

Tangible digital collaborative storytelling in adolescents with intellectual disability and neurodevelopmental disorders

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Abstract

Background: Collaborative storytelling can be a helpful tool to promote cognitive and social skills in adolescents with neurodevelopmental disorders.

Aims: The current study aimed to explore the benefits of collaborative storytelling using traditional (TST), digital (DST), and tangible digital (TDST) methodologies.

Materials and Methods: Fourteen Spanish students with mild to moderate intellectual disability and other neurodevelopmental comorbid disorders participated in collaborative storytelling sessions in the classroom, following an experimental, mixed, and cross-sectional design. The study comprised three individual assessments of narrative skills and eight collaborative storytelling sessions using different storytelling methodologies. Individual and collaborative stories were videotaped, transcribed verbatim, and analysed for formal and content characteristics. Behaviours and interactions during the collaborative storytelling were analysed for each group and session.

Results: The results show a positive effect of collaboration on students' stories, compared to individual performance, regardless of the methodology used.

Conclusion: Collaboration, technological device handling, and shared storytelling did not present a barrier for the participants.

KEYWORDS

adolescence, cooperative learning, intellectual disability, narrative competence, neurodevelopmental disorders, tangible digital storytelling

1 | INTRODUCTION

1.1 | Storytelling development during childhood and adolescence

Storytelling or narrative competence is a complex socio-cognitive function closely related to language and event representation

(Hudson & Shapiro, 1991; Iandolo, 2021; Iandolo et al., 2012, 2013) that develops as the person progresses through evolutionary steps (Botvin & Sutton-Smith, 1977; Bruner, 1988; Iandolo, 2021). Storytelling results from the integration of cognitive and social skills (communication, language, intelligence, memory, social and executive competencies) and allows the person to elaborate information, reflect, make judgements, and interact with others, sharing memories, representations, beliefs, and fantasies (Botvin & Sutton-Smith, 1977; Bruner, 1990, 1986, 1991; Iandolo, 2011; Iandolo et al., 2012).

Cristina Alonso-Campuzano and Giuseppe Iandolo provided the same contribution to the work (co-first/equal authorship).

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The capacity to tell a story is a primary instrument for participation in social life from early childhood (Iandolo, 2021). The linguistic-narrative and social development achieved during childhood helps define personal identity and relationships, and navigate complex social realities such as school (Bird & Reese, 2006; Pasupathi & Hoyt, 2009).

Telling a story requires knowledge and memory of the structure of events and representations (Iandolo, 2021; Mandler, 1984; Nelson, 1989; Westby, 1991), theory of mind (Abbeduto et al., 2004; Flynn, 2018; Siller et al., 2014; Tarchi et al., 2019), relational models, context and socio-cultural elements (McCabe et al., 2006; Nelson, 1999).

Children and adolescents with neurodevelopmental disorders and intellectual disability may face challenges areas that influence developing narrative skills, such as verbal fluency, language development, memory, word retrieval, and executive functions (Corbett et al., 2009; Diamond, 2013; Geurts et al., 2004; Henry et al., 2015; Hurks et al., 2010; Vaucheret Paz et al., 2017).

1.2 | Collaborative storytelling during childhood and adolescence

Collaborative storytelling is a tool for the co-construction of meanings and narratives through group conversation focused on a topic (Alonso-Campuzano et al., 2021; Bruner, 1991; Iandolo, 2011, 2021). Due to its sizeable social dimension, collaborative and cooperative learning have been effective instruments for developing narrative competence since early and middle childhood (Iandolo, 2021; Vermette et al., 2004).

In the last three decades, several researchers have pointed out the benefits of collaborative learning in primary educational settings (Alonso-Campuzano et al., 2021; Johnson et al., 2000; Johnson & Johnson, 1999; Johnson & Johnson, 2008; Nokes-Malach et al., 2015; Nokes-Malach et al., 2019; Salma, 2020).

Creative collaboration progresses from childhood to adolescence with the ability to coordinate social perspective and transactive dialogue use, elaborating and expanding reciprocal concepts in an exploratory conversation (Azmitia & Montgomery, 1993; Hoever et al., 2012; Oztop & Gummerum, 2020; Segundo-Marcos et al., 2023). To foster students' collaborative and creative imagination, the teacher must accompany adolescents through unknown contents and tasks with specific and time-delimited assignments, considering the knowledge dependency, appropriateness of resources, and group relational dynamics (Hong et al., 2009; Pierroux et al., 2022).

According to Stavroussi et al. (2010), there is a dearth of scientific literature on collaborative learning among students with intellectual disability. Some research has focused on mixed collaborative groups of students with intellectual disability and typical development in inclusive schools (Katz & Mirenda, 2002; Muniroh et al., 2017). Regarding collaborative digital storytelling, a few case studies and research have shown positive outcomes regarding educational skills and personal empowerment in intellectual disability (Manning, 2010; Saridaki & Meimaris, 2018). The paucity of research in collaboration in

the intellectual disability context may be due to the assumption of less development of essential metacognitive competencies that have been considered essential in this type of learning (Wishart et al., 2007).

1.3 | Tangible and digital storytelling in educational settings

Tangible digital storytelling (TDST) is a narrative methodology that combines storytelling, tangible objects, and multimedia technology, supporting the simultaneous manipulation of concepts and objects in the physical and digital environment (Baranauskas & Posada, 2017; Catala et al., 2017; Harley et al., 2016; Iandolo, 2021). Tangible digital storytelling (TDST) devices can support multiuser collaborative interactions (Baranauskas & Posada, 2017; Katifori et al., 2020; Kurdyukova et al., 2009; Zancanaro et al., 2007) and the user's experience awareness, getting through different senses to engage and expand the learning experience (Eisenberg et al., 2004; Filosofi et al., 2021; Somma & Desideri, 2020).

The tangible dimension integration, can be beneficial in people with disabilities and special education needs (Alessandrini et al., 2014; Bonillo et al., 2019; Francis et al., 2019; Somma et al., 2021; Somma & Desideri, 2020), supporting processes like concept abstraction, sequencing, experience's memory (Matos et al., 2015; Ten Brug et al., 2012, 2015, 2016; Young et al., 2011), communication or story retelling performance (Hengeveld et al., 2008, 2009; Matos et al., 2015).

Collaborative storytelling can expand the possibilities in both the creation and transmission of stories, particularly for students struggling with abstract or complex content due to factors such as age, educational level, learning difficulties, or neurodevelopmental disorders (Filosofi et al., 2021; Harley et al., 2016). Promoting collaborative interactions require adaptations to task requirements, context, and user skills (Alonso-Campuzano et al., 2021; Stock & Zancanaro, 2007). Use of digital storytelling methodologies allows students with intellectual disabilities to focus on content, formulate sequences, provide additional elements to storytelling (Francis et al., 2019; PÉrusseau-Lambert et al., 2018), and gain confidence in their ability to create and express ideas through a digital medium (Botturi et al., 2014; Saridaki & Meimaris, 2018). Digital storytelling can also increase opportunities to scaffold traditional literacy for students with neurodevelopmental disorders, as it helps students learn new skills by applying them creatively (Botturi et al., 2014; Rodić & Granić, 2022; Somma & Desideri, 2020).

Despite this, research on digital and tangible digital storytelling (TDST) has been more focused on tool development than on the possible uses of these tools in the educational field (Hassan et al., 2021; Peñuelas-Calvo, 2020). Therefore, TDST requires experimentation in use as a novel educational technology (Botturi et al., 2014; Eisenberg et al., 2004; Iandolo, 2021; Rodić & Granić, 2022; Somma & Desideri, 2020; Sweeney-Burt, 2014) as this technology can offer new learning opportunities, empowerment, and autonomy (Francis et al., 2019; Manning, 2010; PÉrusseau-Lambert et al., 2018; Saridaki & Meimaris, 2018; Somma & Desideri, 2020).

This study explores the effects of collaborative storytelling activities in a sample of 14 adolescents with intellectual disability and comorbid neurodevelopmental disorders in a special education school in Madrid (Spain) by comparing students' interactions and the final stories produced with different methodologies (traditional—TST, digital—DST, and tangible digital—TDST).

The research questions focused on understanding if and how TDST procedures can improve the form and content of group stories during collaborative activities. First, we expected to find a positive effect of the tangible digital methods in front of other methods, reflected in the quality of the group stories and interactions. Secondly, we expected to find a positive effect of collaborative work, with higher quality and content balance in collaborative stories compared to the individual storytelling performance. Finally, we expected the groups with the highest task collaboration scores to tell more sophisticated stories regarding form and content balance. The research questions merged into six hypotheses:

H1. Students with intellectual disability, with and without other neurodevelopmental comorbid conditions, can engage in inclusive, collaborative storytelling using tangible and digital methods.

H2. Collaborative tangible digital storytelling (TDST) has a more significant effect on individual narrative skills than collaborative digital storytelling.

H3. Collaborative TDST produces stories with higher formal and content quality than those created using only digital collaborative methods.

H4. TDST yields more inclusive and prosocial group interactions than collaborative digital storytelling.

H5. Collaborative stories supported by different methodologies (TST, DST, TDST) exhibit higher formal and content quality than stories created by participants alone in their baseline, intermediate, and final individual assessments.

H6. The level of collaboration impacts the story quality supported by the three different methodologies (TST, DST, TDST).

2 | METHODOLOGY

2.1 | Design

The study adopted an experimental, mixed, and cross-sectional design to examine the dynamics of storytelling and collaboration among two classes of Spanish special education students with intellectual disability, with and without other neurodevelopmental comorbidities. The research employed various storytelling methodologies, including tangible digital (TDST), digital (DST), and traditional storytelling (TST).

