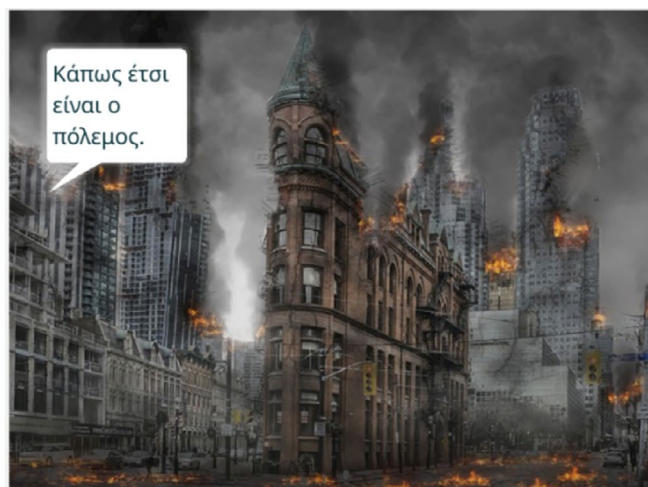
TABLE 5 Raw number of participants and corresponding percentages involved in metafunctional dimensions.

Dimension	Participants	Number of participants	Percentage
Narrative pattern			
Vectors	All participants (P1–P13)	13	100
Conceptual pattern			
Classification process	P1, P3, P4, P5, P6, P7, P8, P9, P11, P12	10	77
Analytical process	P2, P4, P5, P6, P7, P8, P9, P11, P12	9	69
Symbolic process	P1, P3, P5, P6, P7, P8, P10, P13	8	62
Interactional dimension			
Gaze			
Direct gaze	P2, P6, P7, P10	4	31
Indirect gaze	P1, P3, P4, P5, P8, P11, P13	7	54
Mixed gaze	P9, P12	2	15
Distance and social interaction			
Social and public distances	P1, P3, P4, P5, P11	5	38
Social distance only	P7, P10, P12, P13, P6	v	38
Personal and social distances	P2, P6, P8, P9	4	31
Angle and power dynamics			
Frontal and eye-level shots	All participants (P1–P13)	13	100
Low angles	P4, P5, P8, P9, P11, P12	6	46
High angles	P1	1	8
Compositional dimension			
Information value			
Left-to-right and top-to-bottom layouts	P1, P3, P4, P5, P7, P8, P10, P11, P12	9	69
Right-to-left and central-marginal Layout	P4, P9	2	15
Top-to-bottom and central marginal layouts	P13	1	8
Top-to-bottom layout only	P2	1	8
Combination of all layouts	P6	1	8
Salience			
Size and central placement	All participants (P1-P13)	13	100
Use of colours	P5, P6, P8, P9	4	31
Bold textual elements and high-contrast imagery	P3, P11, P12	3	23
Framing			
Clear borders for framing	P1, P6, P11, P12	4	31
Integrated layout (text & images)	P3, P4, P5, P8, P9, P10, P13	7	54
Mixed framing approaches	P2, P7	2	15

imagery enriched the storytelling by conveying abstract themes in a visually or metaphorically compelling way. For instance, P8 said: 'I used this image because the tree is bare and the war causes destruction.' This aligns with the interview subtheme of 'cultural relevance' under the theme of 'social and cultural context', where students used cultural symbols, creating a deeper connection with their audience while allowing them to resonate with shared cultural meanings. P4 said: 'I used a picture of a dove since it is a universal symbol of peace; I wanted the freedom, the feeling of freedom to be clear to everyone'. Such choices reveal students' effort to engage with and create shared cultural meanings.

Finally, P5, P6, P7 and P8 balanced all four processes, creating narratives that were both structured and thematically rich.

Interactional metafunction

The interactional dimension focuses on how participants engaged the viewer through visual modes such as gaze, distance and angle, influencing the viewer's relationship with the depicted content.

Gaze: The gaze was crucial in establishing connection or detachment between the viewer and the

story. Four out of thirteen participants utilised direct gaze to create an intimate connection, particularly in scenes where the characters were involved in actions that required empathy or reflection. For example, P7's characters, especially the grandmother, were designed to make direct eye contact with the audience, fostering a sense of involvement and emotional engagement. P7 explained: 'I want the figures to look at the readers making them feel part of the story and creating intensive feelings, just as I feel'. In contrast, seven participants chose to adopt an impersonal perspective, using indirect gaze to position the viewer as an observer. This choice aligns with their intention to inform rather than directly engage. P6, while predominantly using indirect gaze in the scene featuring Jesus, employed a direct gaze, underscoring the moral and emotional weight of Jesus' presence in the narrative. P6 explained: 'Jesus looks at us and protects us. In this scene he is disappointed by our actions while he behaves us in a good manner.' Two out of thirteen participants utilised both direct and indirect gaze to create varied levels of engagement.

