Received: 28 February 2023 | Revised: 14 August 2023 | Accepted: 5 September 2023

DOI: 10.1111/jar.13159

ORIGINAL ARTICLE

JARID Journal of Applied Research in Intellectual Disabilities bild WILEY

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

Cristina Alonso-Campuzano[1] | Giuseppe Iandolo[1] | Fabio Filosofi[2] | Angela Tardivo[3] | Noelia Sosa-González[3] | Angela Pasqualotto[2,4] | Paola Venuti[2]

[1]Department of Psychology, School of Biomedical Sciences, European University of Madrid, Madrid, Spain

[2]Department of Psychology and Cognitive Science, University of Trento, Trento, Italy

[3]Observation and Functional Diagnosis Division, PSISE Clinical and Developmental Psychological Service, Madrid, Spain

[4]Department of Education and Learning, University of Applied Sciences and Arts of Southern Switzerland, Locarno, Switzerland

Correspondence
Giuseppe Iandolo, Department of Psychology, School of Biomedical Sciences, European University of Madrid, Calle Tajo S/N. (Urb. El Bosque), Villaviciosa de Odón (Madrid), 28670 Spain.
Email: giuseppe.iandolo@universidadeuropea.es

Funding information
European Commission; Erasmus+

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).

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, Wecshler, 2007), narrative skills (Bears Family Projective Test; Iandolo & 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

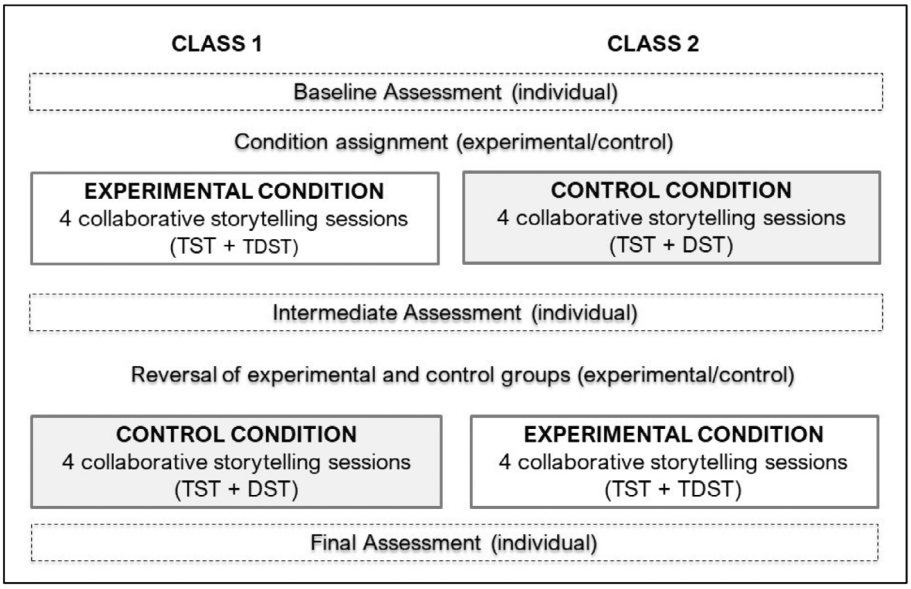


FIGURE 1 Experimental design scheme.

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; Wecshler, 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, Wecshler, 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 Weschler Intelligence Scale for Children and Adolescents WISC-IV (Wecshler, 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 ($N = 14$).

			Class 1		Class 2		Total
		Group N	1 A 3	1 B 3	2 A 4	2 B 4	 14
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

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 (Kruskall–Wallis $= 10.53$; df 2; $p < .01$), propositions (Kruskall-Wallis $= 10.57$; df 2; $p < .01$), and episodes (Kruskall-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.

			Collaborative storytelling					Individual storytelling		
Variable		Measures	Tangible digital (TDST) [Exp.]	Digital (DST) [Control]	Traditional (TST) [Control]	Traditional (TST) [Exp.]	TST comparison control vs. Exp. Mann–Whitney U/Student's t	Baseline	Post control	Post Exp.
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 ($p < .01$)
	Propositions off task	Min (Max)	0 (9)	0 (92)	0 (8)	0 (7)	$U = 31.00$; $p = .96$	0 (13)	0 (15)	0 (9)
		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 ($p < .01$)
	Propositions	Min (Max)	5 (33)	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)
		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 ($p < .01$)
	Episodes	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)
		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 ($p = .05$)
	Narrative structure	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 ($p < .01$)
Story analysis (content)	Balance 1. Positive vs. negative solutions	Min (Max)	−1 (2)	−1 (2)	1 (1)	0 (2)	$U = 32.00$; $p = 1.00$	0 (2)	−1 (2)	0 (3)
		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 ($p < .01$)
	Balance 2. Solved vs. unsolved problems	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)
		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 ($p = .14$)**
	Balance 3. Positive vs. negative relationships	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)

(Continues)

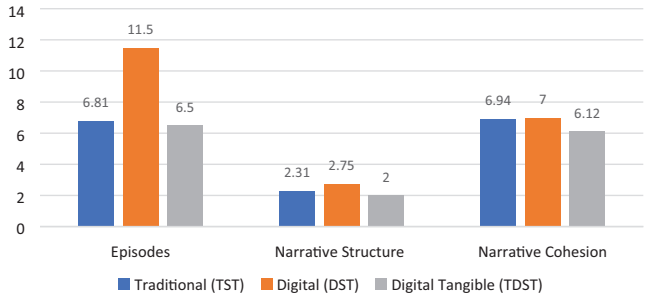
TABLE 2 (Continued)