As illustrated in Figure 1, the study's experimental structure consisted of three individual assessments (baseline, intermediate, and final measurements) and two blocks of collaborative storytelling sessions (experimental and control). For the baseline assessment, intelligence (WISC-IV, Wechsler, 2007), narrative skills (Bears Family Projective Test; landolo & Alonso-Campuzano, 2021), verbal fluency (NEPSY-II; Korkman et al., 2014), and sociographic class measures (Moreno, 1960) were assessed. Narrative skills (using the Bears Family Projective Test) were re-evaluated for the intermediate and final assessments.

The collaborative storytelling sessions were conducted in blocks of four, which were differentiated based on the experimental condition (a combination of TDST/TST) and control condition (a combination of DST/TST). After the first block of four sessions and the intermediate

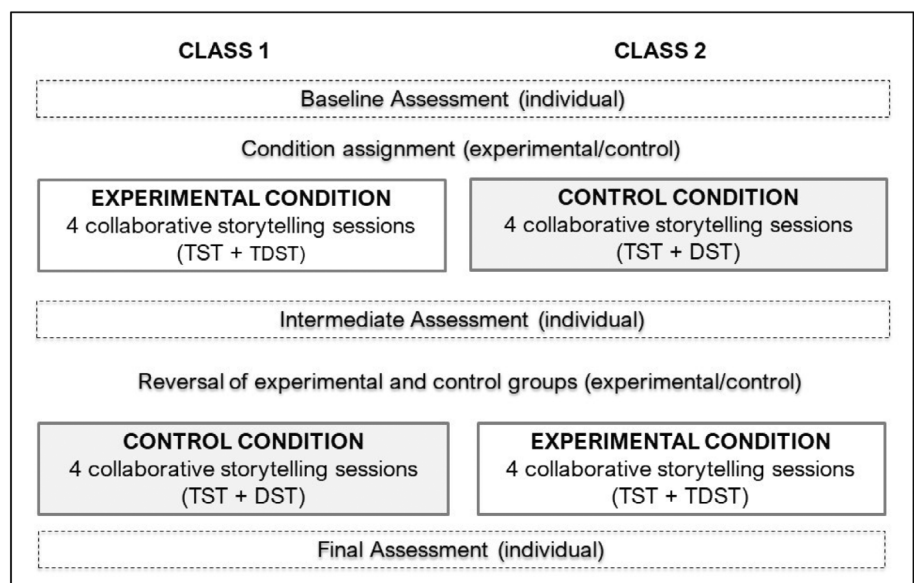


FIGURE 1 Experimental design scheme.

assessment, the classes were switched between the experimental and control conditions, resulting in eight sessions per class (four sessions in each condition).

2.2 | Participants

Fourteen students, seven boys (50%) and seven girls (50%), aged between 11 and 17 (Mean: 14:08 years; SD 1.38 years; Table 1), proceeding from two classes (6 and 8 students per class) of a special education school in Madrid (Spain), participated in the study. All participants presented mild to moderate intellectual disability ranging between FSIQ 46 and FSIQ 63 (mean FSIQ 52.21; SD 5.19; Table 1) on the Wechsler intelligence scale (WISC-IV; Wechsler, 2007). According to teachers' reports, two students (14.3%) had a comorbid diagnosis of autism spectrum disorder (ASD), and three students (21.4%) presented severe language impairments. All participants had a previous psychiatric diagnosis validated by a disability commission of the Spanish public system.

Concerning participants' gender, the results indicated higher scores in FSIQ in male participants (Mean men 55.71, SD 4.15; Mean women 48.71, SD 3.55; $t = -3.39$; $Df 12$; $p < .01$) and a male trend toward greater verbal fluency (Mean males 6.71, SD 3.10; Mean females 3.71, SD 2.36; $t = -2.04$; $Df 12$; $p = .06$). Concerning age, results show no correlations with IQ, verbal fluency, form, and content of the individual narrative performance.

According to the baseline results from the NEPSY-II verbal fluency test (Korkman et al., 2014), most participants showed standard scores below their normative age (Comparison Phonological vs. Semantic Total mean 5.2; SD 3.1), with impairments in both

semantic (Semantic Fluency, $M 2.1$; $SD 2.1$) and phonological fluency (Phonological Fluency, $M 2.5$; $SD 2.1$).

2.3 | Instruments

For the individual data collection, we used five instruments: the Spanish version of the Wechsler Intelligence Scale for children and adolescents (WISC-IV, Wechsler, 2007), the NEPSY-II verbal fluency test (Korkman et al., 2014), the Bears Family Projective Test (Iandolo, 2011; Iandolo & Alonso-Campuzano, 2021; Venuti & Iandolo, 2003), an ad-hoc teacher's questionnaire about student's performance and behaviour in the classroom, and the Moreno's Sociogram technique (Moreno, 1960).

For the group data collection, we used two instruments based on session video recordings: an observation sheet of group collaboration designed for the study and the Bears Family Story Integrated Analysis System.

In group activities, students used three collaborative methodologies and instruments: TST with paper and pencil, DST with Tablet and Google Toontastic 3D software, and TDST with i-Theatre.

All collaborative storytelling sessions followed the same standard protocol regardless of the methodology used (TST, DST, TDST).

2.3.1 | Individual data collection

The Wechsler Intelligence Scale for Children and Adolescents WISC-IV (Wechsler, 2007) is the most widely used tool for assessing general cognitive skills in children between 6 and 16:11 years.

TABLE 1 Descriptive statistics for baseline IQ and verbal fluency assessment results ($N = 14$).

		Group N	Class 1		Class 2		Total 14
			1 A 3	1 B 3	2 A 4	2 B 4	
WISC-IV IQ (Mean 100; SD 15)	Verbal comprehension (VCI)	Min (Max)	55 (73)	50 (68)	50 (68)	58 (61)	50 (73)
		Mean (SD)	62.7 (9.3)	59 (9.0)	56.7 (8.6)	59.5 (1.7)	59.3 (6.9)
	Perceptual reasoning (PRI)	Min (Max)	52 (72)	47 (66)	57 (64)	53 (79)	47 (79)
		Mean (SD)	61.3 (10.1)	59 (10.4)	61.5 (3.3)	65.2 (12.3)	62.0 (8.7)
	Working memory (WMI)	Min (Max)	50 (65)	50 (65)	51 (62)	57 (61)	50 (65)
		Mean (SD)	59.7 (8.4)	59 (7.9)	56.5 (4.9)	58.3 (2.3)	58.2 (5.5)
Processing speed (PSI)		Min (Max)	62 (70)	53 (66)	45 (63)	57 (67)	45 (70)
		Mean (SD)	65.3 (4.2)	59.7 (6.5)	55.7 (8.5)	61.3 (5.1)	60.1 (6.8)
Full scale intelligence quotient (FSIQ)		Min (Max)	46 (55)	46 (56)	47 (59)	49 (63)	46 (63)
		Mean (SD)	52 (5.2)	49.7 (5.5)	52.5 (5.2)	54 (6.4)	52.2 (5.2)
Verbal fluency (Mean 10; SD 3)	Semantic fluency	Min (Max)	1(2)	1 (7)	1 (7)	1 (2)	1 (7)
		Mean (SD)	1.33 (0.58)	3.33 (3.21)	2.50 (3.00)	1.25 (0.50)	2.1 (2.1)
	Phonological fluency	Min (Max)	1 (4)	1 (4)	1 (8)	1 (5)	1 (8)
		Mean (SD)	2.33 (1.53)	2.33 (1.53)	3.25 (3.30)	2.00 (2.00)	2.5 (2.1)
	Comparison score (phonological vs. semantic)	Min (Max)	3 (9)	2 (9)	3 (10)	3 (10)	2 (10)
		Mean (SD)	5.67 (3.05)	4.67 (3.78)	5.75 (3.40)	4.75 (3.50)	5.2 (3.1)

It provides a global intelligence quotient score (FSIQ) and IQ scores in verbal comprehension (VCI), perceptual reasoning (PRI), working memory (WMI), and processing speed (PSI). The Spanish version of WISC-IV presents a reliability of around .83 (Fisher's $z = .83$; Min. 0.72, Max. 0.91).

The verbal fluency test of the NEPSY-II Neuropsychological Battery (Korkman et al., 2014) is a standardised task for assessing language, vocabulary acquisition, and retrieval in children aged between 3:00 and 16:11 years. The task is divided into two parts: semantic fluency, asking for the retrieval of words considering a semantic category (Reliability index 0.64), and phonological fluency, asking for the retrieval of words considering their first letter (Reliability index = 0.79).

The Bears Family Projective Test (Iandolo, 2011; Iandolo & Alonso-Campuzano, 2021; Venuti & Iandolo, 2003) is a thematic constructive-projective test for stimulation and assessment of story-telling production between 3 and 11 years. The child's task is to play and create a story using the Bears Family playset inspiration. The story is videotaped, transcribed verbatim, and analysed using the Bears Family Integrated Story Analysis System (Iandolo, 2011; Iandolo & Alonso-Campuzano, 2021; Venuti & Iandolo, 2003). This instrument has been used to assess narrative production in adolescents with neurodevelopmental conditions (ASD) in previous research (Iandolo et al., 2020; López-Florit et al., 2021).

The Bears Family Integrated Story Analysis System uses four dimensions for formal story analysis: A. Microstructure: number of words, number of propositions and number of story episodes; B. Narrative structure index, considering the number of structure elements used in the story (introduction, main character, time/space setting, conclusion, long term conclusion); C. Story cohesion index, with different complexity levels ranging from 1 to 11, analysing story sophistication and organisation around a problem and its solutions (0: No story; 1: Play material description; 2: Arbitrary actions; 3: Random episodes; 4: Interconnected episodes; 5: Thematic sequences; 6: Problematic reaction; 7: Problem solution dyad; 8: Problem solution dyad with mediation; 9: Dyadic chains; 10: Dyad with secondary elements; 11: Dyadic cycles with secondary elements); D. Content analysis: with four balance indexes considering problems with positive versus negative solution (balance 1), solved versus unsolved problems (balance 2), character's positive versus negative relationships (balance 3) and adaptive versus maladaptive behaviours (balance 4). Concerning analysis reliability, the formal microstructural dimension shows a reliability index of Cronbach's Alpha = 0.52, while content analysis (content balance indexes) shows the reliability of Cronbach's Alpha = 0.70. Previous research with this instrument indicated acceptable values of reliability with Cohen kappa values between 0.91 and 0.93 (Alonso-Campuzano et al., 2021; Esposito et al., 2018; Iandolo et al., 2020).