Distance and Social Interaction: Distance was another key element in shaping the viewer's relationship with the narrative. Most participants employed a range of distances, from personal to public, to emphasise different aspects of their stories. 5 out of 13 participants predominantly used social and public distances, especially in scenes of war and devastation. P4 explained: 'I want the audience to feel they are part of what I describe, but not to totally into it.' This choice allowed the viewer to observe events from a distance, emphasising the collective impact of war without focusing too closely on individual experiences. P3 relied on distant shots of landscapes in 'Isolated Villages,' highlighting the isolation and vastness of rural environments. 5 out of 13 participants primarily employed social distance, balancing engagement with a level of detachment. This approach was effective in scenes involving broader themes or symbolic actions, such as advocating for peace. Finally, four out of thirteen students used a mix of personal and social distances. For instance, P8 said for the picture showing the boy from the waist up: 'I put this image because it shows the boy so close, helping others to feel what the boy is feeling.' Personal distance was used to create intimacy in discussions, while social distance provided a broader perspective on collective experiences, such as the impact of war on communities.

Angle and Power Dynamics: The choice of angle played a significant role in conveying power dynamics and involvement. A commonality across all stories was the use of frontal and eye-level shots to establish equality between the viewer and the characters. P2 said: 'I use images that we can clear see in front of us since for example the child could be one of us.' This perspective reinforced the notion of shared experiences. 6 out of 13 participants

employed low angles to convey power dynamics. For instance, P12 used a low angle, positioning the viewer in a less powerful stance compared to war. P12 noted: 'The war is so big and scary, and we're so tiny compared to it.' In contrast, one student used a high angle in certain scenes, such as those depicting soldiers, to create a sense of power dynamics.

The aforementioned findings align with the subtheme of 'audience engagement' under the theme of 'social and cultural context'. Participants' image choices enabled them to convey their emotions and power dynamics in ways that written text alone may not have achieved. P5 explained: 'I believe that the images did 70% of the work […]But with the distance of images, they can understand more things, like the emotion.'

Compositional metafunction

The compositional dimension involves the arrangement of visual and textual elements on the page, influencing how information is processed and understood by the viewer.

Information Value

Across the participants, the use of left-to-right and top-to-bottom layouts was employed selectively rather than consistently throughout their stories. In particular scenes, 9 out of 13 participants used these layouts to highlight the progression from general to specific or ideal to real. Two participants used a right–left and central-marginal layout in their story. One participant applied a top-to-bottom and central-marginal layout in several scenes, while another primarily utilised a top-to-bottom structure in their story. One out of thirteen students employed a combination of top-to-bottom, right–left and central-marginal layouts in different parts of their story.

Salience

Salience was achieved through the strategic use of colour, size and placement. 4 out of 13 participants used bright colours to highlight key messages related to peace, contrasting these with darker tones used for war imagery. This aligns with the subtheme of 'diverse modes for emotional expression' (theme: 'emotional expression'), where students mentioned the use of different colours to convey emotions. P11 said: 'I used black to write about war and white for peace. Black shows war's sadness, while white peace's calm'.

The size and central placement of important symbols were employed across all stories to draw the viewer's attention to the central themes. For instance, P10 said: 'I included the disabled girl in this central position to show that these people should not be excluded from important conversations.' Three participants used bold textual elements and high-contrast imagery to ensure that specific messages or concepts stood out.

Framing

Framing varied across participants, with some opting for clear borders and others for more integrated layouts. Four out of thirteen students used distinct borders to separate text from images, ensuring clarity in the narrative flow. For example, P10 said: 'I decided to put my texts in boxes to avoid confusing the audience.' In contrast, around the half of the participants chose less defined frames, allowing for a more seamless integration of text and imagery. Two students utilised a mix of framing approaches, sometimes separating elements to emphasise differences or connections between concepts, and at other times integrating visuals and text to create a more fluid storytelling experience.

Transformation and transduction processes

The Table 6 presents the raw number of participants and the corresponding percentages of those involved in transformation and transduction processes.

Based on Table 6, all 13 participants utilised transformation and transduction processes to varying extents. All stories employed visual transformation by altering images or visual symbols to reflect shifts in narrative. For instance, participants like P3, and P13, and P10 transformed their visual content to depict transitions from negative to positive themes. Textual transformation was also common across 8 out of 13 participants, who changed the type of the text, font styles, sizes, or letter colour to emphasise key points. For instance, P6 commented: 'I decided to let Jesus speak to the hearts of the audience.'