Variable		Measures	Collaborative storytelling					Individual storytelling		
			Tangible digital (TDST) [Exp.]	Digital (DST) [Control]	Traditional (TST) [Control]	Traditional (TST) [Exp.]	TST comparison control vs. Exp. Mann–Whitney U/Student's t	Baseline	Post control	Post Exp.
		Asym. (Kurt.)	−050 (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)**
	Balance 4. Adaptive vs. maladaptive behaviours	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)
Group interaction (collaboration) improper behaviours	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)**				
	Off task conversation	Min (Max)	1.00 (2.00)	1.00 (2.16)	1.00 (2.83)	1.00 (2.33)	*t* = 0.20 (*Df* 14); *p* = .84			
		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)**				
	Group self-regulation	Min (Max)	1.00 (1.66)	1.25 (1.75)	1.00 (1.75)	1.00 (1.71)	*t* = 0.26 (*Df* 14); *p* = .80			
		Mean (SD)	1.34 (0.20)	1.39 (1.56)	1.31 (0.25)	1.34 (2.09)				
		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)**				
performance	Focus on the task	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)**				
Group interaction (collaboration) prosocial BEHAVIOURS	Positive comments	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)**				
	Social awareness	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			
		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)**				
	Social cognition	Min (Max)	1.00 (1.50)	1.00 (1.75)	1.00 (1.50)	1.00 (1.66)	*t* = 0.76 (*Df* 14). *p* = .46			
		Mean (SD)	1.21 (0.18)	1.35 (0.25)	1.22 (0.18)	1.30 (0.23)				

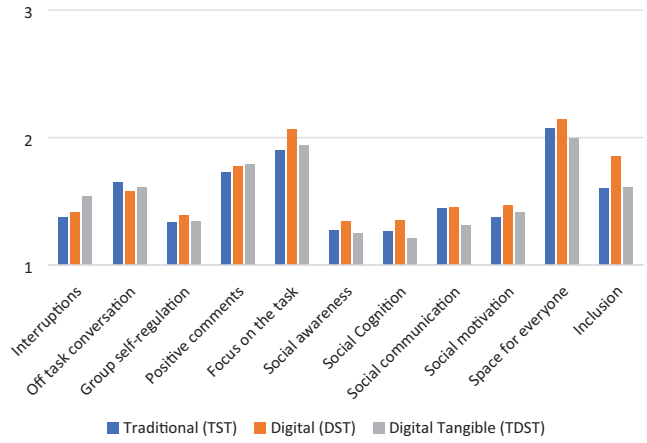
TABLE 2 (Continued)

Variable		Measures	Collaborative storytelling					Individual storytelling		
			Tangible digital (TDST) [Exp.]	Digital (DST) [Control]	Traditional (TST) [Control]	Traditional (TST) [Exp.]	TST comparison control vs. Exp. Mann–Whitney U/Student's t	Baseline	Post control	Post Exp.
		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)**				
	Social communication	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)				
		Shapiro Wilk (p)	**0.87 (0.15)**	**0.94 (0.65)**	**0.91 (0.33)**	**0.95 (0.73)**				
	Social motivation	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)**				
	Inclusion	Min (Max)	1.33 (2.16)	1.42 (2.75)	1.00 (2.33)	1.00 (2.00)	$t = -1.00$ (*Df* 14). $p = .33$			
		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 indicaes significant value.



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



GRAPH 2 Group stories mean values for collaboration.

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 3 Individual narrative competence.

	Number of words			Propositions off task		
Assessment	**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), $p = .06$		
	Propositions			**Episodes**		
Assessment	**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), $p = .83$		
	Narrative structure			**Narrative cohesion**		
Assessment	**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), $p = .50$		
	Balance 1. Positive vs. negative solutions			**Balance 2. Solved vs. unsolved problems**		
Assessment	**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), $p = .73$		
	Balance 3. Positive vs. negative relationships			**Balance 4. Adaptive vs. maladaptive behaviours**		
Assessment	**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.

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

	Number of words			Propositions off task		
Methodology	**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	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST
	***p* = <.01**	*p* = 1.00	***p* = <.01**	***p* = .04**	*p* = 1.00	*p* = .11
	Propositions			**Episodes**		
Methodology	**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	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST
	***p* = <.01**	*p* = 1.00	***p* = <.01**	***p* = .03**	*p* = 1.00	***p* = .05**
	Narrative structure			**Narrative cohesion**		
Methodology	**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	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST
	p = .56	*p* = .76	*p* = .30	*p* = 1.00	*p* = 1.00	*p* = 1.00
	Balance 1. Positive vs. negative solutions			**Balance 2. Solved vs. unsolved problems**		
Methodology	**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	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST
	p = .39	*p* = .18	*p* = 1.00	*p* = .59	*p* = .99	*p* = 1.00
	Balance 3. Positive vs. negative relationships			**Balance 4. Adaptive vs. maladaptive behaviour**		
Methodology	**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	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST
	p = 1.00	*p* = 1.00	*p* = 1.00	*p* = .12	*p* = 1.00	*p* = .45

Note: Bold indicaes 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).

