Assessing the effectiveness of multimodality in a classroom-based narrative intervention

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ABSTRACT

This study assesses the MultiModal Narrative (MMN) intervention aimed at enhancing children's oral narrative skills, focusing on its multimodal component, which includes story enactment by teachers and children, and an audiovisual multimodal retelling by a storyteller. A cluster randomized trial was conducted (9 classrooms, 115 children), comparing a control group, a multimodal narrative-based group (complete MMN), and a narrative-based group (MMN without controlling for multimodality). The children's oral narrative macrostructure, microstructure, and perspective-taking skills were measured pre- and post-intervention. Results revealed that both intervention groups improved on the three narrative measures for a trained story, but only the narrative-based group showed a transfer to untrained stories. Further analyses indicated that language-based interactions involving active story enactment activities affected classroom dynamics and prevented children's learning transfer. The study also suggests that multimodality should be integrated in a way that complements, and does not disrupt, the narrative intervention activities.

Keywords: narrative intervention, multimodality, narrative macrostructure, narrative perspective-taking, narrative microstructure

INTRODUCTION

The development of the ability to narrate a story typically takes place during the preschool years and continues to progress throughout childhood, constituting one of the more complex abilities in child language development. Early narrative skills are considered as a reliable and ecologically valid measure for evaluating children's linguistic development (for a review, see Dickinson & McCabe, 2001). In addition, narrative skills have also been found to be both predictive and precursors of subsequent linguistic, literacy, social, and academic performance (e.g., Babayiğit et al., 2021; Dickinson & McCabe, 2001; Griffin et al., 2004).

Narrative interventions allow language to be trained holistically, and researchers and practitioners have been devoted to developing interventions that promote oral narrative skills in preschool- and school-aged children. In the last years, different narrative-based interventions have been implemented and have generally been found to be effective (see Nelson & Khan, 2019 and Pico et al., 2021 for reviews focusing on narrative interventions; for reviews on more general language-based interventions, refer to Donolato et al., 2023 and Walker et al., 2020).

Within the literature on narrative interventions, most studies have focused on boosting children's narrative macrostructure (i.e., the structure of the narrative discourse in terms of story grammar elements, such as character, problem, attempt, and resolution) and narrative microstructure (i.e., narrative productivity at the sentence level, such as the total number of words or the number of different words). Despite the variability in the duration of each narrative intervention (ranging from two-session interventions to whole academic year interventions), the vast majority of studies have reported positive outcomes after implementing the intervention for narrative macrostructure (e.g., Henry & Solari, 2020; Hettiarachchi, 2022), showing that training story grammar elements can also transfer to narrative microstructure (e.g., Gillam, Olszewski et al., 2014; Spencer et al., 2018) (see e.g., Pico et al., for a review). These studies have also revealed that narrative interventions can promote transfer to other linguistic skills, such as vocabulary (Gillam, Olszewski et al., 2014; Suggate et al., 2021), or reading and writing (e.g., Spencer & Petersen, 2018*b*; Petersen et al., 2022). For instance, Spencer et al. (2018) implemented the registered narrative intervention *Story Champs* in three preschool classrooms throughout the school year and compared it to three other control classrooms. The authors conducted two narrative assessments in winter and spring and found that, at both time points, the intervention group achieved significantly better story grammar skills (measured with a narrative retelling task) than the control group. Similarly, Pinto et al.

(2019) compared 470 five-year-olds' narrative competence and reported that children who received the narrative intervention obtained significantly better narrative structure, coherence, and cohesion scores than those in control classrooms. For other studies reporting similar findings, see Daelman et al. (2024), Douglas et al. (2019), Gillam, Olszewski et al. (2014), Khan et al. (2014), Nelson et al. (2021), and West et al. (2021).

When retelling a story, it is not only relevant to talk about what happened in the story, but also about how the characters felt and thought (Veneziano et al., 2020). Despite the significant effects on narrative measures, few studies have systematically trained and evaluated perspective-taking aspects within the story (i.e., the characters' emotions, perspectives, and mental states), but have generally considered emotions as another story grammar element (e.g., Gillam, Gillam, & Laing, 2014; Spencer & Petersen, 2018*a*). One exception is the study by Veneziano et al. (2020), which implemented a short individualized narrative intervention with 5- to 8-year-old French students. In this training session, the children were asked to retell a story by looking at a set of images, and then the interventionist started a conversation to talk about the character's mental states. The results showed that after the intervention, the narrative retelling discourses of children receiving the intervention contained more mental states than those of children in the control group (see also Dodd et al., 2011 for students with autism). Within the context of preschool classrooms, Pronina and colleagues (2021) showed that a narrative-based intervention focusing on characters' emotions and mental states was effective in boosting expressive pragmatic skills (in terms of the appropriateness of answering different speech acts). These studies highlight the importance of incorporating direct instruction on emotions and perspectives into narrative interventions.

The effectiveness of most narrative interventions can be explained through the use of various educational strategies to support language learning. As reported in a recent review by Pico et al. (2021), most interventions provide specific instructions on unfolding narrative macrostructural elements, typically accompanied by visual support (e.g., story grammar icons, pictures, or storyboards). Another key strategy for training macrostructure elements is to employ verbal support, such as verbal prompting through question-and-answer sequences or positive feedback (e.g., repetitions and expansions). In line with these strategies, a recent study by Spencer and Petersen (2020) postulated a set of principles for effective narrative intervention, which included guidelines such as promoting active oral participation and making the intervention as fun as possible, framing the stories in a socially relevant context for children, and providing different opportunities for children to retell the whole story, which in turn allows

for generalization to other stories. To the best of our knowledge, there is an educational strategy that has been incorporated less frequently into narrative interventions, namely multimodality.

Multimodality refers to how we use our body, hands, face, and voice to communicate (Perniss, 2018). In narrative storytelling, multimodality refers to enactment strategies such as using gestures to represent concepts like events or actions (e.g., Demir et al., 2015; Li, 2024; Macoun & Sweller, 2016), having a storyteller narrate and enact the story (e.g., Macoun & Sweller, 2016; Vilà-Giménez et al., 2019), or promoting story enactment, either by the interventionist or the children themselves (e.g., Bernstein et al., 2024; Vilà-Giménez & Prieto, 2020). In fact, lab-based studies have found that observing gestures during a storyteller's narration enhanced children's narrative recall and retelling skills (e.g., Guilbert et al., 2021; Macoun & Sweller, 2016; McKern et al., 2021; Vilà-Giménez et al., 2019). In fact, it is not only observing gestures that helped, but also producing them while narrating the story again (e.g., Parrill et al., 2018; Vilà-Giménez & Prieto, 2020). Vilà-Giménez and Prieto (2020) showed that a one-session individualized narrative intervention involving both observing and producing gestures was effective for promoting five-year-old children's narrative macrostructure skills. All of these studies are in line with the multimodal enrichment paradigm (Mathias & von Kriegstein, 2023), which claims that our body can promote language learning (see also Dargue et al., 2019; Goldin-Meadow, 2014; Hostetter, 2011; Rohlfing, 2017; Vilà-Giménez & Prieto, 2021 for reviews on the effects of gesture use on comprehension and production).