The teacher's questionnaire (Appendix S1) is an ad-hoc survey created for the study about each student in two domains: 1. teacher's familiarity with the student (registered using four items: a. how long the teacher met the student, b. hours/week in class, c. knowledge of some difficulty in the student, d. presence of diagnosed disorders:

intellectual disability, autism, language, behaviour, others); and 2. student's skills, measured using four comparison items considering the general level of the class in seven levels (from much less to much more than classmates): a. how well does he/she work in class, b. how well the student behaves in class, c. level of learning competencies, d. level of student's observed happiness. The student skills dimensions present a reliability index of 0.74 (Cronbach's alpha), indicating that they converge in a unitary average of the teacher's perception of each student's academic skills and behavioural performance in class.

Moreno's Sociogram (Moreno, 1960) is a sociometric methodology that asks student to indicate two preferred and two non-preferred classmates for collaboration. It allows for calculating preferences and rejections between classmates. We used the students' answers for group formation, following a criterion of non-choice and non-exclusion in the answers to simulate a neutral sociographic condition.

2.3.2 | Group data collection

Regarding collecting data on the collaborative activity, both the behavioural and interactive aspects during task execution (small group observation) and the result of the group work (collaborative story) have been considered.

The small group observation sheet is an observational system specially designed for this research, to be filled out by teachers or researchers assessing students' behaviour and interactions during collaborative activities in the classroom. The system asks the observers to rate the presence and frequency of student's group interaction on a three-point Likert scale (1, No/Never; 2, Enough/Sometimes; 3, A lot/ Always). The system considers three variables related to group competencies for coping with the task and internal organisation, and six categories specifically directed to rate collaboration and prosocial behaviours.

The three items related to group coping with the task and internal organisation are the following: (1) Student's affirmations aimed to organise and redirect groupmates' attention to the task (group self-regulation); (2) positive comments directed to others' contributions (positive comments); (3) communication and efforts directed to the task goal (focus on the task).

The six items related to group collaboration and prosocial behaviours are the following: (1) consideration of others' emotions and reactions (social awareness); (2) ability to read social keys and reciprocal-relational actions (social cognition); (3) ability to express ideas and emotions following conversation rules (social communication); (4) social initiative, reciprocity and interest in groupmates (social motivation); (5) communication management, turn-taking, availability to express and listen to others' opinions about a common goal (space for everyone); (6) adaptation and involvement of all group members, considering individual features and needs to facilitate and promote participation (inclusion). All the group collaboration and prosocial behaviours items positively correlated, reaching a high-internal consistency (Cronbach's $\alpha = 0.90$). The high correlation between the six

collaboration and pro-social dimensions indicated that these variables merge into a general macro-dimension of inclusion oriented to synergy and consensus group decision-making.

Collaborative stories were videotaped, transcribed verbatim, and analysed using the Bears Family Integrated Story Analysis System (Iandolo, 2011; Iandolo & Alonso-Campuzano, 2021; Venuti & Iandolo, 2003), the same coding system used in individual storytelling assessment. Formal and content elements of the stories were considered.

2.3.3 | Collaborative instruments

The traditional collaborative storytelling methodology (TST) provided the groups with paper and pencils to draw or write the elements of their story while debating it.

The digital collaborative storytelling methodology (DST) equipped the group with an Apple iPad Pro 12.9" (2017) with Google Toontastic 3D software (<https://toontastic.withgoogle.com>). Toontastic 3D is a software for creating animated short films with different story structures, characters, settings, recording dialogues, and music effects. The Toontastic app has been used in different studies, supporting its quality as a digital storytelling tool in educational settings (Lagergren & Holmberg, 2017; Rowsell & Harwood, 2015).

The tangible digital collaborative storytelling methodology (TDST) furnished the small group with i-Theatre, a digital and tangible interactive tool for creating multimedia stories for children since they are 4 years old (i-theatre.org). i-Theatre combines tangible materials and

interactive multi-touch digital technology with visual, auditory, and tangible feedback made of concrete objects. The device consists of a wooden table on wheels, an interactive, integrated tactile system, and a scanner, allowing digital stories to be composed by children's drawings on paper. Once the drawings have been entered into the system, children can cut, animate, and recompose them into sequences, adding words and sounds.

2.3.4 | Standard protocol for collaborative storytelling

The standard protocol for collaborative storytelling was common to all methodologies and conditions. The session protocol lasted 60 min and was structured in six steps.

First, the researcher presented an image with emotional and relational content on the classroom digital blackboard or projector. We selected high-quality situational-relational photographs with at least two children about four topics (A. friendship, B. inclusion/exclusion, C. support, D. conflict; Figure 2).

In the second step, the researcher explained the task: «*It is time to tell a story. Think about how to create a story about the image. We will use these materials to help us make up a shared story. We can see this image (the researcher describes the image in detail). Now you can talk to your group mates and think about how you could tell a story. Then, I will ask you to choose a group delegate to tell the story to the rest of the class.*

In the third step, the researcher provided each group with paper and pencils for drawing or writing and a small portable video camera



(a) Friendship



(b) Inclusion/Exclusion



(c) Support



(d) Conflict

FIGURE 2 Visual stimuli for sessions' topics presentation.

with an audio recorder. Additionally, the group members were asked to introduce themselves on camera. After that, in the fourth step, the researcher indicated the storytelling methodology assigned to each group for the session (TST, DST, TDST) and gave support and instructions if required. The teacher and the researcher supported the initiative to participate in the story creation at the beginning of the activity, helping students to propose ideas, and handle the instruments, when students asked for them, and supervised the final story recording to ensure that the story was ready for the class presentation. In the fifth step, the researcher allocated 15–20 min for group discussion, allowing participants to brainstorm and collaboratively generate a story. After the first 10 min, the researcher reminded participants of the purpose of the activity, saying: «Well, you can keep thinking and talking about the story, remember that later I will ask you to tell a story about the image, a story with a beginning, a middle part, and an end.».

Finally, the sixth step was storytelling for the class, where groups were asked to choose a group delegate to tell the story to their classmates. Despite this, in most sessions, the storytelling for the class was modified following participants' spontaneous proposal of collaborating in the story presentation, where groupmates divided the story into parts during the public storytelling to the class. This modification generated a double benefit: it reinforced participants' desire for participation and collaboration and allowed participants to contribute according to their competencies. As an example, one of the participants with severe language impairment was in charge of showing the designs made by the group during the story creation phase.

2.4 | Procedure

The study procedure included seven phases: (1) students' baseline individual assessment; (2) class-group random assignment to an experimental and control condition; (3) the first phase of activities; (4) students' intermediate individual assessment; (5) class-group inversion between experimental and control condition; (6) the second phase of activities; (7) students' final assessment (Figure 1).

In the assessment phases (1, 4, and 7), two trained child psychologists assessed the students' individual narrative skills competence (Bears Family Projective test) and verbal fluency (NEPSY-II) and asked for the sociometric questions (Moreno's Sociogram).

In the second phase (class-group random assignment to the experimental and control conditions), students were assigned into groups of 3–4 participants (two groups per class). The group formation followed a criterion of non-choice and non-exclusion in the answers provided by each student to the sociometric questions (Moreno's Sociogram) to simulate a neutral sociographic condition. In other words, the students were grouped, promoting collaboration between non-mentioned classmates in response to the sociogram questions (preferred and non-preferred classmates). Classes were assigned randomly to experimental (TST & TDST) and control conditions (TST & DST). After completing the first activities phase (phase 3), this assignment was reverted in phase 5, after the intermediate individual assessment (phase 4).

In the activity's phases (3 and 6), experimental and control groups performed four sessions of collaborative storytelling on consecutive dates, under the teacher's and researcher's supervision, with the same structure and topics (Figure 2). In the experimental condition, each group performed two sessions using the TDST tool (i-Theatre) and two sessions with the traditional methodology (paper and pencil). In the control condition, each group performed two sessions with the DST tool (iPad with Toontastic) and two sessions using the traditional methodology (paper and pencil).

Before starting sessions in both conditions, each class underwent a 45-min training session on using I-Pad & Toontastic (DST control group) and i-Theatre (TDST experimental group). During the training sessions, a researcher explained and practiced the storytelling recording steps and device handling (Toontastic before the control condition & i-Theatre before the experimental condition). The teacher and the researcher filled out an observation sheet to collect information about students' collaboration and performance during collaborative storytelling sessions. At least two observers (researcher and teacher) observed and coded the collaborative group work immediately after finishing the session with the storytelling for the class using the small group observation sheet. The inter-observer agreement analysis was evaluated in all sessions, obtaining a statistically acceptable Cohen's kappa index ($\kappa = 0.95$).

Finally, the group stories were transcribed verbatim from video recordings and analysed by two trained researchers through the Bears Family Story Integrated Analysis System (Iandolo & Alonso-Campuzano, 2021; Venuti & Iandolo, 2003). The reliability was evaluated in 100% of the stories analysed using Cohen's kappa index, which was statistically acceptable ($\kappa = 0.98$).

2.5 | Analysis plan

Initially, descriptive statistics of individual storytelling competence, considering gender, age, verbal fluency, and intelligence measures, are shown. All data are described through average, standard deviation, skewness, kurtosis, and Shapiro–Wilk normality test, considering individual and collaborative stories. Differences between collaborative stories using the traditional methodology (TST) during the control and experimental condition are explored through the Mann–Whitney U test.

For the first hypothesis, the collaborative story form and the group interaction with the traditional (TST), digital (DST), and tangible digital storytelling (TDST) methodologies are described.