	Interruptions			Off task conversation			Group self-regulation		
Methodology	**TST**	**DST**	**TDST**	**TST**	**DST**	**TDST**	**TST**	**DST**	**TDST**
Average (SD)	1.37 (0.45)	1.41 (0.44)	1.54 (0.62)	1.65 (0.50)	1.58 (0.45)	1.61 (0.39)	1.33 (0.22)	1.39 (1.56)	1.34 (0.20)
Kruskal–Wallis Test/ANOVA	Kruskal–Wallis = 0.42 (*df* 2), $p = .81$			*F* 0.07 (*df* 2), $p = .93$			Kruskal–Wallis = 1.12 (*df* 2), $p = .57$		
Bonferroni post-hoc/Tukey post-hoc	TST & DST	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST
	$p = 1.00$	$p = 1.00$	$p = 1.00$	$p = .93$	$p = .98$	$p = .99$	$p = 1.00$	$p = 1.00$	$p = 1.00$
	Positive comments			**Focus on the task**			**Social awareness**		
Methodology	**TST**	**DST**	**TDST**	**TST**	**DST**	**TDST**	**TST**	**DST**	**TDST**
Average (SD)	1.73 (0.39)	1.77 (0.22)	1.79 (0.21)	1.90 (0.29)	2.06 (0.37)	1.94 (0.25)	1.27 (0.22)	1.34 (0.24)	1.25 (0.22)
Kruskal–Wallis Test/ANOVA	Kruskal–Wallis = 0.76 (*df* 2), $p = .68$			*F* 0.72 (*df* 2), $p = .50$			*F* 0.37 (*df* 2), $p = .69$		
Bonferroni post-hoc/Tukey post-hoc	TST & DST	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST
	$p = 1.00$	$p = 1.00$	$p = 1.00$	$p = .46$	$p = .95$	$p = .72$	$p = .77$	$p = .95$	$p = .69$
	Social Cognition			**Social communication**			**Social motivation**		
Methodology	**TST**	**DST**	**TDST**	**TST**	**DST**	**TDST**	**TST**	**DST**	**TDST**
Average (SD)	1.26 (0.20)	1.35 (0.25)	1.21 (0.18)	1.44 (0.24)	1.45 (0.21)	1.31 (0.09)	1.37 (0.26)	1.47 (0.29)	1.41 (0.19)
Kruskal–Wallis Test/ANOVA	*F* 0.88 (*df* 2), $p = .42$			*F* 1.31 (*df* 2), $p = .42$			*F* 0.39 (*df* 2), $p = .68$		
Bonferroni post-hoc/Tukey post-hoc	TST & DST	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST
	$p = .60$	$p = .85$	$p = .40$	$p = .99$	$p = .31$	$p = .37$	$p = .65$	$p = .93$	$p = .89$
	Space for everyone			**Inclusion**					
Methodology	**TST**	**DST**	**TDST**	**TST**	**DST**	**TDST**			
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), $p = .75$			*F* 1.27 (*df* 2), $p = .29$					
Bonferroni post-hoc/Tukey post-hoc	TST & DST	TST & TDST	DST & TDST	TST & DST	TST & TDST	DST & TDST			
	$p = .93$	$p = .87$	$p = .73$	$p = .30$	$p = .99$	$p = .42$			

TABLE 6 Individual versus collaborative stories comparison.

	Number of words		Propositions off task		Propositions		Episodes	
Methodology	**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 *U*	***U* = 732.00, *p* = .03**		*U* = 646.00, *p* = .21		***U* = 784.50, *p* = <.01**		*U* = 573.50, *p* = .86	

	Narrative structure		Narrative cohesion		Balance 1. Positive vs. negative solutions		Balance 2. Solved vs. unsolved problems	
Methodology	**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 *U*	***U* = 738.50, *p* = .02**		***U* = 790.50, *p* = <.01**		*U* = 675.00, *p* = .12		*U* = 591.00, *p* = .68	

	Balance 3. Positive vs. negative relationships		Balance 4. Adaptive vs. maladaptive behaviour	
Methodology	**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 *U*	*U* = 526.50, *p* = .66		*U* = 453.50, *p* = .16	

Note: Bold indicaes significant value.

TABLE 7 Significative correlations between collaboration and story variables (Spearmon's rho).

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

Note: Bold indicaes 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; Iandolo 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 rehearsal 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; Kanisauskas, 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.

ACKNOWLEDGMENTS

We want to extend our appreciation to teachers, students, and staff members of Fundación A LA PAR Madrid (Spain) for actively facilitating this project and for their work in the training and social inclusion of people with intellectual disabilities and neurodevelopmental disorders.

FUNDING INFORMATION

This research was funded by the Erasmus+ included europe.eu project (G.I) https://www.includedeurope.eu/.

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.