Based on this, a handful of recent studies have gone one step further and have tested the effects of multimodality in real-life classrooms. First of all, to the best of our knowledge, only a few of classroom-based narrative interventions have systematically incorporated a multimodal component, with mixed findings. One example is the *Story Champs* intervention (Spencer & Petersen, 2018*a*), where conventional or metaphoric gestures are used to represent abstract concepts, such as the different macrostructural elements (e.g., placing the fingertips together to represent the setting of the story). Although the specific contribution of these gestures within *Story Champs* has not been tested, significant narrative improvements after the intervention have been found (e.g., Petersen et al., 2022; Spencer et al., 2018). Other studies have used a more naturalistic approach involving child-directed storytelling and story enactment activities, and have directly tested its effects. For instance, Pronina et al. (2021) systematically incorporated multimodality into a narrative intervention using facial expressions to act out different emotional and mental terms. The authors compared the performance on pragmatic and socioemotional skills of three different groups of children: a control group not receiving

the intervention, a group receiving the intervention with the systematic multimodal embodiment of facial expressions, and another group receiving the intervention without the multimodal component. The results showed that both groups receiving the intervention (with no difference between them) improved their expressive pragmatic skills, but that the intervention was not effective in improving emotion understanding and mental state comprehension. More broadly, other studies have incorporated story enactment strategies as drama-based activities using pantomime gestures (see e.g., Bernstein et al., 2024; see also Corbett et al., 2016 for autistic children and Nicolopoulou et al., 2015 for low-income children). For instance, Bernstein and colleagues (2024) compared children's narrative recall abilities after receiving a classroom-based storybook reading intervention either in the absence or presence of a drama-based activity to act as the main character. Their results showed that, although there were no differences between groups in the quality of children's story retell, those receiving the intervention used more gestures when retelling the stories.

Overall, with all these studies, we have seen the value of oral narrative interventions for children's language development. However, the specific contribution of multimodality to narrative intervention practices is less clear. Although studies conducted in an individualized or lab-based context have reported positive effects of multimodality, the two studies testing the effects of multimodality with groups of typically developing students in classrooms (e.g., Bernstein et al., 2024, Pronina et al., 2021) have shown null results. To address the potential asymmetry between the positive effects of multimodality at the more individual one-to-one lab-based and at the classroom level, we believe that it is worth testing the effectiveness of this multimodal component. Moreover, provided that teachers inherently use gestures in their professional practice, we need more research on how multimodality should be systematically incorporated into narrative intervention practice, and its potential effectiveness should be further investigated. This approach would enable teachers to not only implement this strategy effectively in the classroom but also acknowledge its potential value (e.g., Seccia & Goldin-Meadow, 2024).

The present study aims to assess the potential effectiveness of the multimodal component of a novel multimodal narrative-based intervention (the *MultiModal Narrative Intervention*©, henceforth *MMN;* blinded, accepted). MMN was designed for implementation in preschool classrooms as a supplementary component of standard curricular activities. The intervention systematically trains narrative macrostructure and perspective-taking elements with the aid of validated educational strategies, together with a strong multimodal component that affects the

behavior of the three social actors involved in the intervention, namely the enactment by the teacher, the enactment by children, and the observation of an audiovisual multimodal retelling by a storyteller. The present study specifically seeks to test whether the MMN's multimodal component is effective in improving preschool children's oral narrative skills (i.e., macrostructure, microstructure, and perspective-taking). To do this, children's narrative performance after a full implementation of MMN for three weeks will be compared to a group of children receiving the same MMN intervention without the multimodal component and to a group of children not receiving the intervention. We hypothesize that children who receive the intervention with a systematic multimodal component will show greater improvements than those who receive the same narrative-based intervention without the controlled multimodal component (e.g., Mathias & von Kriegstein, 2023) and those that do not receive the intervention (e.g., Nelson & Khan, 2019; Pico et al., 2021).

METHOD

Design

To test the effectiveness of the MMN intervention, particularly the contribution of its multimodal component, this study followed a cluster randomized controlled trial with three different groups: a control group that did not receive the intervention and two experimental groups. One experimental group received the MMN intervention (henceforth multimodal narrative-based group) and another one received the MMN intervention without the multimodal component (henceforth narrative-based group).

Participants

A total of 115 children (55 girls) from an initially recruited sample of 136 children participated in this study (see Appendix I for the CONSORT 2010 flow diagram of the process from participant enrollment until analysis). The sample size for this study was calculated *a priori* using G*Power Version 3.1.9.6 (Faul et al., 2009) with inputs of .05 for alpha, three groups, and two for the number of measurements. The sample size necessary to have an acceptable level of power (1-β error probability = 0.8) and to detect small effect sizes of .15 was 111 participants.

Participants were Spanish-Catalan bilinguals aged between 4;9 and 6;2 attending their last year of preschool. Participants were recruited from nine preschool classes in three public schools in L'Hospitalet de Llobregat, a city in the metropolitan area of Barcelona, Catalonia. All three schools were located in the same neighborhood, with middle-low to middle socioeconomic status (according to the socioeconomic territorial index calculated by the Statistical Institute of Catalonia). The inclusion criteria were as follows: children attending the last year of preschool (I5 in the Catalan education system), with the only restriction that they needed to have normal hearing. The final sample consisted of 106 children with typical development, while 9 children had a professional report indicating developmental difficulties with language and communication. Participants' structural language abilities and non-verbal IQ were evaluated using standardized tests before the intervention (Kaufman & Kaufman, 1990, for non-verbal IQ; Wiig et al., 2013, for structural language). A set of pairwise t-tests was performed to assess potential differences between the three groups. No significant differences were found between the groups in terms of age (*p*s > .361), structural language (*p*s > .135), or non-verbal IQ (*p*s >

.467). See Table 1 below for the descriptives of the participants' demographic, linguistic and cognitive characteristics.

Table 1. Participants' demographic, linguistic and cognitive characteristics

	Control	**Narrative-based**	**Multimodal narrative-based**
N of participants (*N* of females and males)	38 (16 F, 22 M)	41 (20 F, 21 M)	36 (19 F, 17 M)
N of participants with language difficulties (*N* of F and M)	4 (2 F, 2 M)	2 (2 M)	3 (3 M)
Age: Mean (SD)	5.38 (0.33)	5.40 (0.35)	5.45 (0.38)
Age: Range	4.75–6.08	4.75–6.17	4.75–6.17
CELF: Mean (SD)	89.14 (16.99)	92.76 (16.19)	87.29 (13.91)
CELF: Range	40–115	55–120	55–113
K-BIT: Mean (SD)	101.58 (12.73)	102.73 (12.46)	100.57 (13.62)
K-BIT: Range	72–123	77–141	66–123

This study received ethical approval from the Institutional Committee for Ethical Review of Projects at the host university of the first and third authors (2021, ref.: 228) and from the Regional Ministry of Education (Catalan Government). Legal guardians were provided with detailed information about the project and provided written consent for their child to participate in the study. Given that the intervention was implemented as a regular class activity, the legal guardians of the children allocated to the intervention groups were informed that if they did not provide consent for their child to participate, their child would still participate in the intervention sessions, but they would not be administered the pre- and post-intervention assessments.