For hypotheses two to four, the Kruskal–Wallis test with Bonferroni post-hoc is applied to explore: (i) post-control and post-experimental differences in individual storytelling performance with the Bears Family Projective Test; (ii) formal and content differences in collaborative stories between storytelling methodologies (TST, DST, TDST); (iii) group collaboration using the three methodologies.

For the fifth hypothesis, the Mann–Whitney's U test explores differences between collaborative and individual story form and content. Finally, Spearman's rho correlations between collaboration and group story performance are reported for hypothesis six.

3 | RESULTS

3.1 | Descriptive statistics

Most story variables show a non-normal distribution, while the collaborative measures generally display a normal distribution (see Table 2). For this reason, nonparametric and parametric statistics were used in data analysis.

The participants, from two different school classes, worked in four collaborative groups, accomplishing collaborative storytelling sessions, eight sessions for each class, four sessions in the experimental condition (TST & TDST), and four as control (TST & DST), on consecutive days throughout October 2021 (Table 2). Three of the four groups were mixed concerning gender. In one group, participants were only females due to the sociometric criteria adopted in the workgroup's formation (no election & no rejection).

The groups created a total of 32 collaborative stories (one story per group and session) with a total of 16 stories with traditional methodology (50% TST) in experimental and control conditions, eight stories with digital methodology (25% DST), and eight stories with tangible digital methodology (25% TDST).

Moreover, the study involved three individual evaluations with each participant. As a result of individual evaluations, the study also obtained 42 individual stories using the Bear Family Projective Test.

Results indicate positive correlations in individual stories between FSIQ and the number of off-topic propositions (Spearman's $r = 0.57$ $p = .05$), between verbal comprehension (VCI) and the narrative cohesion (Spearman's $r = 0.62$ $p = .05$), between processing speed index (PSI), the number of individual story words (Spearman's $r = 0.66$ $p = .05$) and propositions (Spearman's $r = 0.67$ $p = .05$).

Results showed no significant differences in the story and collaboration when participants worked with the traditional methodology (16 stories, TST) during the experimental and control conditions (Table 2). For this reason, stories created with traditional TST methodology were considered as a whole, independently of experimental and control conditions.

3.2 | H1: Collaborative storytelling in adolescents with neurodevelopmental disorders

The study's first hypothesis considered that all students could carry out the collaborative storytelling activity using different technological instruments. According to collaborative stories analysis, the four groups created stories collaboratively in all the storytelling sessions, reaching a story length average of between six and eleven episodes, a narrative structure of at least two elements, and a narrative cohesion level of between 6 (problematic reaction) to 7 (problem-solution dyads) on average (Graph 1).

Collaboration scores reached acceptable mean values with the different methodologies (Graph 2; Table 2), with low values in improper collaborative behaviours (interruptions, off-task conversation, group self-regulation), medium values in performance behaviours (focused on the task), and medium-low in prosocial behaviours (positive comments, space for everyone, inclusion, social awareness, social cognition, social communication, and social motivation).

3.3 | H2: Effect of collaborative storytelling methodology on individual narrative skills

The study's second hypothesis expected a more significant effect of the tangible digital methodology on the participant's narrative competence in the assessment after the experimental condition. Results show that eight collaborative storytelling sessions with diverse methodologies (4 with TST, 2 with DST, and 2 with TDST) did not significantly impact the individual's narrative skills (Table 3).

3.4 | H3: Effect of collaborative storytelling methodology on story features

Comparing collaborative stories using the three different methodologies (TST, DST, TDST), the results do not confirm the hypothesis about a higher formal and content quality in TDST stories (Table 4). In the three methodologies (TST, DST, TDST), group stories present similar structure (Fisher's $F = 1.14$, $p = .33$), cohesion (Kruskal-Wallis = 2.09, $p = .35$), and content balance levels (Bal.1 Kruskal-Wallis = 4.62, $p = .10$, Bal.2 Kruskal-Wallis = 2.35, $p = .31$, Bal.3 Kruskal-Wallis = 0.36, $p = .83$, Bal. 4 Kruskal-Wallis = 5.24, $p = .07$).

The only difference lies in stories created with the digital-only modality (DST) that were longer in terms of words (Kruskal-Wallis = 10.53; df 2; $p < .01$), propositions (Kruskal-Wallis = 10.57; df 2; $p < .01$), and episodes (Kruskal-Wallis = 6.16; df 2; $p = .05$) compared to stories developed with the other methodologies (TDST & TST). Collaborative stories developed with Ipad+Toontastic (DST) were longer than those created with TDST & TST methodologies, but that did not imply a better story formal quality (structure and cohesion) and balance.

3.5 | Effect of collaborative storytelling methodology on group interactions

Hypothesis four expected better group collaboration in the tangible digital methodology sessions (TDST) than in the other conditions (TST & DST). No significant differences emerged in the student's collaboration with the three methodologies during the storytelling sessions (Table 5). Considering the small group observation sheet applied during the storytelling session, the participants carried out the collaborative activity similarly regardless of the methodology used.

3.6 | H5: Differences between collaborative and individual stories

For hypothesis five, we expected higher form and content balance sophistication in collaborative stories than in individual stories. The results confirm that collaborative stories supported by different tangible and digital methodologies (TST, DST, TDST) show higher formal quality but not a higher balance of contents than individual stories (Table 6).

TABLE 2 Descriptive statistics for story analysis and collaboration.

Variable	Collaborative storytelling										Individual storytelling		
	Collaborative storytelling					TST comparison control vs. Exp.					Mann-Whitney U/Student's t	Post control	Post Exp.
	Measures	Tangible digital [Exp.]	Digital (DST) [Control]	Traditional (TST) [Control]	Traditional (TST) [Exp.]	Traditional (TST) [Exp.]	Traditional (TST) [Exp.]	Baseline					
Story analysis (form)	Number of words	Min (Max)	18 (135)	72 (361)	39 (200)	41 (91)	U = 28.50; p = .72	19 (452)	27 (270)	43 (313)			
		Mean (SD)	74.37 (36.97)	195.12 (109.37)	80.62 (56.80)	65.62 (17.76)		92.57 (121.13)	72.8 (71.13)	90.54 (77.67)			
		Asym. (Kurt.)	0.33 (0.06)	0.54 (-0.90)	1.69 (2.27)	-0.05 (-1.45)		2.57 (6.32)	2.87 (8.62)	2.76 (8.26)			
		Shapiro Wilk (p)	0.96 (p = .79)	0.90 (p = .28)	0.76 (p = .01)	0.95 (p = .71)		0.57 (p < .01)	0.57 (p < .01)	0.62 (p < .01)			
		Min (Max)	0 (9)	0 (92)	0 (8)	0 (7)	U = 31.00; p = .96	0 (13)	0 (15)	0 (9)			
Propositions off task		Mean (SD)	1.75 (3.15)	19.87 (33.42)	1.50 (2.83)	1.25 (2.43)		1.07 (3.47)	1.81 (2.64)	1.70 (4.71)			
		Asym. (Kurt.)	2.16 (4.88)	1.85 (2.89)	2.20 (4.83)	2.38 (5.88)		3.60 (13.18)	2.31 (6.08)	3.06 (9.50)			
		Shapiro Wilk (p)	0.65 (p < .01)	0.68 (p < .01)	0.63 (p < .01)	0.61 (p < .01)		Constant	0.78 (p = .02)	0.49 (p < .01)			
		Min (Max)	5 (83)	15 (116)	7 (47)	9 (22)	U = 28.50; p = .72	6 (84)	6 (61)	9 (61)			
		Mean (SD)	19.25 (8.84)	53.37 (28.59)	18.25 (14.20)	14.37 (4.30)		18.36 (22.21)	15.10 (16.35)	18.91 (15.42)			
Propositions		Asym. (Kurt.)	0.01 (-0.22)	0.80 (-0.78)	1.57 (1.54)	0.57 (-0.12)		2.51 (6.13)	3.00 (9.25)	2.39 (6.18)			
		Shapiro Wilk (p)	0.99 (p = .99)	0.88 (p = .19)	0.77 (p = .01)	0.97 (p = .87)		0.60 (p < .01)	0.52 (p < .01)	0.68 (p < .01)			
		Min (Max)	2 (10)	7 (27)	3 (12)	4 (10)	U = 31.50; p = .96	4 (26)	5 (18)	5 (17)			
		Mean (SD)	6.50 (2.39)	11.50 (6.65)	6.87 (3.23)	6.75 (2.31)		8.78 (6.32)	7.70 (4.03)	8.36 (3.64)			
		Asym. (Kurt.)	-0.63 (1.14)	2.23 (5.39)	0.66 (-0.82)	0.35 (-1.72)		2.18 (4.19)	2.26 (5.20)	1.34 (2.17)			
Episodes		Shapiro Wilk (p)	0.96 (p = .81)	0.71 (p < .01)	0.91 (p = .42)	0.91 (p = .37)		0.67 (p < .01)	0.67 (p < .01)	0.85 (p = .05)			
		Min (Max)	0 (3)	1 (4)	1 (3)	0 (4)	U = 31.50; p = .96	0 (4)	0 (4)	0 (3)			
		Mean (SD)	2.00 (1.07)	2.75 (0.89)	2.37 (0.74)	2.25 (1.28)		1.57 (1.16)	2.00 (1.05)	1.73 (1.27)			
		Asym. (Kurt.)	-0.93 (0.35)	-1.03 (1.85)	-0.82 (-0.15)	-0.61 (-0.02)		0.32 (0.09)	0.00 (1.67)	-0.44 (-1.54)			
		Shapiro Wilk (p)	0.86 (p = .12)	0.83 (p = .05)	0.80 (0.02)	0.94 (p = .59)		0.90 (p = .12)	0.87 (p = .10)	0.82 (0.02)			
Narrative cohesion		Min (Max)	3 (8)	5 (10)	6 (10)	0 (9)	U = 22.00; p = .33	2 (8)	4 (10)	4 (8)			
		Mean (SD)	6.12 (1.55)	7.00 (1.77)	7.62 (1.19)	6.25 (2.76)		5.07 (1.98)	6.10 (1.91)	5.45 (1.69)			
		Asym. (Kurt.)	-1.19 (1.65)	0.41 (-0.80)	0.97 (1.88)	-1.91 (4.50)		0.09 (-1.26)	0.78 (0.62)	0.62 (-1.55)			
		Shapiro Wilk (p)	0.90 (p = .27)	0.89 (p = .26)	0.89 (p = .24)	0.79 (p = .02)		0.94 (p = .38)	0.89 (p = .16)	0.78 (p < .01)			
		Min (Max)	-1 (2)	-1 (2)	1 (1)	0 (2)	U = 32.00; p = 1.00	0 (2)	-1 (2)	0 (3)			
Balance 1. Positive vs. negative solutions		Mean (SD)	0.37 (0.92)	0.50 (0.92)	1.00 (0.00)	1.00 (0.75)		0.57 (0.65)	0.30 (0.95)	0.54 (0.93)			
		Asym. (Kurt.)	0.49 (0.75)	0.00 (0.00)	Constant	0.00 (-0.70)		0.69 (-0.25)	0.23 (-0.35)	2.09 (4.75)			
		Shapiro Wilk (p)	0.91 (p = .32)	0.93 (p = .52)	0.64 (p < .01)	0.85 (p = .09)		0.76 (p < .01)	0.91 (p = .29)	0.65 (p < .01)			
		Min (Max)	-1 (2)	-1 (1)	0 (1)	-1 (2)	U = 28.50; p = .72	-1 (1)	-1 (2)	-1 (3)			
		Mean (SD)	0.25 (1.03)	0.12 (0.83)	0.62 (5.17)	0.62 (1.06)		0.21 (0.80)	0.30 (0.95)	0.64 (1.12)			
Balance 2. Solved vs. unsolved problems		Asym. (Kurt.)	0.38 (-0.45)	-0.28 (-1.39)	-0.64 (-2.24)	-0.91 (-0.13)		-0.44 (0.60)	0.23 (-0.35)	0.89 (0.81)			
		Shapiro Wilk (p)	0.91 (p = .41)	0.83 (p = .07)	0.77 (p = .01)	0.76 (p = .01)		0.80 (p < .01)	0.91 (p = .29)	0.89 (p = .14)			
		Min (Max)	-3 (3)	-2 (3)	-6 (2)	-1 (2)	U = 20.50; p = .23	-1 (2)	-1 (4)	0 (3)			
		Mean (SD)	0.25 (1.75)	0.25 (2.12)	-0.12 (2.59)	1.00 (1.07)		0.57 (1.02)	0.80 (1.32)	1.09 (0.94)			
		Balance 3. Positive vs. negative relationships											