ORCID

Cristina Alonso-Campuzano https://orcid.org/0000-0002-8212-5696
Giuseppe Iandolo https://orcid.org/0000-0002-4715-7043
Fabio Filosofi https://orcid.org/0000-0001-7986-6795
Angela Tardivo https://orcid.org/0000-0002-1802-3871
Noelia Sosa-González https://orcid.org/0009-0001-3299-8704
Angela Pasqualotto https://orcid.org/0000-0003-2172-5492
Paola Venuti https://orcid.org/0000-0002-1827-0549

REFERENCES

Abbeduto, L., Short-Meyerson, K., Benson, G., & Dolish, J. (2004). Relationship between theory of mind and language ability in children and adolescents with intellectual disability. *Journal of Intellectual Disability Research*, *48*(2), 150–159. https://doi.org/10.1111/j.1365-2788.2004.00524.x

Alessandrini, A., Cappelletti, A., & Zancanaro, M. (2014). Audio-augmented paper for therapy and educational intervention for children with autistic spectrum disorder. *International Journal of Human-Computer Studies*, *72*(4), 422–430. https://doi.org/10.1016/j.ijhcs.2013.12.001

Alonso-Campuzano, C., Iandolo, G., Mazzeo, M. C., González, N. S., Neoh, M. J. Y., Carollo, A., Gabrieli, G., & Esposito, G. (2021). Children's online collaborative storytelling during 2020 COVID−19 home confinement. *European Journal of Investigation in Health, Psychology and Education 2021*, *11*(4), 1619–1634. https://doi.org/10.3390/ejihpe11040115

Azmitia, M., & Montgomery, R. (1993). Friendship, transactive dialogues, and the development of scientific reasoning. *Social Development*, *2*(3), 202–221. https://doi.org/10.1111/j.1467-9507.1993.tb00014.x

Baranauskas, M. C. C., & Posada, J. E. G. (2017). Tangible and shared storytelling: Searching for the social dimension of constructionism. In *Proceedings of the 2017 Conference on Interaction Design and Children* (pp. 193–203). https://doi.org/10.1145/3078072.3079743

Blumenfeld, P. C., Marx, R. W., Soloway, E., & Krajcik, J. (1996). Learning with peers: From small group cooperation to collaborative communities. *Educational researcher*, *25*(8), 37–39. https://doi.org/10.3102/0013189X025008037

Bird, A., & Reese, E. (2006). Emotional reminiscing and the development of an autobiographical self. *Developmental Psychology*, *42*(4), 613–626. https://doi.org/10.1037/0012-1649.42.4.613

Bonillo, C., Baldassarri, S., Marco, J., & Cerezo, E. (2019). Tackling developmental delays with therapeutic activities based on tangible tabletops. *Universal Access in the Information Society*, *18*(1), 31–47. https://doi.org/10.1007/s10209-017-0582-4

Botturi, L., Bramani, C., & Corbino, S. (2014). Digital storytelling for social and international development: From special education to vulnerable children. *International Journal of Art and Technologies*, *7*(1), 92–111. https://bit.ly/3jnsvda

Botvin, G. J., & Sutton-Smith, B. (1977). The development of structural complexity in children's fantasy narratives. *Developmental Psychology*, *13*(4), 377–388. https://doi.org/10.1037/0012-1649.13.4.377

Bause, I. M., Brich, I. R., Wesslein, A. K., & Hesse, F. W. (2018). Using technological functions on a multi-touch table and their affordances to counteract biases and foster collaborative problem solving. *International journal of computer-supported collaborative learning*, *13*, 7–33. https://doi.org/10.1007/s11412-018-9271-4

Bruner, J. (1986). *Actual minds, possible worlds* (p. 1986). Harvard University Press.

Bruner, J. (1988). Research currents: Life as narrative. *Language Arts*, *65*(6), 574–583. https://www.jstor.org/stable/41411426

Bruner, J. S. (1990). *Acts of meaning: Four lectures on mind and culture* (Vol. 3). Harvard university press.

Bruner, J. (1991). The narrative construction of reality. *Critical Inquiry*, *18*(1), 1–21. https://doi.org/10.1086/448619

Catala, A., Theune, M., Gijlers, H., & Heylen, D. (2017, June). Storytelling as a creative activity in the classroom. In *Proceedings of the 2017 ACM SIGCHI Conference on Creativity and Cognition* (pp. 237-242). 10.1145/3059454.3078857.

Corbett, B. A., Constantine, L. J., Hendren, R., Rocke, D., & Ozonoff, S. (2009). Examining executive functioning in children with autism spectrum disorder, attention deficit hyperactivity disorder and typical development. *Psychiatry Research*, *166*(2–3), 210–222. https://doi.org/10.1016/j.psychres.2008.02.005

Di Blas, N., & Ferrari, L. (2014). Digital storytelling at school: What kind of educational benefits? *International Journal of Arts and Technology*, *7*(1), 38–54. https://doi.org/10.1504/IJART.2014.058942

Di Blas, N., & Paolini, P. (2013). Beyond the school's boundaries: PoliCultura, a large-scale digital storytelling initiative. *Journal of Educational Technology & Society*, *16*(1), 15–27. https://www.jstor.org/stable/jeductechsoci.16.1.15

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Eisenberg, M., Buechley, L., & Elumeze, N. (2004, December). Computation and construction kits: Toward the next generation of tangible building media for children. In *CELDA* (pp. 423-426). https://bit.ly/3PDZjuM

Esposito, G., Venuti, P., Iandolo, G., de Falco, S., Wei, C., Bornstein, M. H., & Gabrieli, G. (2018). Microgenesis of typical storytelling. *Early Child Development and Care*, *190*, 1991–2000. https://doi.org/10.1080/03004430.2018.1554653

Flynn, E. E. (2018). Ideas in dialogue: Leveraging the power of child-led storytelling in the multicultural preschool classroom. *Language in Society*, *47*(4), 601–633. https://pdxscholar.library.pdx.edu/socwork_fac/244/