Pre- and post-intervention assessment

Materials

To determine whether the intervention was effective in boosting children's oral narrative skills (i.e., macrostructure, microstructure and perspective-taking), a narrative retelling task with three trained and untrained stories was used. The first two stories were animated wordless cartoons from the series *Die Sendung mit der Maus*, approximately 50 seconds each. The first story featured the main character, a mouse, whereas the second story featured two characters: the mouse and a small elephant. The third story was a 2.30-minute story, which was the first story trained during the intervention (see the subsection *Intervention phase* below). Therefore, the narrative retelling task involved two untrained stories and one trained story. In particular, to ensure that it was the first time that children saw the story, in the post-intervention assessment, children saw two different untrained stories about the same characters (i.e., the mouse and the elephant).

Procedure

The task was administered to each child individually in a silent room at the school during school hours. First, the child watched the cartoon, and the experimenter then asked him/her to stand up and retell the story. The task was presented in the form of a game, such that after the child retold the story, the experimenter had to guess –from a set of four still images– the story the child was talking about. The task was administered before and after the intervention (i.e., between one or two weeks after the last intervention session).

Coding

Each narrative retelling was coded for narrative macrostructure, microstructure and perspective-taking. While macrostructure and perspective-taking were coded during the data collection by the experimenter (i.e., a research assistant), narrative microstructure was coded *a posteriori* by the first author together with two other predoctoral researchers and a research assistant. First, narrative macrostructure was coded using a 0–6 coding scheme adapted from Demir et al. (2014) to assess children's introduction of different macrostructural elements. A score of 6 indicated that the child introduced all elements and added extra details about what happened during the plot, whereas a score of 0 indicated that the child did not introduce any elements or a descriptive sequence.

Narrative microstructure involved two narrative productivity measures, namely the total number of words (TNW, also known as *tokens*) and the total number of different words (TNDW, also known as *types*). After all retellings were transcribed following the CHAT guidelines (MacWhinney, 2000), TNW and TNDW were automatically calculated using the CLAN software (MacWhinney, 2000). The coding for narrative microstructure could only be performed on 107 participants (rather than all 115), provided that eight participants (three from the control group, two from the narrative-based group and three from the multimodal narrative group) had to be excluded because the narrative retelling could not be video recorded due to technical difficulties or because there was too much background noise, and therefore the retelling could not be annotated.

Narrative perspective-taking was coded using a 0–6 coding scheme adapted from Dodd et al. (2011), who assessed children's ability to introduce emotional and mental terms within the retelling. A score of 6 corresponded to a narrative retelling that introduced at least two emotional terms, the cause of these emotions, and at least two mental terms, while a score of 0 corresponded to a narrative retelling that did not include any emotional or mental term.

Inter-rater reliability

Provided that narrative macrostructure and narrative perspective-taking codings were perceptual assessments, inter-rater reliability was calculated using data from 20 participants, corresponding to 120 stories (3 stories × 2 time points) and 17.39% of the data. Reliability was calculated using the original scores and the scores of a trained research assistant. Cohen's kappa was used to calculate inter-rater reliability. The results for narrative macrostructure showed moderate agreement, with 70.8% agreement among coders and a Cohen's kappa of .785. Regarding narrative perspective-taking, the results reported substantial agreement, with 95.8% agreement and a Cohen's kappa of .74.

Intervention phase

The MultiModal Narrative Intervention

The MMN is a multi-tiered narrative-based intervention developed in a co-creation fashion with more than 90 preschool teachers and speech-language therapists working in Catalan

schools and speech therapy centers (blinded, accepted). In this study, we used the universal tier (tier 1) of the MMN intervention, which was implemented at the classroom level.

Intervention protocol. The MMN aims to train oral narrative macrostructure and perspective-taking skills through interaction activities and crucially involves a dedicated multimodal component. The intervention protocol revolves around three different wordless cartoons from the Colombian series *Chigüiro*, each of which is trained for three consecutive days (three stories × three sessions = nine intervention sessions). The protocol is as follows: all intervention sessions follow the same initial set of activities: introduction to the session, watching the wordless cartoons, a short teacher-children interaction about the story plot, and watching a video of the storyteller retelling the story. After these activities, each session has a central activity. In the first session of each story, the central activity consists of a sequential enacted retelling using a question-and-answer sequence with the aid of story icons and short animated videos depicting the main elements and events of the story. The procedure is as follows: the teacher asks a question about each story element (e.g., *Which problem did the character encounter?*), the children answer (e.g., *Meloix was dirty.*) and she then gives feedback by providing a full sentence model (e.g., *Meloix was dirty because he was playing with his ball and the ball fell on the mud.*). While providing this model, the teacher enacts the action and after that, encourages the children to stand up and also enact it. This process is repeated for all elements of the story. In the second session of each story, the central activity centers around the retelling and dramatization of the story. Using a question-and-answer sequence, the teacher asks a pair of children to act as storytellers and actors, such that she asks a question and the child acting as a storyteller answers the question, while the child acting as an actor enacts the action or emotion corresponding to the question. This process is repeated for all story elements, and once all elements are covered, children are allowed to retell and enact the entire story. The central activity during the third session of each story focuses on the generation of personal stories. First, the teacher retells and enacts a personal narrative related to the trained fictional story and encourages children to stand up in front of their classmates and retell their personal stories.

The intervention was implemented over three consecutive weeks, involving three weekly sessions (implemented each Monday, Wednesday and Friday), each of which lasted approximately 25 to 30 minutes. All intervention sessions were implemented in Catalan, the vehicular language in schools in Catalonia, and by each classroom teacher (n = 6), for it to be as natural as possible for children receiving the sessions.

For more detailed information on the MMN intervention protocol, please refer to blinded (accepted).

Differences between the two experimental groups. As mentioned above, two different groups received the same MMN intervention, with the exception that one group received it with the presence of the multimodal component (multimodal narrative-based), the other received it without the multimodal component (narrative based).

The multimodal component is integrated into the intervention involving the three social actors of the intervention, namely, the audiovisual recordings of the storyteller, the teacher, and the children. First, we have the video of the storyteller explaining the story: children in the multimodal narrative-based group watched the video of the storyteller in which she used not only child-directed prosody but also child-directed enactment strategies, implemented through the use of different gestures and facial expressions. The second social actor is the teacher, who apart from using natural multimodal strategies during the intervention, received scripted prompts to enact the main macrostructural and perspective-taking elements of the stories. Finally, the third actor refers to the children receiving the intervention: teachers also had instructions to encourage the children to stand up and also actively enact the macrostructural and perspective-taking elements of the stories. As for the narrative-based group, the video of the storyteller included a retelling in which the storyteller was naturally retelling the story without using gestures, but maintaining natural child-directed facial expressions and a child-directed prosodic style. In addition, teachers in the narrative-base group did not have any specific instruction to enact the stories, but were rather asked to act naturally. Children were not encouraged to enact the story and thus remained seated throughout the session. Figure 1 shows a visual representation of the differences between the two experimental groups regarding the multimodal component, involving the video of the storyteller, the teacher and the children themselves.