(Continues)

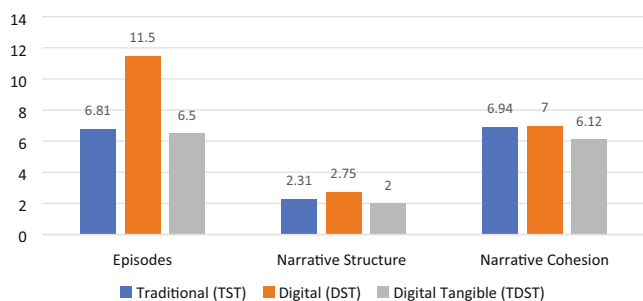
TABLE 2 (Continued)

Variable	Collaborative storytelling						Individual storytelling			
	Measures	Tangible digital (TDST)	Digital (DST)	Traditional (TST)	Traditional (TST)	TST comparison control vs. Exp.	Baseline	Post control	Post Exp.	
		[Exp.]	[Control]	[Exp.]	[Exp.]	Mann-Whitney U/Student's t				
Group interaction (collaboration) improper behaviours	Asym. (Kurt.)	-0.50 (1.36)	-0.31 (-1.24)	-1.99 (4.55)	-0.93 (0.35)		0.03 (-0.93)	1.55 (4.13)	0.66 (0.20)	
	Shapiro Wilk (p)	0.94 (p = .61)	0.95 (p = .74)	0.81 (p = .03)	0.86 (p = .12)		0.90 (p = .09)	0.80 (p = .01)	0.88 (p = .09)	
	Min (Max)	-3 (2)	-5 (1)	-5 (2)	0 (2)	U = 20.50; p = .23	-1 (3)	-2 (4)	0 (2)	
	Mean (SD)	0.00 (1.41)	-1.25 (1.98)	-0.25 (2.12)	0.87 (0.83)		0.50 (1.10)	0.50 (1.58)	0.73 (0.79)	
	Asym. (Kurt.)	-1.21 (3.50)	-1.01 (0.44)	-1.84 (4.24)	0.28 (-1.39)		0.83 (0.88)	0.84 (2.46)	0.57 (-0.97)	
Shapiro Wilk (p)	0.80 (p = .03)	0.90 (p = .31)	Constant	0.83 (p = .06)		0.90 (p = .09)	0.89 (p = .17)	0.80 (p < .01)		
Interruptions	Min (Max)	1.00 (2.66)	1.00 (2.00)	1.00 (1.71)	1.00 (2.60)	U = 29.50; p = .80				
	Mean (SD)	1.54 (0.62)	1.41 (0.44)	1.30 (0.33)	1.44 (0.55)					
	Asym. (Kurt.)	0.90 (-0.35)	0.49 (-1.78)	0.12 (-2.53)	1.49 (2.13)					
	Shapiro Wilk (p)	0.86 (0.12)	0.83 (0.06)	0.76 (0.01)	0.82 (0.05)	t = 0.20 (Df 14); p = .84				
	Min (Max)	1.00 (2.00)	1.00 (2.16)	1.00 (2.83)	1.00 (2.33)					
Off task conversation	Mean (SD)	1.61 (0.39)	1.58 (0.45)	1.63 (0.58)	1.68 (0.44)					
	Asym. (Kurt.)	-0.49 (-1.25)	0.05 (-2.03)	1.41 (2.33)	0.90 (-0.59)					
	Shapiro Wilk (p)	0.88 (0.18)	0.90 (0.28)	0.89 (0.22)	0.97 (0.92)	t = 0.26 (Df 14); p = .80				
	Min (Max)	1.00 (1.66)	1.25 (1.75)	1.00 (1.75)	1.00 (1.71)					
	Mean (SD)	1.34 (0.20)	1.39 (1.56)	1.31 (0.25)	1.34 (2.09)					
Group self-regulation	Asym. (Kurt.)	-0.14 (0.65)	1.96 (4.60)	0.83 (0.02)	0.19 (1.06)					
	Shapiro Wilk (p)	0.98 (0.98)	0.79 (0.02)	0.92 (0.47)	0.98 (0.94)					
	Min (Max)	1.66 (2.33)	1.50 (2.50)	1.33 (2.40)	1.57 (2.16)	t = -1.23 (Df 14); p = .46				
	Mean (SD)	1.94 (0.25)	2.06 (0.37)	1.99 (0.35)	1.82 (0.22)					
	Asym. (Kurt.)	0.31 (-1.6)	-0.46 (-1.57)	-0.90 (0.72)	0.43 (-1.36)					
Shapiro Wilk (p)	0.90 (0.30)	0.90 (0.28)	0.94 (0.61)	0.92 (0.42)						
Focus on the task	Min (Max)	1.50 (2.14)	1.50 (2.25)	1.25 (2.75)	1.14 (2.33)	t = -0.16 (Df 14); p = .87				
	Mean (SD)	1.79 (0.21)	1.77 (0.22)	1.75 (0.46)	1.72 (0.33)					
	Asym. (Kurt.)	0.47 (-0.47)	1.69 (4.30)	1.65 (3.36)	0.15 (2.08)					
	Shapiro Wilk (p)	0.94 (0.66)	0.82 (0.04)	0.85 (0.09)	0.93 (0.50)					
	Min (Max)	1.00 (1.66)	1.00 (1.66)	1.00 (1.66)	1.00 (1.66)	t = 0.22 (Df 14); p = .98				
Positive comments	Mean (SD)	1.25 (0.22)	1.34 (0.24)	1.27 (0.23)	1.27 (0.23)					
	Asym. (Kurt.)	0.80 (0.50)	0.30 (-1.24)	0.47 (-0.42)	0.36 (-0.43)					
	Shapiro Wilk (p)	0.92 (0.46)	0.91 (0.38)	0.94 (0.65)	0.95 (0.68)	t = 0.76 (Df 14); p = .46				
	Min (Max)	1.00 (1.50)	1.00 (1.75)	1.00 (1.50)	1.00 (1.66)					
	Mean (SD)	1.21 (0.18)	1.35 (0.25)	1.22 (0.18)	1.30 (0.23)					
Social awareness	Min (Max)	1.00 (1.66)	1.00 (1.66)	1.00 (1.66)	1.00 (1.66)					
	Mean (SD)	1.25 (0.22)	1.34 (0.24)	1.27 (0.23)	1.27 (0.23)					
	Asym. (Kurt.)	0.80 (0.50)	0.30 (-1.24)	0.47 (-0.42)	0.36 (-0.43)					
	Shapiro Wilk (p)	0.92 (0.46)	0.91 (0.38)	0.94 (0.65)	0.95 (0.68)					
	Min (Max)	1.00 (1.50)	1.00 (1.75)	1.00 (1.50)	1.00 (1.66)					
Social cognition	Mean (SD)	1.21 (0.18)	1.35 (0.25)	1.22 (0.18)	1.30 (0.23)					