Filosofi, F., Alonso-Campuzano, C., Pasqualotto, A., & Iandolo, G. (2021, July). Teachers' perceptions about collaboration and inclusion using a tangible digital storytelling tool (i-theatre) in pre-school and primary education: the INCLUDED project research pilot study. In *Proceedings of EDULEARN21 Conference* (Vol. 5, p. 6th). https://bit.ly/3WuJUPF

Francis, G. A., Farr, W., Mareva, S., & Gibson, J. L. (2019). Do tangible user interfaces promote social behaviour during free play? A comparison of autistic and typically-developing children playing with passive and digital construction toys. *Research in Autism Spectrum Disorders*, *58*, 68–82. https://doi.org/10.1016/j.rasd.2018.08.005

Geurts, H. M., Verté, S., Oosterlaan, J., Roeyers, H., & Sergeant, J. A. (2004). How specific are executive functioning deficits in attention deficit hyperactivity disorder and autism? *Journal of Child Psychology and Psychiatry*, *45*(4), 836–854. https://doi.org/10.1111/j.1469-7610.2004.00276.x

Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, *41*(3), 39–54. https://doi.org/10.3316/ielapa.977489802155242

Harley, D., Chu, J. H., Kwan, J., & Mazalek, A. (2016, February). Towards a framework for tangible narratives. In *Proceedings of the TEI'16: 10th International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 62-69). https://doi.org/10.1145/2839462.2839471

Hassan, A., Pinkwart, N., & Shafi, M. (2021). Serious games to improve social and emotional intelligence in children with autism. *Entertainment Computing*, *38*, 100417. https://doi.org/10.1016/j.entcom.2021.100417

Hengeveld, B., Hummels, C., Overbeeke, K., Voort, R., van Balkom, H., & de Moor, J. (2009, February). Tangibles for toddlers learning language. In *Proceedings of the 3rd International Conference on Tangible and Embedded Interaction* (pp. 161–168). https://bit.ly/3jno2HO

Hengeveld, B., Voort, R., Hummels, C., Moor, J. D., van Balkom, H., Overbeeke, K., & van der Helm, A. (2008). The development of LinguaBytes: An interactive tangible play and learning system to stimulate the language development of toddlers with multiple disabilities. *Advances in Human-Computer Interaction*, *2008*, 1–13. https://doi.org/10.1155/2008/381086

Henry, L. A., Messer, D. J., & Nash, G. (2015). Executive functioning and verbal fluency in children with language difficulties. *Learning and Instruction*, *39*, 137–147. https://doi.org/10.1016/j.learninstruc.2015.06.001

Hoever, I. J., Van Knippenberg, D., Van Ginkel, W. P., & Barkema, H. G. (2012). Fostering team creativity: Perspective taking as key to unlocking diversity's potential. *Journal of Applied Psychology*, *97*(5), 982–996. https://doi.org/10.1037/a0029159

Hong, E., Hartzell, S. A., & Greene, M. T. (2009). Fostering creativity in the classroom: Effects of teachers epistemological beliefs, motivation, and goal orientation. *The Journal of Creative Behavior*, *43*(3), 192–208. https://doi.org/10.1002/j.2162-6057.2009.tb01314.x

Hudson, J. A., & Shapiro, L. R. (1991). From knowing to telling: The development of children's scripts, stories, and personal narratives. In A. McCabe & C. Peterson (Eds.), *Developing narrative structure* (pp. 89–136). Lawrence Erlbaum Associates, Inc.

Hurks, P. P., Schrans, D., Meijs, C., Wassenberg, R., Feron, F. J. M., & Jolles, J. (2010). Developmental changes in semantic verbal fluency: Analyses of word productivity as a function of time, clustering, and switching. *Child Neuropsychology*, *16*(4), 366–387. https://doi.org/10.1080/09297041003671184

Iandolo, G. (2011). *El desarrollo de las competencias narrativas, forma, cohesión y equilibrio de contenido a través del Test Proyectivo de la Familia de los Osos*. Universidad Autónoma de Madrid http://ow.ly/pldc50EdsYt

Iandolo, G., Esposito, G., & Venuti, P. (2013). Cohesión, micro-organización, estructura narrativa y competencias verbales entre tres y once años: el desarrollo narrativo formal. *Estudios de Psicología*, *34*(2), 141–160. https://doi.org/10.1174/021093913806751456

Iandolo, G. (2021). *Aproximación a la educación inclusiva a través de la narración digital tangible*. Sar Alejandría.

Iandolo, G., & Alonso-Campuzano, C. (2021). El Test Proyectivo de la Familia de los Osos. In *Evaluación de competencias narrativas y de representación entre los 3 y los 11 años. Manual con del Sistema Integrado y Análisis del Juego*. Servicio de Psicología, Madrid, España http://ow.ly/2WvF50AdbXE

Iandolo, G., Esposito, G., & Venuti, P. (2012). The bears family projective test: Evaluating stories of children with emotional difficulties. *Perceptual and Motor Skills*, *114*(3), 883–902. https://doi.org/10.2466/02.09.15.21.PMS.114.3.883-902

Iandolo, G., López-Florit, L., Venuti, P., Neoh, M. J. Y., Bornstein, M. H., & Esposito, G. (2020). Story contents and intensity of the anxious

symptomatology in children and adolescents with autism Spectrum disorder. *International Journal of Adolescence and Youth*, *25*(1), 725–740. https://doi.org/10.1080/02673843.2020.1737156

Johnson, D. W., & Johnson, R. T. (1991). Cooperative learning and classroom and school climate. In B. J. Fraser & H. J. Walberg (Eds.), *Educational environments: Evaluation, antecedents and consequences* (pp. 55–74). Pergamon Press.