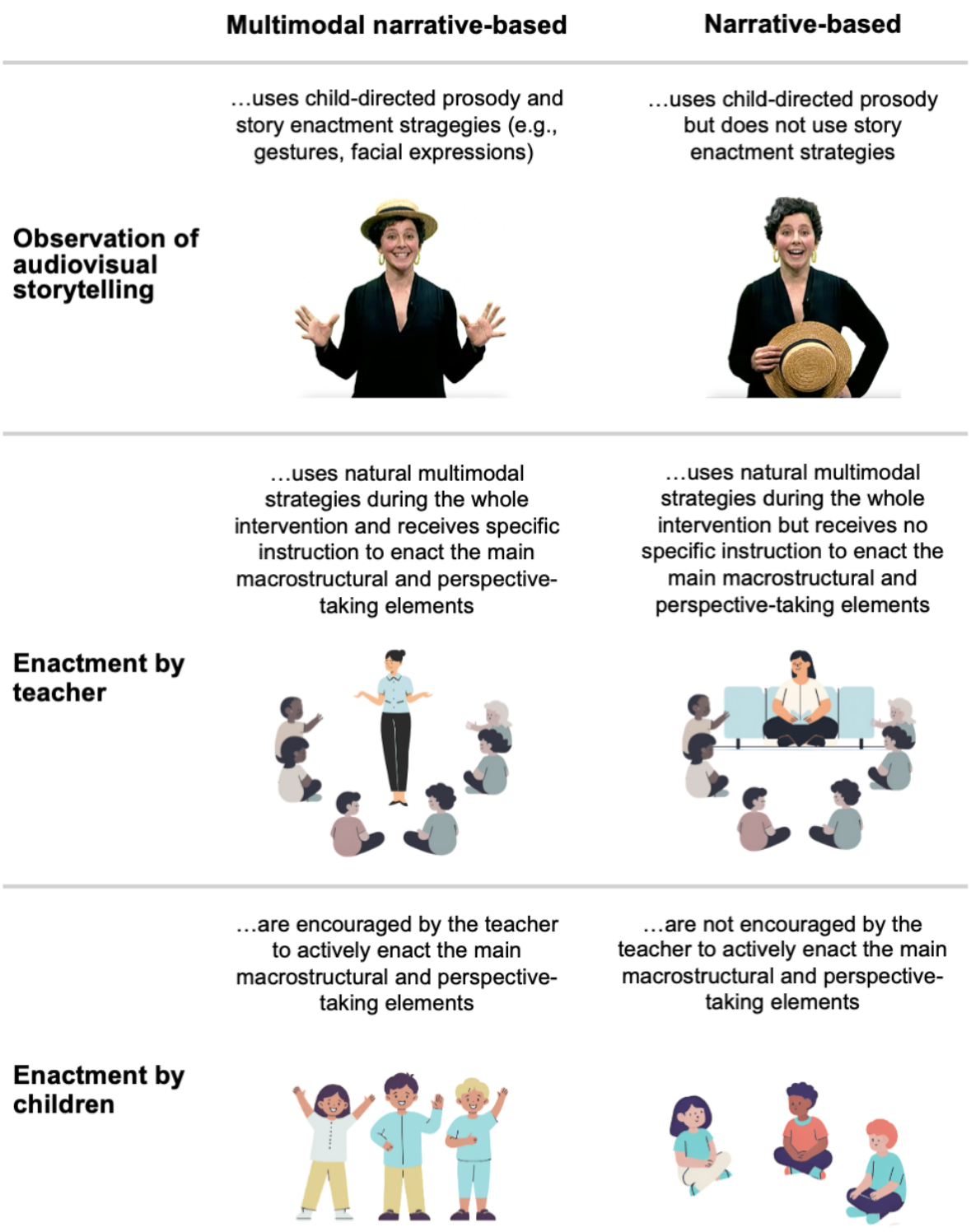

Figure 1. Schematic representation of the implementation of the multimodal component. Left panel shows the multimodal narrative-based group and the right panel shows the narrative-based group.

Note: The first two pictures at the top row are screenshots of the videos of the storyteller; however, the last two sets of pictures at the middle and bottom rows have been generated with an artificial intelligence tool within Canva Magic Studio™.

To ensure that the videos of the storyteller were comparable across the two groups, a group of eight preschool teachers (unfamiliar with the intervention and blind to the intervention group) evaluated the videos on a Likert scale ranging from 1 to 7. It was found that both stimuli were similar in terms of how natural the retelling was (narrative-based: M = 5.78, SD = 1.12; multimodal narrative-based: M = 6.44, SD = 0.85).

Intervention fidelity. The intervention fidelity was assessed using two complementary measures, e.g. teachers' self-assessment and external *a posteriori* evaluation by the researchers. First, after each intervention session, all teachers were asked to complete a short questionnaire that reported the duration of the session and the degree to which they had followed the intervention protocol. The average duration of the sessions was 27.93 minutes (SD = 4.87), with a similar duration for both groups (narrative-based: M = 28.12, SD = 6.10; multimodal narrative-based: M = 27.78, SD = 3.86). Teachers reported that 95% of the time they followed the intervention protocol (narrative-based: 91.30%; multimodal narrative-based: 100%).

Additionally, intervention fidelity was evaluated *a posteriori* through video recordings of the intervention sessions. A research assistant blinded to the intervention group watched a total of 18 intervention sessions (i.e., three sessions × six teachers), corresponding to 33% of the data, and assessed the teacher's treatment fidelity using a 1-to-7 Likert scale (1 = the teacher did not follow the intervention protocol and 7 = the teacher followed the protocol step by step). The results showed that the interventionists systematically followed the intervention procedure (M = 6.33, SD = 0.84; narrative-based: M = 5.67, SD = 0.71; multimodal narrative-based: M = 7, SD = 0). The coder was also asked to assess the implementation of multimodality by the teachers (i.e., how expressive they were with their body using different bodily gestures and facial expressions). Teachers in both groups used gestures and facial expressions throughout the sessions (on a scale of 1 to 7, multimodal narrative-based: M = 6.56, SD = 0.73; narrative-based: M = 3.33, SD = 1). This was because all teachers (both in the narrative-based group and the multimodal narrative-based group) were asked to act naturally, with the only difference being that the teachers in the multimodal group were given specific instructions on how to use gestures throughout the session.