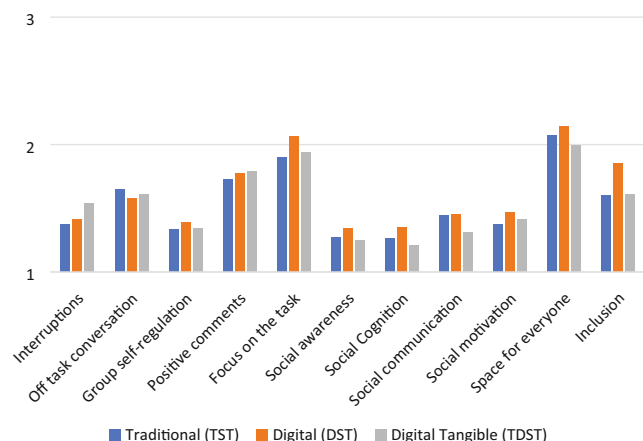
TABLE 2 (Continued)

Variable	Collaborative storytelling						Individual storytelling			
	Measures	Tangible digital (TDST)		Digital (DST)		Traditional (TST)		TST comparison control vs. Exp. Mann-Whitney U/Student's t	Post control	Post Exp.
		[Exp.]	[DST]	[Control]	[Exp.]	[Control]	[Exp.]			
Social communication	Asym. (Kurt.)	0.53 (−0.82)	0.50 (−0.64)	0.21 (−1.16)	0.68 (0.49)					
	Shapiro Wilk (p)	0.91 (0.36)	0.95 (0.71)	0.94 (0.62)	0.91 (0.36)					
	Min (Max)	1.16 (1.50)	1.16 (1.75)	1.33 (1.85)	1.00 (1.50)			$t = -3.24 (Df 14), p = <.01$		
	Mean (SD)	1.31 (0.09)	1.45 (0.21)	1.59 (0.20)	1.29 (1.66)					
	Asym. (Kurt.)	0.72 (2.83)	−0.14 (−1.10)	0.07 (−1.95)	−0.65 (−0.33)					
Social motivation	Shapiro Wilk (p)	0.87 (0.15)	0.94 (0.65)	0.91 (0.33)	0.95 (0.73)					
	Min (Max)	1.16 (1.66)	1.14 (2.00)	1.00 (1.80)	1.00 (1.60)			$t = -1.41 (Df 14), p = .18$		
	Mean (SD)	1.41 (0.19)	1.47 (0.29)	1.46 (0.28)	1.28 (0.22)					
	Asym. (Kurt.)	−0.30 (−1.40)	0.58 (0.02)	−0.61 (−1.15)	0.06 (−1.41)					
	Shapiro Wilk (p)	0.91 (0.38)	0.91 (0.36)	0.90 (0.30)	0.94 (0.59)					
Space for everyone	Min (Max)	1.50 (2.71)	1.71 (3.00)	1.75 (2.50)	1.40 (2.60)			$t = -0.09 (Df 14) p = .18$		
	Mean (SD)	1.99 (0.44)	2.14 (0.48)	2.08 (0.26)	2.07 (0.40)					
	Asym. (Kurt.)	0.70 (−0.92)	0.88 (−0.33)	0.60 (−0.58)	−0.27 (−0.46)					
	Shapiro Wilk (p)	0.90 (0.31)	0.87 (0.15)	0.92 (0.45)	0.95 (0.70)					
	Min (Max)	1.33 (2.16)	1.42 (2.75)	1.00 (2.33)	1.00 (2.00)			$t = -1.00 (Df 14), p = .33$		
Inclusion	Mean (SD)	1.61 (0.28)	1.85 (0.43)	1.70 (0.42)	1.50 (0.35)					
	Asym. (Kurt.)	1.33 (1.25)	1.47 (2.27)	0.08 (0.37)	−0.16 (−1.36)					
	Shapiro Wilk (p)	0.86 (0.12)	0.64 (0.13)	0.93 (0.51)	0.95 (0.70)					

Note: Bold indicates significant value.



GRAPH 1 Group stories mean values for episodes, structure, and cohesion index.



GRAPH 2 Group stories mean values for collaboration.

TABLE 3 Individual narrative competence.

Assessment	Number of words			Propositions off task		
	Baseline	Post control	Post exp.	Baseline	Post control	Post exp.
Average (SD)	92.57 (121.13)	72.8 (71.13)	90.54 (77.67)	1.07 (3.47)	1.81 (2.64)	1.70 (4.71)
Kruskal-Wallis Test	3.81 (df 2), $p = .15$			5.76 (df 2), $p = .06$		
Assessment	Propositions			Episodes		
	Baseline	Post control	Post exp.	Baseline	Post control	Post exp.
Average (SD)	18.36 (22.21)	15.10 (16.35)	18.91 (15.42)	8.78 (6.32)	7.70 (4.03)	8.36 (3.64)
Kruskal-Wallis Test	2.93 (df 2), $p = .23$			0.37 (df 2), $p = .83$		
Assessment	Narrative structure			Narrative cohesion		
	Baseline	Post control	Post exp.	Baseline	Post control	Post exp.
Average (SD)	1.57 (1.16)	2.00 (1.05)	1.73 (1.27)	5.07 (1.98)	6.10 (1.91)	5.45 (1.69)
Kruskal-Wallis Test	0.88 (df 2), $p = .64$			1.39 (df 2), $p = .50$		
Assessment	Balance 1. Positive vs. negative solutions			Balance 2. Solved vs. unsolved problems		
	Baseline	Post Control	Post Exp.	Baseline	Post Control	Post Exp.
Average (SD)	0.57 (0.65)	0.30 (0.95)	0.54 (0.93)	0.21 (0.80)	0.30 (0.95)	0.64 (1.12)
Kruskal-Wallis Test	0.75 (df 2), $p = .69$			0.69 (df 2), $p = .73$		
Assessment	Balance 3. Positive vs. negative relationships			Balance 4. Adaptive vs. maladaptive behaviours		
	Baseline	Post Control	Post Exp.	Baseline	Post Control	Post Exp.
Average (SD)	0.57 (1.02)	0.80 (1.32)	1.09 (0.94)	0.50 (1.10)	0.50 (1.58)	0.73 (0.79)
Kruskal-Wallis Test	1.52 (df 2), $p = .47$			0.65 (df 2), $p = .72$		

Note: Baseline, post-experimental and post-control conditions.

Regarding the formal quality of the stories, collaborative stories show more length (Number of words $U = 732.00$; $p = .03$; Number of propositions $U = 784.50$; $p < .01$), structure ($U = 738.50$, $p = .02$) and cohesion ($U = 790.50$, $p < .01$) in comparison with the stories created individually by the participants.

Especially in the individual assessment, there was a marked variability between stories ($SD > Average$) in terms of the number of words, off-topic propositions, propositions, and the four content balance indexes. On the other hand, in collaborative stories, despite less variability, high variability ($SD > Average$) was observed only in off-topic propositions and the four content balance indexes.

3.7 | H6: Collaboration and group story features

The last study hypothesis supposed a positive impact of collaboration on story form sophistication and content balance, regardless of the storytelling methodology used. Correlational analysis between group collaboration (proceeding from the small group observation sheet) and the form and content of the collaborative stories shows a positive correlation between interruptions during the task and story length (number of words $r = 0.45$, $p < .01$; propositions $r = 0.44$, $p = .01$; episodes $r = 0.37$, $p = .03$) and off-task propositions ($r = 0.48$, $p < .01$), but not converging in more sophisticated stories (Table 7). Group interactions produced more balanced stories regarding the character's adaptive and maladaptive behaviours (Balance 4; $r = 0.49$, $p < .01$). When group interactions showed more social cognition (Balance 2; $r = -0.40$, $p = .02$) and

TABLE 4 Collaborative story features according to the methodology (TST, DST, TDST).

Methodology	Number of words			Propositions off task		
	TST	DST	TDST	TST	DST	TDST
Average (SD)	73.12 (41.39)	195.12 (109.37)	74.37 (36.97)	1.37 (2.55)	19.87 (33.42)	1.75 (3.15)
Kruskal–Wallis Test/ANOVA	Kruskal–Wallis = 10.53 (df 2), p = <.01			Kruskal–Wallis = 3.11 (df 2), p = .21		
Bonferroni post-hoc/Tukey post-hoc	TST & DST p = <.01	TST & TDST p = 1.00	DST & TDST p = <.01	TST & DST p = .04	TST & TDST p = 1.00	DST & TDST p = .11
Methodology	Propositions			Episodes		
	TST	DST	TDST	TST	DST	TDST
Average (SD)	16.31 (10.33)	53.37 (28.59)	19.25 (8.84)	6.81 (2.71)	11.50 (6.65)	6.50 (2.39)
Kruskal–Wallis Test/ANOVA	Kruskal–Wallis = 10.57 (df 2), p = <.01			Kruskal–Wallis = 6.16 (df 2), p = .05		
Bonferroni post-hoc/Tukey post-hoc	TST & DST p = <.01	TST & TDST p = 1.00	DST & TDST p = <.01	TST & DST p = .03	TST & TDST p = 1.00	DST & TDST p = .05
Methodology	Narrative structure			Narrative cohesion		
	TST	DST	TDST	TST	DST	TDST
Average (SD)	2.31 (1.01)	2.75 (0.89)	2.00 (1.07)	6.94 (2.17)	7.00 (1.77)	6.12 (1.55)
Kruskal–Wallis Test/ANOVA	F 1.14 (df 2), p = .33			Kruskal–Wallis = 2.09 (df 2), p = .35		
Bonferroni post-hoc/Tukey post-hoc	TST & DST p = .56	TST & TDST p = .76	DST & TDST p = .30	TST & DST p = 1.00	TST & TDST p = 1.00	DST & TDST p = 1.00
Methodology	Balance 1. Positive vs. negative solutions			Balance 2. Solved vs. unsolved problems		
	TST	DST	TDST	TST	DST	TDST
Average (SD)	1.00 (0.52)	0.50 (0.92)	0.37 (0.92)	0.62 (0.81)	0.12 (0.83)	0.25 (1.03)
Kruskal–Wallis Test/ANOVA	Kruskal–Wallis = 4.62 (df 2), p = .10			Kruskal–Wallis = 2.35 (df 2), p = .31		
Bonferroni post-hoc/Tukey post-hoc	TST & DST p = .39	TST & TDST p = .18	DST & TDST p = 1.00	TST & DST p = .59	TST & TDST p = .99	DST & TDST p = 1.00
Methodology	Balance 3. Positive vs. negative relationships			Balance 4. Adaptive vs. maladaptive behaviour		
	TST	DST	TDST	TST	DST	TDST
Average (SD)	0.44 (2.00)	0.25 (2.12)	0.25 (1.75)	0.31 (0.66)	–1.25 (1.98)	0.00 (1.41)
Kruskal–Wallis Test/ANOVA	Kruskal–Wallis = 0.36 (df 2), p = .83			Kruskal–Wallis = 5.24 (df 2), p = .07		
Bonferroni post-hoc/Tukey post-hoc	TST & DST p = 1.00	TST & TDST p = 1.00	DST & TDST p = 1.00	TST & DST p = .12	TST & TDST p = 1.00	DST & TDST p = .45

Note: Bold indicates significant value.

motivation (Balance 2; $r = -0.37$, $p = .03$), the story showed less balance regarding problems and solutions.