Johnson, D. W., & Johnson, R. T. (1999). What makes cooperative learning work? In D. Kluge, S. McGuire, D. Johnson, & R. Johnson (Eds.), *Cooperative learning* (pp. 23–38). JALT. https://bit.ly/3YPm2bv

Johnson, D. W., Johnson, R. T., & Stanne, M. E. (2000). *Cooperative Learning Methods: A Meta-Analysis*. University of Minnesota Press.

Johnson, R. T., & Johnson, D. W. (2008). Active learning: Cooperation in the classroom. *The Annual Report of Educational Psychology in Japan*, *47*, 29–30. https://bit.ly/3I88GRw

Johnson, D. W., & Johnson, R. T. (2014). Cooperative Learning in 21st Century. *[Aprendizaje cooperativo en el siglo XXI]. Anales de Psicología/Annals of Psychology*, *30*(3), 841–851. https://doi.org/10.6018/analesps.30.3.201241

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational researcher*, *38*(5), 365–379. https://doi.org/10.3102/0013189X09339057

Kanisauskas, S. (2014). The phenomenon of creativity: Philosophical and synergetic insights. *European Scientific Journal*, *10*(14).

Katifori, A., Perry, S., Vayanou, M., Antoniou, A., Ioannidis, I. P., McKinney, S., & Ioannidis, Y. (2020). "Let them talk!" exploring guided group interaction in digital storytelling experiences. *Journal on Computing and Cultural Heritage (JOCCH)*, *13*(3), 1–30. https://doi.org/10.1145/3382773

Katz, J., & Mirenda, P. (2002). Including students with developmental disabilities in general education classrooms: Educational benefits. *International Journal of Special Education*, *17*(2), 14–24. https://shorturl.at/fIEGJ

Keskinova, A., & Ajdinski, G. (2018). Learning problems in children with mild intellectual disability. *International Journal of Cognitive Research in Science, Engineering and Education*, *6*(1), 31–37. https://doi.org/10.5937/ijcrsee1801031K

Knyazeva, H., & Haken, H. (1999). Synergetics of human creativity. *Dynamics, synergetics, autonomous agents: Nonlinear systems approaches to cognitive psychology and cognitive science*, 64–79. https://doi.org/10.1142/9789812815354_0005

Korkman, M., Kirk, U., & Kemp, S. (2014). *NEPSY-II: Manual clínico y de interpretación*. Pearson, The Psychological Corporation.

Kurdyukova, E., André, E., & Leichtenstern, K. (2009, December). Introducing multiple interaction devices to interactive storytelling: Experiences from practice. In *Joint international conference on interactive digital storytelling* (pp. 134–139). Springer. https://doi.org/10.1007/978-3-642-10643-9_18

Lagergren, A., & Holmberg, K. (2017). Learning in new perspectives–entanglement of children, teachers and digital technology. In *EECERA (European Early Childhood Education Research) 2017, Bologna* (pp. 230–230).

López-Florit, L., García-Cuesta, E., Gracia-Expósito, L., García-García, G., & Iandolo, G. (2021). Physiological reactions in the therapist and turn-taking during online psychotherapy with children and adolescents with autism spectrum disorder. *Brain Sciences*, *11*(5), 586. https://doi.org/10.3390/brainsci11050586

McGrath, J. E. (1984). *Groups: Interaction and performance* (Vol. 14). Prentice-Hall.

Mandler, G. (1984). *Mind and body: Psychology of emotion and stress*. WW Norton & Company Incorporated.

Manning, C. (2010). 'My memory's back!'Inclusive learning disability research using ethics, oral history and digital storytelling. *British Journal of Learning Disabilities*, *38*(3), 160–167. https://doi.org/10.1111/j.1468-3156.2009.00567.x

Marcovitch, S., Jacques, S., Boseovski, J. J., & Zelazo, P. D. (2008). Self-reflection and the cognitive control of behavior: Implications for learning. *Mind, Brain, and Education*, *2*(3), 136–141. https://doi.org/10.1111/j.1751-228X.2008.00044.x

Matos, A., Rocha, T., Cabral, L., & Bessa, M. (2015). Multi-sensory storytelling to support learning for people with intellectual disability: An exploratory didactic study. *Procedia Computer Science*, *67*, 12–18. https://doi.org/10.1016/j.procs.2015.09.244

McCabe, A., Peterson, C., & Connors, D. M. (2006). Attachment security and narrative elaboration. *International Journal of Behavioral Development*, *30*(5), 398–409. https://doi.org/10.1177/0165025406071148

Moreno, J. L. (1960). *The sociometry reader*. The Free Press.