Control group: Treatment as usual

Finally, the three class groups constituting the control group did not receive any intervention but continued with their usual sessions involving standard curricular activities. Detailed *a posteriori* reports from the three preschool teachers leading the control groups explained that during the target weeks in which the other groups were taking the interventions they were involved in educational activities to promote new vocabulary and phonological awareness, to establish routines, and to initiate mathematical thinking. No oral narrative activities were performed in any control group.

Statistical analyses

To assess the effectiveness of the intervention on children's oral narrative skills, eight Linear Mixed-Effects (LME) models were performed using the *lme4* package (Bates et al., 2015) in R. The score for each narrative measure (i.e., macrostructure, microstructure (TNW and TNDW) and perspective-taking) for the trained story and the untrained stories was established as the dependent variable (four measures × two scores = eight models). All models included Test (two levels: pre- and post-intervention) and Group (three levels: control, narrative-based, multimodal narrative-based) as fixed factors, together with their two-way interaction. The best random-effects structure was determined using the *performance* package (Lüdecke et al., 2024), which included either by-participant varying intercepts, by-language score-varying intercepts, or both. Finally, for all significant main effects and interactions, post-hoc pairwise comparisons were performed using the Bonferroni correction with the *emmeans* package (Lenth, 2021) and a measure of effect size (via Cohen's *d*).

Particularly, the analyses for narrative macrostructure and narrative perspective-taking were performed using data from all 115 participants, whereas the analyses for narrative microstructure were performed with data from 107 participants (see *Coding* subsection for more details).

RESULTS

This section describes the results obtained from the different analyses. We first provide descriptive statistics for all narrative measures, and then report the statistical results of the LME models conducted with each narrative measure.

Descriptives

Table 2 shows the mean and standard deviation for each narrative measure at pre- and post-intervention assessments broken down by story type (trained, untrained) and group (control, narrative-based, multimodal narrative-based).

Table 2. Descriptives (M and SD) for pre- and post-intervention narrative assessments

		Control		Narrative-based		Multimodal narrative-based	
		PRE	**POST**	**PRE**	**POST**	**PRE**	**POST**
MACRO.	**Trained**	3.79 (1.21)	3.58 (1.22)	3.73 (1.30)	4.56 (1.27)	3.81 (0.98)	4.69 (1.64)
	Untrained	3.86 (1.25)	3.64 (1.13)	3.65 (1.16)	4.02 (0.90)	3.96 (0.77)	4.08 (0.99)
MICRO.: TNW	**Trained**	48.34 (26.31)	43.89 (28.57)	48.49 (27.40)	61.62 (28.82)	46.33 (16.97)	66.58 (31.81)
	Untrained	40.96 (16.03)	36.86 (15.80)	37.88 (13.19)	46.65 (14.33)	42.40 (12.72)	42.74 (14.28)
MICRO.: TNDW	**Trained**	29.11 (12.52)	26.31 (11.15)	28.49 (11.28)	33.18 (11.37)	28.12 (7.62)	35.39 (13.08)
	Untrained	26.03 (7.73)	23.97 (7.13)	24.36 (6.70)	28.28 (6.74)	25.74 (5.88)	25.89 (6.29)
PERS.	**Trained**	0 (0)	0 (0)	0.07 (0.35)	0.34 (0.66)	0.03 (0.17)	0.53 (0.84)
	Untrained	0.17 (0.37)	0.05 (0.16)	1.16 (025)	0.90 (0.12)	0.29 (0.35)	0.17 (0.40)

Note. MACRO. = macrostructure; MICRO. = microstructure; TNW = total number of words; TNDW = total number of different words; PERS. = perspective-taking; PRE = pre-intervention assessment; POST = post-intervention assessment

Narrative macrostructure

The model assessing narrative macrostructure for the trained story showed a main effect of Test, indicating that scores were better at post-intervention than at pre-intervention, regardless of Group (d = .50, p < .001). The two-way interaction between Test and Group was found to be significant. The post-hoc comparisons first indicated that while the control group showed no improvement, the two experimental groups significantly improved from pre- to post-intervention (narrative-based: d = .87, p = .003; multimodal narrative-based: d = .88, p = .003). Second, results showed that at the post-intervention assessment both the narrative-based and multimodal narrative-based groups outperformed the control group (narrative-based: d = –.96, p = .009; multimodal narrative-based: d = –1.09, p = .003) (see Figure 2 and Table 3 for the full statistical results).

The LME model assessing narrative macrostructure for the untrained stories only showed significant results for the two-way interaction between Test and Group. The post-hoc pairwise comparisons reported that only the narrative-based group significantly improved from pre- to post-intervention (d = .56, p = .013) with no differences between groups at post-intervention. For the full statistical results report, see Table 3.

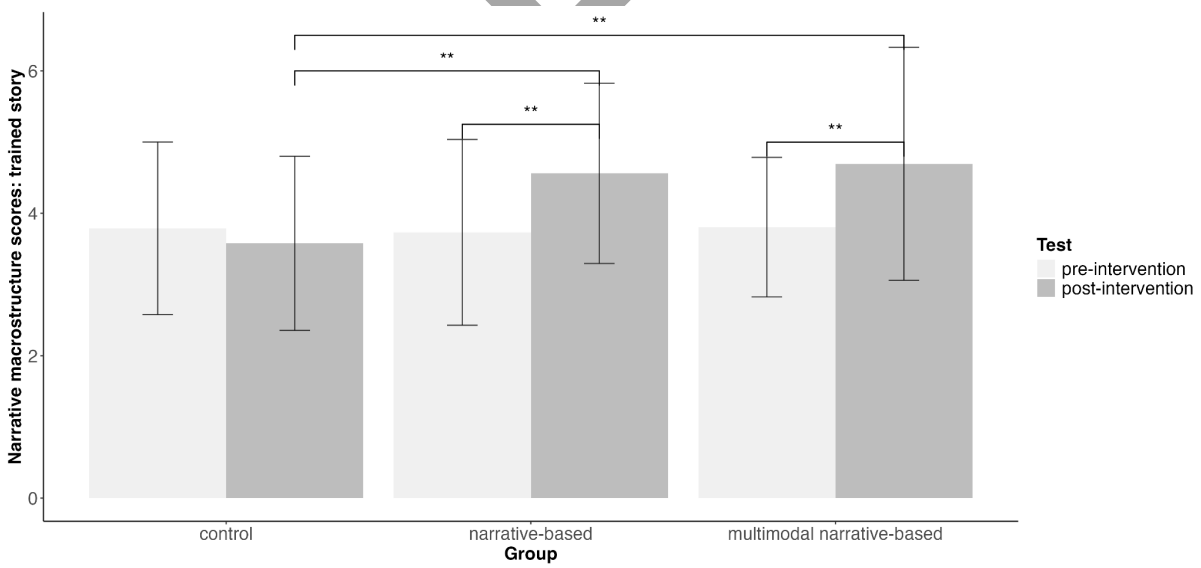

Figure 2. Mean narrative macrostructure scores for the trained story broken down by Test (pre-intervention and post-intervention) and Group (control, narrative-based and multimodal narrative-based). Asterisks represent significant differences: * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 3. Statistical results from the LME models for narrative macrostructure

Trained/Untrained stories	Fixed effects	df	χ^2	*p*
Trained story	Test	1	14.02	< .001
	Group	2	5.70	.058
	Test × Group	2	14.18	< .001
Untrained stories	Test	1	1.06	.304
	Group	2	4.46	.107
	Test × Group	2	7.48	.024

Narrative microstructure

Total Number of Words (TNW)

As for the first narrative microstructure measure, that is, TNW, a main effect of Test was found for the trained stories, which indicated that TNW was significantly higher post-intervention than pre-intervention (d = .48, p < .001), regardless of group. The model also reported a significant interaction between Test and Group. The interaction showed first that both narrative-based and multimodal narrative-based groups improved from pre- to post-intervention (d = .66, p = .004 and d = 1.02, p < .001, respectively), and that at post-intervention they outperformed the control group (narrative-based: d = –.89, p = .017; multimodal narrative-based: d = –1.14, p = .002) (see Figure 3 and Table 4 for the full statistical results report).