4 | DISCUSSION

The current study explored the impact of three different methodologies of collaborative storytelling (traditional–TST, digital–DST, and tangible digital–TDST) on 14 Spanish adolescents with mild to moderate intellectual disability and other comorbid neurodevelopmental disorders.

The sample created a total of 16 collaborative stories with the traditional methodology (TST), 8 with the digital (DST), and 8 with the tangible digital one (TDST) with teacher and researcher support. Moreover, the participants created 42 individual stories using the

Bears Family Projective Test in three moments (baseline, intermediate and final assessment).

4.1 | H1: Collaborative storytelling in adolescents with neurodevelopmental disorders

The results provided support for the first hypothesis, indicating that adolescents with mild to moderate intellectual disability could collaborate to create stories using both digital (DST & TDST) and traditional (TST) methodologies.

The story length was higher in the digital-only modality (DST), with an average of 11 episodes, compared to traditional and tangible digital stories (TST, TDST), with an average of six episodes. Regardless of the methodology used (TST, DST, TDST), results showed similar levels of narrative

TABLE 5 Collaboration and storytelling methodology (TST, DST, TDST).

Methodology	Interruptions		Off task conversation		Group self-regulation	
	TST	DST	TST	DST	TST	DST
Average (SD)	1.37 (0.45)	1.41 (0.44)	1.65 (0.50)	1.58 (0.45)	1.33 (0.22)	1.39 (1.56)
Kruskal-Wallis Test/ANOVA	Kruskal-Wallis = 0.42 (df 2), <i>p</i> = .81		F 0.07 (df 2), <i>p</i> = .93		Kruskal-Wallis = 1.12 (df 2), <i>p</i> = .57	
Bonferroni post-hoc/Tukey post-hoc	TST & DST <i>p</i> = 1.00	TST & TDST <i>p</i> = 1.00	TST & DST <i>p</i> = .93	TST & TDST <i>p</i> = .98	TST & DST <i>p</i> = 1.00	TST & TDST <i>p</i> = 1.00
Positive comments						
Methodology	TST	DST	TST	DST	TST	DST
Average (SD)	1.73 (0.39)	1.77 (0.22)	1.90 (0.29)	2.06 (0.37)	1.27 (0.22)	1.34 (0.24)
Kruskal-Wallis Test/ANOVA	Kruskal-Wallis = 0.76 (df 2), <i>p</i> = .68		F 0.72 (df 2), <i>p</i> = .50		F 0.37 (df 2), <i>p</i> = .69	
Bonferroni post-hoc/Tukey post-hoc	TST & DST <i>p</i> = 1.00	TST & TDST <i>p</i> = 1.00	TST & DST <i>p</i> = .46	TST & TDST <i>p</i> = .95	TST & DST <i>p</i> = .77	TST & TDST <i>p</i> = .95
Focus on the task						
Methodology	TST	DST	TST	DST	TST	DST
Average (SD)	1.73 (0.39)	1.77 (0.22)	1.90 (0.29)	2.06 (0.37)	1.27 (0.22)	1.34 (0.24)
Kruskal-Wallis Test/ANOVA	Kruskal-Wallis = 0.76 (df 2), <i>p</i> = .68		F 0.72 (df 2), <i>p</i> = .50		F 0.37 (df 2), <i>p</i> = .69	
Bonferroni post-hoc/Tukey post-hoc	TST & DST <i>p</i> = 1.00	TST & TDST <i>p</i> = 1.00	TST & DST <i>p</i> = .46	TST & TDST <i>p</i> = .95	TST & DST <i>p</i> = .77	TST & TDST <i>p</i> = .95
Social awareness						
Methodology	TST	DST	TST	DST	TST	DST
Average (SD)	1.26 (0.20)	1.35 (0.25)	1.44 (0.24)	1.45 (0.21)	1.37 (0.26)	1.47 (0.29)
Kruskal-Wallis Test/ANOVA	F 0.88 (df 2), <i>p</i> = .42		F 1.31 (df 2), <i>p</i> = .42		F 0.39 (df 2), <i>p</i> = .68	
Bonferroni post-hoc/Tukey post-hoc	TST & DST <i>p</i> = .60	TST & TDST <i>p</i> = .85	TST & DST <i>p</i> = .99	TST & TDST <i>p</i> = .31	TST & DST <i>p</i> = .65	TST & TDST <i>p</i> = .93
Social communication						
Methodology	TST	DST	TST	DST	TST	DST
Average (SD)	1.26 (0.20)	1.35 (0.25)	1.44 (0.24)	1.45 (0.21)	1.37 (0.26)	1.47 (0.29)
Kruskal-Wallis Test/ANOVA	F 0.88 (df 2), <i>p</i> = .42		F 1.31 (df 2), <i>p</i> = .42		F 0.39 (df 2), <i>p</i> = .68	
Bonferroni post-hoc/Tukey post-hoc	TST & DST <i>p</i> = .60	TST & TDST <i>p</i> = .85	TST & DST <i>p</i> = .99	TST & TDST <i>p</i> = .31	TST & DST <i>p</i> = .65	TST & TDST <i>p</i> = .93
Social motivation						
Methodology	TST	DST	TST	DST	TST	DST
Average (SD)	2.07 (0.32)	2.14 (0.48)	1.99 (0.44)	1.60 (0.38)	1.85 (0.43)	1.61 (0.28)
Kruskal-Wallis Test/ANOVA	F 0.29 (df 2), <i>p</i> = .75		F 1.27 (df 2), <i>p</i> = .29		F 1.27 (df 2), <i>p</i> = .29	
Bonferroni post-hoc/Tukey post-hoc	TST & DST <i>p</i> = .93	TST & TDST <i>p</i> = .87	DST & TDST <i>p</i> = .73	TST & DST <i>p</i> = .30	TST & TDST <i>p</i> = .99	DST & TDST <i>p</i> = .42
Space for everyone						
Methodology	TST	DST	TST	DST	TST	DST
Average (SD)	2.07 (0.32)	2.14 (0.48)	1.99 (0.44)	1.60 (0.38)	1.85 (0.43)	1.61 (0.28)
Kruskal-Wallis Test/ANOVA	F 0.29 (df 2), <i>p</i> = .75		F 1.27 (df 2), <i>p</i> = .29		F 1.27 (df 2), <i>p</i> = .29	
Bonferroni post-hoc/Tukey post-hoc	TST & DST <i>p</i> = .93	TST & TDST <i>p</i> = .87	DST & TDST <i>p</i> = .73	TST & DST <i>p</i> = .30	TST & TDST <i>p</i> = .99	DST & TDST <i>p</i> = .42
Inclusion						
Methodology	TST	DST	TST	DST	TST	DST
Average (SD)	2.07 (0.32)	2.14 (0.48)	1.99 (0.44)	1.60 (0.38)	1.85 (0.43)	1.61 (0.28)
Kruskal-Wallis Test/ANOVA	F 0.29 (df 2), <i>p</i> = .75		F 1.27 (df 2), <i>p</i> = .29		F 1.27 (df 2), <i>p</i> = .29	
Bonferroni post-hoc/Tukey post-hoc	TST & DST <i>p</i> = .93	TST & TDST <i>p</i> = .87	DST & TDST <i>p</i> = .73	TST & DST <i>p</i> = .30	TST & TDST <i>p</i> = .99	DST & TDST <i>p</i> = .42

TABLE 6 Individual versus collaborative stories comparison.

Methodology	Number of words		Propositions off task		Propositions		Episodes	
	Individual	Collab.	Individual	Collab.	Individual	Collab.	Individual	Collab.
Average (SD)	86.28 (93.81)	103.94 (81.85)	1.49 (3.56)	6.09 (17.97)	17.60 (18.22)	26.31 (25.67)	8.34 (4.87)	7.91 (4.39)
Mann-Whitney's <i>U</i>	<i>U</i> = 732.00, <i>p</i> = .03		<i>U</i> = 646.00, <i>p</i> = .21		<i>U</i> = 784.50, <i>p</i> = <.01		<i>U</i> = 573.50, <i>p</i> = .86	
Methodology	Narrative structure		Narrative cohesion		Balance 1. Positive vs. negative solutions		Balance 2. Solved vs. unsolved problems	
	Individual	Collab.	Individual	Collab.	Individual	Collab.	Individual	Collab.
Average (SD)	1.74 (1.15)	2.34 (1.00)	5.49 (1.88)	6.75 (1.92)	0.49 (0.82)	0.72 (0.77)	0.37 (0.94)	0.41 (0.87)
Mann-Whitney's <i>U</i>	<i>U</i> = 738.50, <i>p</i> = .02		<i>U</i> = 790.50, <i>p</i> = <.01		<i>U</i> = 675.00, <i>p</i> = .12		<i>U</i> = 591.00, <i>p</i> = .68	
Methodology	Balance 3. Positive vs. negative relationships			Balance 4. Adaptive vs. maladaptive behaviour				
	Individual		Collab.	Individual		Collab.		
Average (SD)	0.80 (1.08)		0.34 (1.91)	0.57 (1.14)		-0.16 (1.76)		
Mann-Whitney's <i>U</i>	<i>U</i> = 526.50, <i>p</i> = .66			<i>U</i> = 453.50, <i>p</i> = .16				

Note: Bold indicates significant value.