Muniroh, N., Apriyanti, M., Musayaroh, S., & Yuliana, S. (2017). The positive impact of collaborative learning for student with intellectual disability in inclusive school. *Journal of ICSAR*, *1*(1), 68–71. https://doi.org/10.17977/um005v1i12017p068

Nelson, K. (1999). Event representations, narrative development and internal working models. *Attachment & Human Development*, *1*(3), 239–252. https://doi.org/10.1080/14616739900134131

Nelson, O. (1989). Storytelling: Language experience for meaning making. *The Reading Teacher*, *42*(6), 386–390. https://www.jstor.org/stable/20200160

Nokes-Malach, T. J., Richey, J. E., & Gadgil, S. (2015). When is it better to learn together? Insights from research on collaborative learning. *Educational Psychology Review*, *27*(4), 645–656. https://doi.org/10.1007/s10648-015-9312-8

Nokes-Malach, T. J., Zepeda, C. D., Richey, J. E., & Gadgil, S. (2019). Collaborative learning: The benefits and costs. In J. Dunlosky & K. A. Rawson (Eds.), *The Cambridge handbook of cognition and education* (pp. 500–527). Cambridge University Press. https://doi.org/10.1017/9781108235631.021

Oztop, P., & Gummerum, M. (2020). Group creativity in children and adolescents. *Cognitive Development*, *56*, 100923. https://doi.org/10.1016/j.cogdev.2020.100923

Pasupathi, M., & Hoyt, T. (2009). The development of narrative identity in late adolescence and emergent adulthood: The continued importance of listeners. *Developmental Psychology*, *45*(2), 558–574. https://doi.org/10.1037/a0014431

Peñuelas-Calvo, I., Jiang-Lin, L. K., Girela-Serrano, B., Delgado-Gomez, D., Navarro-Jimenez, R., Baca-Garcia, E., & Porras-Segovia, A. (2020). Video games for the assessment and treatment of attention-deficit/hyperactivity disorder: A systematic review. *European child & adolescent psychiatry*, 1–16. https://doi.org/10.1007/s00787-020-01557-w

Pérusseau-Lambert, A., Anastassova, M., Boukallel, M., Chetouani, M., & Grynszpan, O. (2018). Haptic and tactile interfaces for autism: A systematic review. *Enfance*, *1*(1), 65–90. https://doi.org/10.3917/enf2.181.0065

Pierroux, P., Steier, R., & Ludvigsen, S. R. (2022). Group creativity in adolescence: Relational, material and institutional dimensions of creative collaboration. *Journal of the Learning Sciences*, *31*(1), 107–137. https://doi.org/10.1080/10508406.2022.2025813

Rodić, L. D., & Granić, A. (2022). Tangible interfaces in early years' education: A systematic review. *Personal and Ubiquitous Computing*, *26*(1), 39–77. https://doi.org/10.1007/s00779-021-01556-x

Rogat, T. K., & Linnenbrink-Garcia, L. (2011). Socially shared regulation in collaborative groups: An analysis of the interplay between quality of social regulation and group processes. *Cognition and Instruction*, *29*(4), 375–415. https://doi.org/10.1080/07370008.2011.607930

Rowsell, J., & Harwood, D. (2015). "Let it go": Exploring the image of the child as a producer, consumer, and inventor. *Theory into Practice*, *54*(2), 136–146. https://doi.org/10.1080/00405841.2015.1010847

Salonen, P., Vauras, M., & Efklides, A. (2005). Social interaction-what can it tell us about metacognition and coregulation in learning? *European Psychologist*, *10*(3), 199–208. https://doi.org/10.1027/1016-9040.10.3.199

Salma, N. (2020). Collaborative learning: An effective approach to promote language development. *International Journal of Social Sciences & Educational Studies*, *7*(2), 57–61. https://ijsses.tiu.edu.iq/

Saridaki, M., & Meimaris, M. (2018, June). Digital Storytelling for the empowerment of people with intellectual disabilities. In *Proceedings of the 8th international conference on software development and technologies for enhancing accessibility and fighting info-exclusion* (pp. 161-164). https://doi.org/10.1145/3218585.3218664

Segundo-Marcos, R., Carrillo, A. M., Fernández, V. L., & González, M. T. D. (2023). Age-related changes in creative thinking during late childhood: The contribution of cooperative learning. *Thinking Skills and Creativity*, *49*, 101331. https://doi.org/10.1016/j.tsc.2023.101331

Siller, M., Swanson, M. R., Serlin, G., & Teachworth, A. G. (2014). Internal state language in the storybook narratives of children with and without autism spectrum disorder: Investigating relations to theory of mind abilities. *Research in Autism Spectrum Disorders*, *8*(5), 589–596. https://doi.org/10.1016/j.rasd.2014.02.002

Stasser, G., & Birchmeier, Z. (2003). Group creativity and collective choice. In P. B. Paulus & B. A. Nijstad (Eds.), *Group creativity: Innovation through collaboration* (pp. 85–109). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195147308.003.0005

Slavin, R. E. (1989). Research on cooperative learning: An international perspective. *Scandinavian Journal of Educational Research*, *33*(4), 231–243. https://doi.org/10.1080/0031383890330401

Slavin, R. E. (1992). When and why does cooperative learning increase achievement? Theoretical and empirical perspectives. In R. Hertz-Lazarowitz (Ed.), *Interaction in cooperative groups: The theoretical anatomy of group learning*. New Publisher.