The model evaluating TNW for the untrained stories reported a significant Test × Group interaction. Post-hoc comparisons showed that while the narrative-based group had significantly more words at post-intervention than at pre-intervention (d = .83, p < .001), the control and multimodal narrative-based groups did not. It also showed that at post-intervention, the narrative-based group outperformed the control group (d = .–90, p = .014) (see Table 4).

Total Number of Different Words (TNDW)

Regarding the TNDW for the trained story, the model showed a main effect of Test and a significant two-way interaction. The effect of Test showed that there were more different words post-intervention than pre-intervention (d = .36, p = .009). The interaction showed that both experimental groups significantly improved after the intervention (narrative-based: d = .56, p = .015; multimodal narrative-based: d = .87, p < .001) and that their TNDW was higher than the one of the control group post-intervention (narrative-based: d = –.82, p = .030; multimodal narrative-based: d = –1.08, p = .003) (see Figure 3 and Table 4).

Concerning the untrained stories, only the two-way interaction was found to be significant. This suggested that only the narrative-based group improved from pre- to post-intervention (d = .82, p < .001) and had significantly higher scores than the control group post-intervention (d = –.93, p = 0.16). For the full statistical results report, see Table 4.

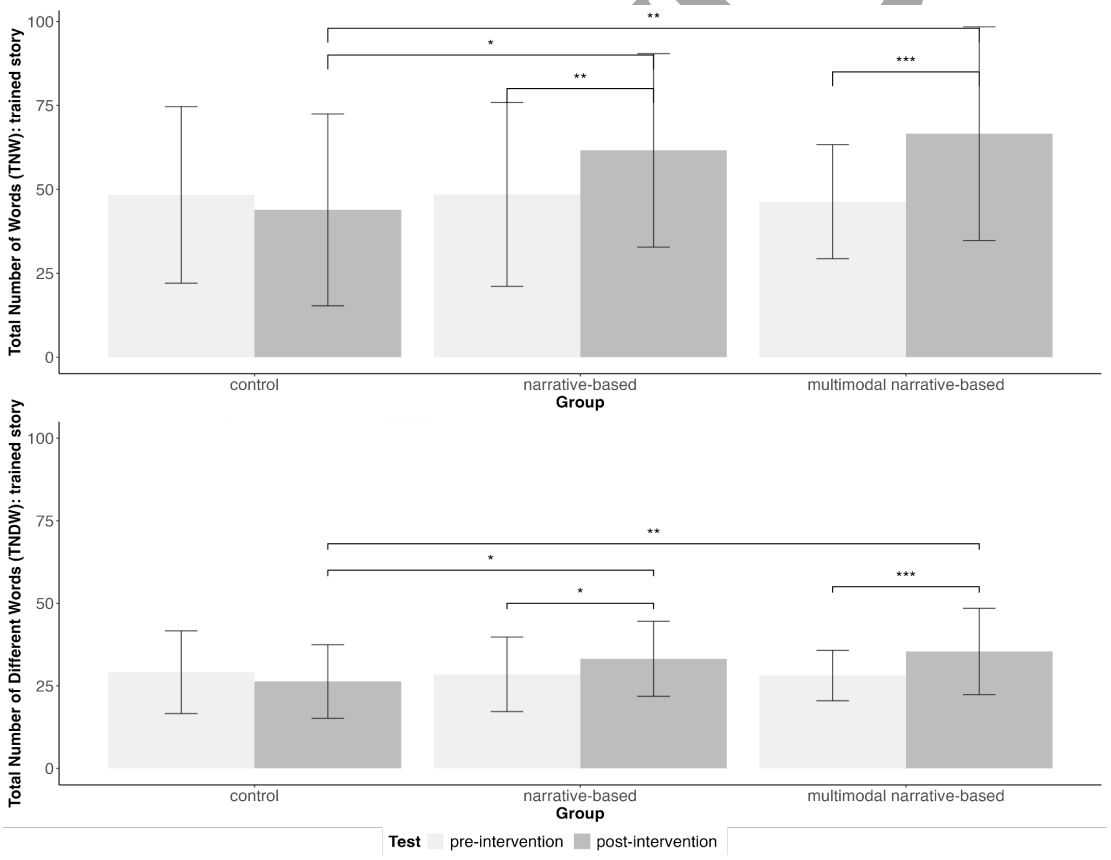

Figure 3. Mean microstructure values for the trained story broken down by Test (pre-intervention and post-intervention) and Group (control, narrative-based and multimodal narrative-based). Asterisks represent significant differences: * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 4. Statistical results from the LME models for narrative microstructure

Measure	Trained/Untrained stories	Fixed effects	df	χ^2	*p*
TNW	Trained story	Test	1	12.34	< .001
		Group	2	4.09	.129
		Test × Group	2	14.02	< .001
	Untrained stories	Test	1	1.98	.16
		Group	2	2.32	.314
		Test × Group	2	14.26	< .001
TNDW	Trained story	Test	1	7.01	< .001
		Group	2	3.35	.187
		Test × Group	2	13.44	.001
	Untrained stories	Test	1	1.52	.217
		Group	2	1.25	.537
		Test × Group	2	14.99	< .001

Narrative perspective-taking

The results for narrative perspective-taking of the trained story showed a main effect of Test, suggesting that scores at the post-intervention assessment were significantly higher than those at pre-intervention (d = .56, p < .001). A main effect of Group was also reported, indicating that while there were no differences between the two experimental groups (p = .918), the multimodal narrative-based group and the narrative-based group were significantly higher than the control group (narrative-based: d = –.45, p = .018; multimodal narrative-based: d = –.62, p < .001). The interaction Test × Group was found to be significant. This indicated that only the multimodal narrative-based group improved from pre- to post-intervention (d = 1.11, p < .001),

while the narrative-based and the control groups did not (p = .085 and p = 1, respectively). The post-hoc comparisons also showed that while there were no differences between the three groups at pre-intervention, at post-intervention the two experimental groups had significantly higher scores than the control group (narrative-based: d = –.74, p = .012; multimodal narrative-based: d = –1.17, p < .001) (see Figure 4 and Table 5 for the full statistical results report).