Additionally, twelve out of thirteen students engaged in auditory transformation. Indicatively, in P6's, P7's and P12's stories, the background music and voice recordings were carefully adjusted to align with the narrative's mood, transitioning from sombre tones during discussions of war to more soothing sounds during peaceful scenes. P5 said: 'If it is a happy scene, I try to sound happy, but if it's sad or serious, I speak more softly and sadly.' This aligns with the subtheme of 'cultural relevance' (theme: 'social and cultural context'). Students used different tonal variations to create an emotional connection with their audience while expressing themselves. P12 explained: 'The sad guitar music was for when the story spoke about the consequences of war. We all understand that this sound is about sadness.' Additionally, some students highlighted changes in voice tone as a culturally relevant element that made their expressions more relatable to the audience.

In terms of transduction, all participants effectively translated information across modes. Visual to textual transduction was evident across seven out of thirteen participants' stories. For instance, in the stories of P2, P7 and P9, images of war or peace were accompanied by text that provided context or amplified the narrative's meaning. P7 said: 'I made it like this because war destroys things and hurts people. I want everyone not only to see but also read how bad it is.' Textual to visual transduction was also employed by 8 out of 13 participants. Indicatively, in P1's and P8's stories, written descriptions of war's impacts were visually represented through images of destruction. Seven out of thirteen participants used visual to auditory transduction, where visual scenes were paired with sound effects or music that reinforced the narrative's emotional tone. Textual to auditory transduction was utilised by nine participants, where written dialogues or narratives were complemented by voice recordings, adding a personal layer to the story.

These findings support the subtheme of 'diverse modes for emotional expression' (theme: 'emotional expression'), as students found that using various modes helped them express emotions more effectively. They also align with the subtheme of inclusivity (theme: 'social and cultural context'). Students noted that music, audio, and images made their stories more accessible, especially for those with special needs or learning difficulties. As P1 explained: '[…] They will be able to listen to it if they cannot read well and struggle. If they have dyslexia like me.' Similarly, P6 noted: 'For a deaf person, it would be better to see it, for a blind person to hear it.'

While all participants engaged in visual and textual transformation and transduction processes, some did

TABLE 6 Raw number of participants and corresponding percentages involved in transformation and transduction processes.

Processes	Participants	Number of participants	Percentage
Transformation process			
Visual transformation	All participants	13	100
Textual Transformation	P3, P4, P5, P6, P8, P9, P11, P12	8	62
Auditory Transformation	P1, P2, P3, P4, P5, P6, P7, P8, P9, P11, P12, P13	12	92
Transduction process			
Visual to Textual Transduction	P1, P2, P3, P7, P9, P11, P13	7	46
Textual to Visual Transduction	P1, P2, P3, P7, P8, P9, P11, P13	8	62
Visual to Auditory Transduction	P2, P4, P5, P6, P8, P10, P13	7	46
Textual to Auditory Transduction	P1, P2, P3, P5, P6, P7, P8, P11, P12	9	69

not fully utilise auditory modes. Specifically, in the transformation process participants P7, P12, P1 and P11 made minimal use of music. On the other hand, P6 and P2 incorporated diverse types of music into their narratives, using it to enhance the emotional tone of different scenes. Despite this, they did not include voice recordings, relying solely on the interplay between visual and textual transformations, supported by music. In contrast, P5 and P8 chose to focus on voice recordings without using music.

In terms of transduction, while visual and textual modes were consistently transduced across the stories, the same did not apply for the auditory transduction. P7, P12, P1 and P11, for example, focused on visual-to-textual and textual-to-visual transductions, with minimal reliance on auditory transduction. Conversely, P6 and P2 used music as a significant part of their transduction process, translating visual and textual elements into auditory experiences. P5 and P8, by excluding music, leaned into visual-to-auditory and textual-to-auditory transductions through their use of voice recordings.

The observed patterns in the above metafunctions and processes suggest that the participants were not only aware of the cultural significance of the modes they used but also adept at manipulating these to create narratives that resonate with their intended audiences, reflecting their background and considering the sociocultural context in which their stories are situated.

DISCUSSION

This study examined how DST facilitates cultural expression among primary students with dyslexia, considering the socio-cultural context. Results showed that by integrating modes, participants conveyed emotions and meanings.

The representational aspect of multimodal design highlights how students constructed narratives that blend personal experiences with broader cultural symbols, creating narratives that resonate with their realities. Through the interactional dimension, students engaged their audiences with intentional choices in gaze, distance, and angles. These visual strategies aligned with their cultural contexts, allowing them to draw on familiar ways of relating to others emotionally. This aligns with Sarica's (2023) and Kim and Li's (2021) study, which found that typically developing students sought to establish emotional connections with their audiences while expressing their emotions through multiple modes of DST. However, this study extends these findings by focusing on students with dyslexia and showing how multimodal storytelling not only supports emotional expression but also fosters cultural identity—allowing students to express who they are, where they come from, and what matters to them through culturally resonant visual and auditory choices.