Somma, F., & Desideri, L. (2020). A rapid review on Tangible User Interfaces-augmented storytelling in inclusive education. In *Proceedings of the Third Workshop on Technology Enhanced Learning Environments for Blended Education*, June 10–11, 2022, Foggia, Italy. https://bit.ly/3VeBjQ7

Somma, F., Di Fuccio, R., Lattanzio, L., & Ferretti, F. (2021). Multisensorial tangible user interface for immersive storytelling: a usability pilot study with a visually impaired child. In *Technology Enhanced Learning Environments for Blended Education—The Italian e-Learning Conference 2021*. CEUR Workshop Proceedings, Volume 2817, 2021 *teleXbe*. https://bit.ly/3jkDLXO

Stadler, M. A., & Ward, G. C. (2005). Supporting the narrative development of young children. *Early Childhood Education Journal*, *33*(2), 73–80. https://doi.org/10.1007/s10643-005-0024-4

Stavroussi, P., Papalexopoulos, P. F., & Vavougios, D. (2010). Science education and students with intellectual disability: Teaching approaches and implications. *Problems of Education in the 21st Century*, *19*, 103 https://bit.ly/3G4r3V7

Stock, O., & Zancanaro, M. (Eds.). (2007). *PEACH-intelligent interfaces for museum visits*. Springer Science & Business Media.

Sweeney-Burt, N. (2014). Implementing digital storytelling as a technology integration approach with primary school children. *Irish Journal of Academic Practice*, *3*(1), 1–25. https://bit.ly/3FIIA50

Tarchi, C., Bigozzi, L., & Pinto, G. (2019). The influence of narrative competence on mental state talk in kindergarten and primary school children. *British Journal of Developmental Psychology*, *37*(4), 535–550. https://doi.org/10.1111/bjdp.12295

Ten Brug, A., van der Putten, A., Penne, A., Maes, B., & Vlaskamp, C. (2012). Multi-sensory storytelling for persons with profound intellectual and multiple disabilities: An analysis of the development, content and application in practice. *Journal of Applied Research in Intellectual Disabilities*, *25*(4), 350–359. https://doi.org/10.1111/j.1468-3148.2011.00671.x

Ten Brug, A., Van der Putten, A. A., Penne, A., Maes, B., & Vlaskamp, C. (2015). Factors influencing attentiveness of people with profound intellectual and multiple disabilities to multisensory storytelling. *Journal of Policy and Practice in Intellectual Disabilities*, *12*(3), 190–198. https://doi.org/10.1111/jppi.12128

Ten Brug, A., Van der Putten, A. A. J., Penne, A., Maes, B., & Vlaskamp, C. (2016). Making a difference? A comparison between multi-sensory and regular storytelling for persons with profound intellectual and multiple disabilities. *Journal of Intellectual Disability Research*, *60*(11), 1043–1053. https://doi.org/10.1111/jir.12260

Van Leeuwen, A., & Janssen, J. (2019). A systematic review of teacher guidance during collaborative learning in primary and secondary education. *Educational Research Review*, *27*, 71–89. https://doi.org/10.1016/j.edurev.2019.02.001

Vaucheret Paz, E., Puga, C., García Básalo, M. J., Pintos, P., Trossero, I., Richards, A., Ekonen, C., Corleto, M., Leist, M., & Agosta, G. (2017). Verbal fluency: A rapid neuropsychological test for the detection of cognitive disorders in pediatrics. *Acta Neurológica Colombiana*, *33*(3), 142–147. https://doi.org/10.22379/24224022148

Venuti, P., & Iandolo, G. (2003). *El Método proyectivo de la "Familia de los Osos"*. ODF Lab. Universidad de Trento.

Vermette, P., Harper, L., & DiMillo, S. (2004). Cooperative & Collaborative Learning… with 4-8 year olds: How does research support Teachers' practice? *Journal of Instructional Psychology*, *31*(2), 130–134. https://eric.ed.gov/?id=EJ774077

Volet, S., Summers, M., & Thurman, J. (2009). High-level co-regulation in collaborative learning: How does it emerge and how is it sustained? *Learning and Instruction*, *19*(2), 128–143. https://doi.org/10.1016/j.learninstruc.2008.03.001

Westby, C. E. (1991). *Learning to talk, talking to learn: Oral-literate language differences*. In C. S. Simon (Ed.), *Communication skills and classroom success* (pp. 334–357). Thinking.

Wecshler, D. (2007). *WISC-IV: escala de inteligencia de Wechsler para niños-IV*. Pearson.

Wishart, J. G., Willis, D. S., Cebula, K. R., & Pitcairn, T. K. (2007). Collaborative learning: Comparison of outcomes for typically developing children and children with intellectual disabilities. *American Journal on Mental Retardation*, *112*(5), 361–374. https://doi.org/10.1352/0895-8017(2007)112[0361:CLCOOF]2.0.CO;2

Young, H., Fenwick, M., Lambe, L., & Hogg, J. (2011). Multi-sensory storytelling as an aid to assisting people with profound intellectual disabilities to cope with sensitive issues: A multiple research methods analysis of engagement and outcomes. *European Journal of Special Needs Education*, *26*(2), 127–142. https://doi.org/10.1080/08856257.2011.563603

Zancanaro, M., Pianesi, F., Stock, O., Venuti, P., Cappelletti, A., Iandolo, G., Prete, M., & Rossi, F. (2007). Children in the museum: An environment for collaborative storytelling. In *PEACH-intelligent interfaces for museum visits* (pp. 165–184). Springer.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Alonso-Campuzano, C., Iandolo, G., Filosofi, F., Tardivo, A., Sosa-González, N., Pasqualotto, A., & Venuti, P. (2023). Tangible digital collaborative storytelling in adolescents with intellectual disability and neurodevelopmental disorders. *Journal of Applied Research in Intellectual Disabilities*, 1–20. https://doi.org/10.1111/jar.13159