TABLE 7 Significant correlations between collaboration and story variables (Spearman's rho).

Collaboration	Story				Bal. 1		Bal. 2		Bal. 3		Bal. 4	
	Words	Off-task prop.	Prop.	Episodes	Structure	Cohesion	1	Bal. 2	3	Bal. 4		
Interruptions	<i>r</i> = 0.45, <i>p</i> < .01	<i>r</i> = 0.48, <i>p</i> < .01	<i>r</i> = 0.44, <i>p</i> = .01	<i>r</i> = 0.37, <i>p</i> = .03								
Off-task conversation												
Group self-regulation												
Positive comments												
Focus on the task												
Social awareness												
Social cognition									<i>r</i> = -0.40, <i>p</i> = .02			
Social comm.												
Social motivation									<i>r</i> = -0.37, <i>p</i> = .03			
Space for everyone												<i>r</i> = 0.49, <i>p</i> = <.01
Inclusion												

Note: Bold indicates significant value.

structure (with at least two elements) and cohesion (characterised by problems, reactions, and solutions without mediators). It indicates that group stories reached a narrative structure and cohesion typical of the sequencing and narration phase of primary school students, regardless of the methodology employed (Esposito et al., 2018; Hudson & Shapiro, 1991; landolo et al. 2013, 2020; Stadler & Ward, 2005).

Regarding collaboration, results showed medium-low levels of prosocial behaviours, despite the group effort toward the task, and low values in improper collaborative behaviours. Participants' neurodevelopmental conditions can explain this medium-low narrative and collaborative performance levels, below expected in typically developing adolescents.

Even though collaborative learning is rarely used with students with intellectual disabilities (Wishart et al., 2007), the results indicated

that participants demonstrated active attention, listening and engagement, according to their competencies. All groups reached good collaboration and narrative performance levels in a structured cooperative activity with teacher and researcher support (Van Leeuwen & Janssen, 2019).

4.2 | H2: Effect of collaborative storytelling methodology on individual narrative skills

The results do not support the second hypothesis, considering the impact of collaborative tangible digital storytelling (TDST) on individual narrative skills. Participants' narrative skills remained unchanged after

eight collaborative storytelling sessions. Potential explanations include the limited number of sessions or the participant's try skills, causing different effects on learning and socialisation (Keskinova & Ajdinski, 2018).

4.3 | H3: Effect of collaborative storytelling methodology on the story features

Group stories showed similar structure, cohesion, and content balance levels regardless of the methodology employed (TST, DST, TDST). It indicates that technological devices were not barriers to students' collaborative work.

The only difference observed lies in more length but not a better formal quality (structure and cohesion) or content balance in collaborative stories created with the digital-only modality (DST). A possible explanation is that the digital-only methodology may be more familiar to participants, implying turn-taking in the instrument handling, generating overlaps in story arguments and off-topic propositions, and increasing the story length.

4.4 | H4: Effect of collaborative storytelling methodology on group interactions

Group stories showed similar levels of collaboration regardless of the methodology employed (TST, DST, TDST). The absence of differences could be rooted in the student's need for the teacher and researcher's guidance during the activity, facilitating collaborative work to reach the group story. One possible explanation is that participants dedicated more effort to following instructions to create the story instead of focusing on the group interaction, prioritising the result over the collaborative process. It can be related to the novelty of the activity, their neurodevelopmental conditions, and difficulties in executive and social functioning (Gillies, 2016; Marcovitch et al., 2008).

4.5 | H5: Differences between collaborative and individual stories

Collaboration positively affected stories' formal sophistication (length, structure, and cohesion) compared to individual narrative performance.

The positive effect of collaboration on group story is in line with previous studies (Di Blas & Ferrari, 2014; Di Blas & Paolini, 2013; Slavin, 1992, 1989; Zancanaro et al., 2007). The higher formal sophistication of the collaborative stories likely results from students' mutual support and positive interdependence (Alonso-Campuzano et al., 2021; Johnson & Johnson, 1991, 2009, 2014; Zancanaro et al., 2007). On the other hand, no content balance differences were detected between collaborative and individual stories. The story's content reflects the storyteller's cognitive skills since it requires manipulating problems and arguments. According to previous studies, children with typical development, and without emotional and behavioural difficulties tend to balance negative and maladaptive contents with positive and adaptive ones

during storytelling (Iandolo, 2021; Iandolo et al., 2012). Collaborative storytelling promotes content balance, considering the need for agreement as a mutual form of control and regulation, helping to close previous plots opened throughout the story (Alonso-Campuzano et al., 2021; Rogat & Linnenbrink-Garcia, 2011; Salonen et al., 2005; Volet et al., 2009).

In this study, the absence of differences in content balances between collaborative and individual stories can be due to participants' social, behavioural, and representative skills. Cognitive and relational difficulties may have limited the effects of collaborative work, plot control, and regulation, affecting participants' shared representation and story balances (Bause et al., 2018; McGrath, 1984; Stasser & Birchmeier, 2003).

4.6 | H6: Collaboration and group story features

Finally, collaboration in storytelling allowed for a more balanced portrayal of characters' behaviours when each participant had the space to contribute. Previous research supports this finding, as studies have pointed to the more balanced content in collaborative stories (Alonso-Campuzano et al., 2021; Rogat & Linnenbrink-Garcia, 2011; Volet et al., 2009). Oppositely, when the group members demonstrated more social cognition and motivation, the story showed less balance between problems and solutions. One possible explanation is that the more the group members considered each other, the more they failed to close the problematic elements proposed by the partner. This opposite effect refers to a possible information overload due to the participants' executive and social difficulties. In this way, the groups that collaborate the most can lose resources when solving problems related to creating a shared history.

5 | CONCLUSIONS

The current study highlighted the potential of collaborative storytelling activities with adolescents in special education, despite their executive and social difficulties. Students with intellectual disabilities and comorbid neurodevelopmental disorders could create stories individually and collaboratively. Both traditional and technological instruments can support individual and collaborative story creation, with guidance from teachers who prioritised both the task and the interaction. The absence of differences between the methodologies indicated that students can successfully manage digital and traditional storytelling with educational support. However, the findings suggested that eight collaborative storytelling sessions may not significantly enhance individual and group narrative competencies.

This study's findings stress that teachers can plan and execute collaborative storytelling activities within the classroom, considering students' executive and social skills, storytelling features, group dynamics, traditional, tangible, and digital instruments. The teacher sometimes can support collaborative processes that prioritise the task, and other times the social interaction, especially with adolescents with

neurodevelopmental difficulties, pointing to balance decision-making, listening, and expanding reciprocal concepts. Collaborative storytelling can support the group experience also in adolescents with intellectual disability, fostering social perspective and transactive dialogue rather than distracting or involving them in useless conversations (Azmitia & Montgomery, 1993; Hoever et al., 2012; Oztop & Gummerum, 2020; Segundo-Marcos et al., 2023). Moreover, the teacher must consider that tangible digital storytelling adds the possibility of recording the experience to meta-represent and rehearse the intertwined information declared by the group. In this way, his/her role becomes promoting the collaborative and creative student's transactive storytelling dialogue, accompanying them through unknown contents and tasks with specific assignments delimited in time, promoting inclusion, synergy, and consensus, expanding and closing the topics and problematic elements proposed by the group partners.

Regarding the instruments developed for the study, the six collaboration and pro-social dimensions of the small group collaboration sheet (social awareness, social cognition, social communication, social motivation, and inclusion) correlated with each other, reaching a high internal consistency (Cronbach's $\alpha = 0.90$). It suggests that these variables probably merge into a general macro-dimension of inclusion oriented to synergy and consensus, well-known in the collaborative scientific literature (Blumenfeld et al., 1996; Kanisaukas, 2014; Knyazeva & Haken, 1999). In future studies, it will be necessary to explore the relationship between these collaborative dimensions, consensus, and synergy in the group's task execution, decision-making, and agreement.

Another study limitation was not evaluating the proper and improper device handling after the training phase. In future studies, it will be helpful to consider measuring the participant's ability to employ the different digital methodologies.

Future studies should consider increasing the sessions and allowing for debriefing time. These implementations should aim at narrative competence stimulation and metacognition related to the social and task experience.

AUTHOR CONTRIBUTIONS

Conceptualization: Cristina Alonso-Campuzano, Fabio Filosofi, Paola Venuti and Giuseppe Iandolo. **Formal analysis:** Cristina Alonso-Campuzano and Giuseppe Iandolo. **Investigation:** Cristina Alonso-Campuzano, N. Sosa-González, M.C.M., and Angela Tardivo. **Resources:** Giuseppe Iandolo. **Data curation:** Cristina Alonso-Campuzano, Angela Pasqualotto and Giuseppe Iandolo. **Writing-original draft preparation:** Cristina Alonso-Campuzano, Fabio Filosofi, Angela Tardivo and Giuseppe Iandolo. **Writing-review and editing:** Cristina Alonso-Campuzano, Giuseppe Iandolo, Angela Pasqualotto, Paola Venuti. **Supervision:** Giuseppe Iandolo and Paola Venuti. **Project administration:** Giuseppe Iandolo. **Funding acquisition:** Giuseppe Iandolo and Paola Venuti. All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Dataset at https://figshare.com/articles/dataset/Tangible_digital_collaborative_storytelling_in_adolescents_with_intellectual_disability_and_neurodevelopmental_disorders/22179479.

INFORMED CONSENT

Informed consent was obtained from all subjects involved in the study.

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