Regarding the untrained stories, only a main effect of Test was found for narrative perspective-taking, indicating that scores were overall better pre-intervention than post-intervention (d = .30, p = .025) (see Table 5).

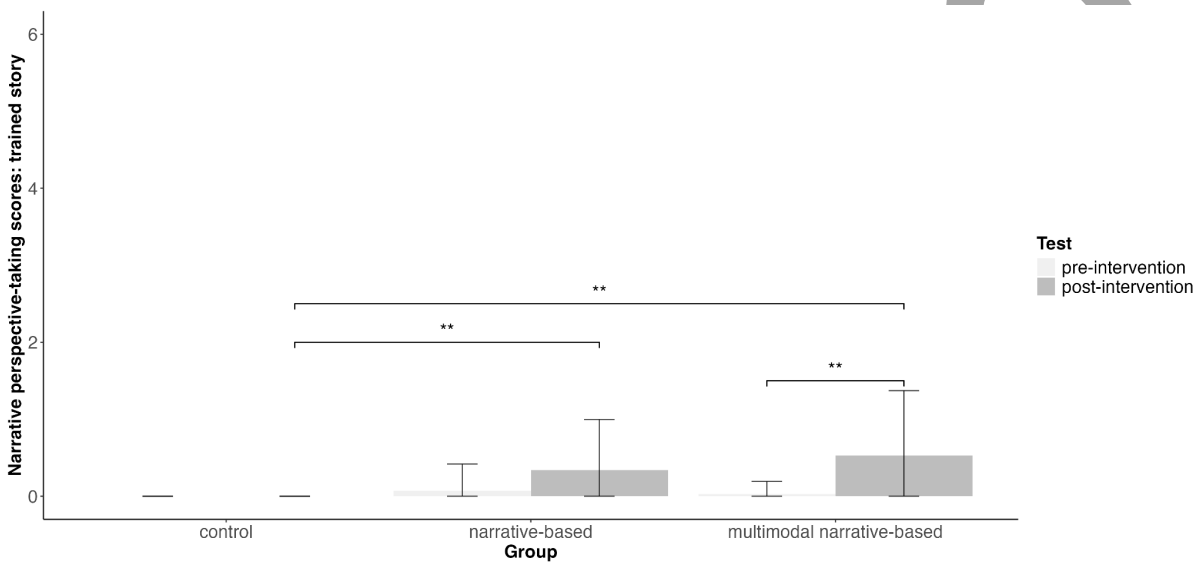

Figure 4. Mean narrative perspective-taking scores for the trained story broken down by Test (pre-intervention and post-intervention) and Group (control, narrative-based and multimodal narrative-based). Asterisks represent significant differences: * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$.

Table 5. Statistical results from the LME models for narrative perspective-taking

Trained/Untrained stories	**Fixed effects**	**df**	χ^2	p
Trained story	Test	1	17.81	< .001
	Group	2	15.07	< .001
	Test × Group	2	11.25	.004

Untrained stories	Test	1	4.84	.028
	Group	2	5.33	.07
	Test × Group	2	1.96	.376

DISCUSSION

The present study aimed to assess the effectiveness of the MMN intervention, particularly its core multimodal component, in fostering preschool children's oral narrative skills. To do this, we implemented the tier 1 of the MMN intervention with 115 children attending the last year of preschool in three schools in a city in the metropolitan area of Barcelona. Our results revealed that only the narrative-based group showed significant improvements in both narrative macrostructure and microstructure but not narrative perspective-taking when assessing untrained stories. These findings thus reject our hypothesis that the children receiving the intervention with the specific multimodal component would show greater improvements than those in the narrative-based group. Nonetheless, our findings showed that the two experimental groups (multimodal narrative-based and narrative-based) significantly improved their oral narrative macrostructure, microstructure, and perspective-taking skills when assessing the trained story, and that they both outperformed the control group not receiving the intervention.

Based on the multimodal enrichment paradigm (Mathias & von Kriegstein, 2023) and on the great amount of research suggesting the causal role of multimodality on children's language development (for reviews, see Dargue et al., 2019; Goldin-Meadow, 2014; Hostetter, 2011; Rohlfing, 2017; Vilà-Giménez & Prieto, 2021), we expected significant improvements of the group receiving the MMN intervention with the multimodal component. Despite the positive outcome of the multimodal component for improving children's oral narrative macrostructure, microstructure and perspective-taking skills for the trained story, there was no generalization effect for the untrained stories.

There are two possible explanations for our findings related to the naturalistic nature of the study. First, it should be taken into account that many studies assessing the causal role of multimodality (particularly gesture) in children's language learning were lab-based studies in which participants were tested individually in a very controlled environment where they either saw an audiovisual stimulus of someone gesturing (i.e., like the videorecordings of the storyteller within the MMN intervention) or someone standing still. However, as also reported recently by Bernstein and colleagues (2024), this isolated testing of gesture effects can be difficult in a naturalistic environment, such as a classroom, provided that interventions like the one implemented in this study or the one implemented by Bernstein et al. (2024) are naturalistic interventions that are integrated into the regular teaching curriculum in the school setting. Also, related to the naturalistic implementation of the intervention, there is a second factor that could

explain our findings. We hypothesized that the specific way preschool teachers implemented the intervention might have played a key role. As mentioned above (see the *Intervention fidelity* subsection), teachers in both the narrative-based and the multimodal narrative-based naturally used gestures. To determine whether this could have had an impact on the children's classroom behavior, a complementary assessment of the implementation of the intervention was conducted. A research assistant who was blinded to the intervention group watched 18 intervention sessions (i.e., 33% of the sessions) and evaluated children's and teachers' behavior throughout the sessions in terms of (a) the teachers' effort to maintain children's attention and concentration, and (b) the number of times they had to ask children to stay silent, pay attention to the activity, or sit down. On a Likert scale of 1 to 7 (1 = low effort, no need to intervene to ask children to pay attention and 7 = high effort, constant intervention to ask children to pay attention), the results showed the teachers in the multimodal narrative-based group had to intervene way more often (M = 3.67, SD = 1.87) than those in the narrative-based group (M = 1.67, SD = 0.50). Although there was no time difference between the two groups in relation to the duration of the sessions (approximately 25 to 30 minutes), it was also observed that teachers in the multimodal narrative-based group had to ask for silence, for them to sit down or pay attention an average of 13.67 times per session (SD = 10.61), while those in the narrative-based group only an average of 1.44 times per session (SD = 1.51). These assessments showed that the classroom dynamics of the multimodal narrative-based group, which required that children stood up and enacted the stories and then sat down again, could have been too intense and thus, disrupted and even affected negatively children's transfer to the untrained story, whereas children receiving the narrative-based intervention might have been more focused on the activity as they were sitting most of the time. Bernstein et al. (2024) also acknowledged the need to observe the behavior by children and the particular implementation by the teacher to see if their behavior can be a potential explanation to their null findings, which has been in fact corroborated in our study. Therefore, we believe that multimodality can be useful in classroom settings with preschoolers if it is implemented in a more natural and less intense manner that does not affect the dynamics of the teacher-group interaction (such as in the narrative-based group). For example, two other potential implementations of the multimodal component would be to have a specific time frame in the intervention session to enact the whole story, rather than enacting each story element step by step, or to enact the actions and emotions while sitting down. These implementations would help children pay attention to the language interaction and become less distracted by the enactment component. Another aspect that should be taken into account is children's experience with language-based and multimodal interactive activities

in the classroom, as in some contexts (like ours), children are usually sitting throughout the sessions and are not used to engaging in more active activities such as multimodal story enactment. Based on all this, it would be interesting for future research to test the effectiveness of the multimodal component implemented in a more structured way, allowing children to focus more on the language-based interaction.