The compositional design further highlights how students' cultural backgrounds shaped their narratives. The careful organisation of information through layout, salience and framing reflects the ways in which cultural backgrounds affect stories. As Jewitt and Bezemer (2016) note, composition in multimodal texts reflects culturally shaped communicative practices. For example, by placing significant elements in prominent positions, students draw attention to culturally meaningful symbols, ensuring that their narratives resonate with both personal and collective identities.

Both the processes of transduction and transformation became a means of expressing their cultural experiences. These design choices align with what Jewitt et al. (2016) describe as design-based literacy practices, where learners orchestrate multimodal resources to achieve communicative goals. This aligns with Kumpulainen et al. (2020) study, who observed that students communicated their experiences and knowledge about the nature with and through the characters' changes in their stories. However, that study focused on nature-based content, while our findings suggest that students with dyslexia similarly leverage these processes to represent sociocultural themes despite literacy challenges. Additionally, Lambert (2010) and Yang (2012) emphasised that variations in tone and pace not only convey the storyteller's emotions but also reflect their identities. Our findings expand on this by supporting that while some students indeed used music and voice to convey emotional shifts, others used sound more as a background feature.

We can conclude that by integrating visual and auditory modes, students had alternative pathways for expression, compensating for difficulties in writing. Rather than relying on transcription—such as spelling and handwriting—to create meaning, multimodal writing reduced cognitive load associated with these skills, enabling students to allocate more cognitive resources to creative thinking and communication. DST thus provided communicative friendly support for dyslexic and neurodivergent learners, aligning with Frith's statement that 'cultural tools give us power to mitigate the symptoms of neuro-cognitive deficits' (Frith, 2002, p.64).

CONCLUSION

This study contributes new insight into how DST can be used not only as an inclusive literacy approach for students with dyslexia, but also as an approach for cultural expression. While previous studies have recognised the multimodal affordances of DST, they have primarily focused on typically developing populations (Bjørgen, 2010; Kim & Li, 2021; Kumpulainen et al., 2020; Sarıca, 2023; Schlauch et al., 2022; Yang, 2012), with only limited attention given to struggling writers (Sylvester & Greenidge, 2009). This study's methodological framework enables within-subject comparisons over time and

grounds interpretation in both product and process—an approach not evident in the aforementioned work. This research is among the first to explicitly examine how students with dyslexia use these affordances to integrate their socio-cultural backgrounds into narrative production.

By applying Green's 3D model in conjunction with a socio-semiotic lens—a combination not employed in prior studies—this study extends the conversation from simply *how* students compose with multiple modes to *why* and *what* they choose to represent, shedding light on the cultural and emotional intentionality behind these choices.

This matters because it reframes students with dyslexia not as learners compensating for deficits, but as meaning-makers and cultural participants who bring valuable perspectives to the classroom. The use of multimodal design allowed students to express ideas and emotions that traditional writing often hinders. This supports a more asset-based understanding of dyslexia, emphasising potential rather than limitation.

The study also offers practical implications for educators: DST should be viewed as a culturally responsive pedagogical approach that enhances equity in literacy instruction. Educators can integrate the DST into their teaching practices by following the teacher-friendly framework presented in Phase B in Table 2, which scaffolds multimodal storytelling through stages of oral expression, multimodal design and cultural reflection. DST enables authentic engagement and inclusive participation. Students made design choices that reflect their unique backgrounds, while all of them, regardless of literacy challenges, could express their thoughts and emotions through multiple modes.

By foregrounding cultural meaning-making in DST for students with dyslexia, this study opens up new directions for research and practice, advocating for literacy environments that are not only multimodal but also culturally sustaining. While this study provides valuable insights into how students with dyslexia engage in multimodal meaning-making through DST, the limitations of small sample size and specific cultural context should be acknowledged. Future research could expand this focus to other neurodivergent populations and diverse cultural settings.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare relevant to the content of this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon reasonable request to the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

Ethical approval was obtained.

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Endnotes

[i] Green's 3D model consists of three interrelated and overlapping dimensions: the operational, (related to the use of language and technology), cultural (meaning making in cultural contexts) and critical (reflecting and analysing). For the purpose of this paper, we focus on and present the cultural dimension. For further details on these dimensions and their alignment with DST process, see Kritsotaki et al. (2024).

[ii] For the purpose of this paper, we present only the themes from the interviews that are relevant to the sociosemiotic analysis of the texts in the Results section.

[iii] The mathematical formula was: percentage = (total number of participants/number of participants using a process/element) × 100.

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