The results of the present study complement and expand on the results of previous investigations. As mentioned above, very few studies have systematically integrated and tested the effects of the multimodality component within a classroom-based narrative intervention, and those that have done so have reported mixed findings. In a classroom environment, existing studies have reported null results, similar to those reported in the present study preventing learning transfer effects to untrained stories. For instance, Pronina and colleagues implemented an intervention focusing on embodying mental states through facial expressions in a preschool setting and assessed how the intervention could boost pragmatic and socioemotional measures. They found that while the intervention was effective in improving children's expressive pragmatic skills, there was no difference between children receiving the embodied intervention and those receiving the intervention without embodiment, specifically for emotion understanding and mental state verb comprehension, which were directly trained during the intervention. Similarly, Bernstein et al. (2024) compared children's narrative recall after receiving a storybook-reading intervention, with or without drama-based activities involving the teacher and children standing up and acting out as the main characters experiencing the main actions and events of the story plot. The authors found no significant differences between the two groups after the intervention in their ability to retell a story. These two studies incorporated multimodality in a similar fashion as in the present study: involving teachers enacting the main elements of stories and involving children in also enacting the stories. For this, we believe that in our study, the fact of asking children to stand up and involve their whole body in the enactment might have also disrupted their concentration on the target skill. These findings seem to point out that on the one hand, it is more challenging to isolate the beneficial effects of multimodality when implemented in a more naturalistic context (such as a real classroom setting) and that in those settings it might be more beneficial to train professionals to implement the multimodal component in a more structured and less intense manner so that it does not disrupt the communicative interaction between the teacher and the children.

Complementarily, although our main aim was to test the effectiveness of the multimodal component within the MMN intervention, it was also relevant to examine the overall

effectiveness of the intervention, composed of different educational strategies (not only multimodality). Both experimental groups showed significant improvements in the three narrative measures, particularly in the trained story. We believe that our findings contribute to the existing evidence on group-based narrative intervention research reporting its potential to boost young children's oral narrative macrostructure skills and transfer them to narrative microstructure skills (e.g., Daelman et al., 2024; Gillam, Olszewski et al., 2014; Nelson et al., 2022; Pinto et al., 2019; Spencer et al., 2018; West et al., 2021; for reviews, see Pico et al., 2021). We think that several factors have played a role in the effectiveness of the MMN intervention. On the one hand, the intervention was designed in a co-creation fashion with a group of more than 90 preschool teachers and speech-language therapists, such that it was tailored to the Catalan context, integrating professionals' usual practices and needs. On the other hand, the MMN intervention complies with the narrative intervention principles postulated by Spencer and Petersen (2020), as well as with the strategies commonly used in narrative intervention studies described in the recent reviews by Favot et al. (2021) and Pico et al. (2021). These principles and strategies include specific instruction on the macrostructure (i.e., story elements), use of visual support such as pictures or icons, and verbal prompting. The MMN intervention was designed considering previous literature, and therefore includes strategies such as training story elements through a verbal question-and-answer sequence, providing oral feedback, and using audiovisuals such as video cartoons, icons, and animated pictures.

The current study not only assessed narrative macrostructure and microstructure, but also narrative perspective-taking, understood as children's ability to talk about the emotions and perspectives of the characters. Although the intervention also seemed to boost these skills, particularly for the trained story, we observed that the scores for this measure were quite low, ranging from 0 to 2 when they could go up to 6. We believe that even though children are able to recognize and verbalize emotions at the age of three (see Widen & Nelson, 2022 for a review), being able to include them when retelling a story is a more challenging task that is not acquired until later in development, around the age of eight to nine (e.g., Veneziano et al., 2020). Building a narration is complex because it involves memorizing story events, expressing them in order, and using appropriate vocabulary. Therefore, if on top of that, children also need to remember the emotions and perspectives of the characters, which are less salient aspects of the story compared to the macrostructural elements, this makes it even a more complex task. For this reason, we believe that preschool children might find it too challenging to talk about

the story plot and the characters' emotions and perspectives at the same time, and for this reason, they focus mainly on what happened (i.e., macrostructure). It would be interesting that future studies test whether a longer intervention could help obtain stronger effects. In addition, further research could conduct more fine-grained analyses of children's narrative perspective-taking to assess which specific emotional or mental terms children are able to identify and use more frequently.

This study has certain limitations. First, post-intervention assessments were conducted at the end of the intervention period, which meant that the children were evaluated approximately after one to two weeks. Therefore, the results of this study correspond to the immediate effects of the intervention. A delayed post-intervention assessment would have been useful for determining whether the intervention effects remained over time. In fact, this delayed assessment was planned before the start of data collection but could not be implemented because of school schedule restrictions which resulted in the dropout of one school. Second, this study tested the implementation of a tier 1 intervention for all children in the classroom. Although there were nine children with language and communication difficulties within the sample, a full multi-tiered intervention could not be implemented because of the difficulty in coordinating both classroom intervention and small-group or individual interventions. Therefore, these children only received the tier 1 instruction without any extra support. Despite this, we descriptively assessed whether this group of children with language and communication needs was also able to show improvements. We observed that whereas those in the control group (N = 3) showed no improvement, those in the experimental groups (narrative-based: N = 2; multimodal narrative-based: N = 4) still showed gains in most narrative measures, particularly narrative macrostructure and microstructure (*macrostructure*: M_{gain} = 0.5–2; *TNW*: M_{gain} = 15.5–49; *TNDW*: M_{gain} = 5–19.67). A general tendency for children with language and communication needs to show greater narrative gains than children with typical development was also observed (for more details, see Appendix II).

The findings of this study have implications for classroom intervention practice and research. It was shown that a short 9-session multimodal-based narrative intervention program can be effective in fostering preschool children's oral narrative skills. Regarding the particular implementation of multimodality in classroom environments, educators should pay attention to the fact that multimodality needs to be well integrated into narrative interventions in a way that it complements (and does not disrupt) communicative interactions, as these integration mechanisms can have impactful consequences for children's learning. Thus, our findings

provide valuable information on potentially beneficial ways to implement multimodality in narrative intervention practice in the classroom.

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