

Evaluating the feasibility and preliminary effectiveness of a multi-tiered multimodal narrative intervention program for preschool children

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ABSTRACT

Studies in implementation science have pointed to the importance of conducting feasibility and pilot studies prior to implementing new interventions in educational or healthcare programs. The main aim of the present study is to evaluate the intervention's feasibility and preliminary effectiveness of a novel multi-tiered narrative intervention program –the MultiModal Narrative (MMN) program– in Catalan that was co-creatively designed to boost preschool children's narrative and pragmatic skills. First we describe here in detail the novel program, which consisted of a set of interventions oriented around the retelling of a narrative in a multimodal fashion, that is, with an abundant use of appropriate gesture and facial expression and careful attention to the pragmatic aspects of communication. We then describe the results of a self-reported feasibility study (Study 1) after this program was trial-implemented by groups of preschool teachers and speech-language therapists in their respective professional contexts. Results from Study 1 revealed that most professionals adhered to the intervention protocol, that they found it enjoyable and easy to implement and that it fostered active participation on the part of children. Second, a pre- and post-intervention pilot study (Study 2) was conducted in which the researchers measured the effect of the multimodal narrative intervention on the 41 (31 typically developing and 10 with neurodevelopmental disorder) children who participated in the trial implementation. Results from Study 2 revealed that after the intervention the narrative and pragmatic skills of all the children had improved. All in all, these results suggest that a full-fledged implementation of the MMN intervention program is feasible and has the potential to improve children's narrative and pragmatic skills in both clinical and educational contexts.

Keywords: narrative intervention, multi-tiered system of supports, multimodal communication, narrative skills, pragmatic skills

1. INTRODUCTION

The ability to orally narrate a story is one of the key milestones in language development, as it entails the ability to utilize complex language in a logically sequenced fashion. Narrative abilities emerge between the ages of 4 and 5 and continue to develop over childhood from initial short and simple stories to long and more complex discourses. Narratives have been shown to be a valid and ecological measure of preschool- and school-aged children's language skills (see Dickinson & McCabe, 2001 for a review). Given that oral narrative skills have been shown to be directly linked to not only linguistic, but also overall academic and even social development in children (e.g., Babayiğit et al., 2021; Griffin et al., 2004), a number of educational and clinical interventions have been designed that seek to foster the development of narrative skills in children.

Narrative interventions, that is, interventions that focus on language through the generation or retelling of stories, are considered "one of the most powerful approaches to language intervention" (Spencer & Petersen, 2020, p. 1081). In recent decades, dozens of narrative interventions have been designed to train the oral language skills of preschool- and school-aged children (see Donolato et al., 2023; Favot et al., 2021b and Pico et al., 2021, for reviews). Such interventions have been designed to target both typically developing (TD) and clinical populations. While the former are typically implemented in classroom settings, the latter are intended to help children with severe linguistic or communicative impairments. Narrative-based interventions have commonly focused on training children to recognize and reproduce narrative macrostructure (i.e., the organization of the main structural elements of a story, like character, problem, attempt, solution, final) or narrative microstructure (i.e., linguistic elements within a narrative discourse, like the number of words). Generally, these interventions have been shown to be successful in improving narrative skills (TD populations: Spencer et al., 2015; Stevens et al., 2010; Vilà-Giménez et al., 2019; clinical populations: Favot et al., 2021a; Fey et al., 2010; Gillam et al., 2018; Hettiarachchi, 2016; Spencer et al., 2013; Swanson et al., 2005), as well as early literacy writing and reading skills (e.g., Petersen et al., 2022).

The gains obtained in narrative interventions have been traced back to the systematic application of a set of verbal and audiovisual scaffolding techniques (see Spencer & Petersen, 2020 for a review). First, concerning verbal scaffolding, the language used by the teachers or speech-language therapists (SLTs) implementing the intervention must represent a good model for children, simple yet structured, with short, clear sentences, which are often repeated several

times. Effective interventionists use conversational activities such as talking about the story or question-and-answer sequences which favor not only story comprehension but also social interaction. Importantly, they use positive feedback in reaction to input from children accompanied by reformulations and repetitions (e.g., Bunning et al., 2017; Mori & Cigala, 2016; Spencer & Petersen, 2020). Second, verbal scaffolding is usually accompanied by visual or audiovisual materials that help children visualize key aspects of the macrostructure elements of the story. Visual materials are typically story pictograms or story icons, which serve as visible schematic representations of macrostructure elements, whereas audiovisual materials can be short videos or cartoons.

Although the use of such complementary visual or audiovisual materials is widespread, to date little attention has been paid to the value of multimodality in the performance of oral narratives. Here we understand multimodality as a supporting language strategy that involves the natural communicative use of manual co-speech gestures, body movements and facial expressions, together with prosody (e.g., Perniss, 2018). When we communicate, and particularly when we narrate a story, we naturally use our body and voice to express and enact the main macrostructural elements of a story, as well as the characters' emotions and perspectives. Following the embodied cognition and multimodal enrichment paradigms, which claim that our body interacts with our cognitive and linguistic capacities and therefore can play a role in language learning (e.g., Foglia & Wilson, 2013; Ionescu & Vasc, 2014; Mathias & von Kriegstein, 2023), we hypothesize that the deliberate integration of multimodal enactment techniques into narrative-based interventions is likely to enhance their positive effect. Indeed, recent scientific evidence has shown that multimodality plays a pivotal role in language development (see Goldin-Meadow, 2014; Hostetter, 2011; Hübscher & Prieto, 2019 for reviews) and that short individual multimodal-based interventions can improve the reproduction of narrative macrostructure (see Vilà-Giménez et al., 2019; Vilà-Giménez & Prieto, 2020). Despite this evidence, to our knowledge (with one exception; see Pronina et al. 2021) multimodality has not been integrated in a controlled and systematic way into narrative-based interventions. This is something which we sought to do in our MultiModal Narrative (henceforth MMN) intervention program.

The recently emerged field of implementation science recommends that interventions should be not only based on hard evidence but also designed and implemented considering input from users so that the interventions are fully adapted to their ultimate implementation context (Brett et al., 2014; Peters et al., 2013). This evidence-based approach can help ensure that the

interventions are maximally useful for those they are intended to serve (Laustsen et al., 2021). In the case of our MMN intervention program (the participatory creation process of which is described elsewhere in **** et al., under review) we felt that it was essential to conduct a feasibility study and a small-scale trial, both involving potential end-users before any future large-scale implementation was undertaken (e.g., Aschbrenner et al., 2022; Eldridge et al., 2016), especially in the case of a multi-tiered intervention like the one described here, because the procedures and methodologies proposed must be equally appropriate for both clinical and educational contexts.

With this evidence-based approach in mind, the present study has the goal of conducting two complementary studies to evaluate the feasibility and the preliminary effectiveness of the MMN intervention program in real education and healthcare settings in Catalonia. The remainder of the article is organized as follows. Section 2 describes in detail the main concepts underlying MMN program and the design of the program itself, offering a step-by-step protocol for its implementation. Section 3 reports the results of the MMN feasibility assessment carried out by a group of 31 professionals after they had piloted the intervention in their respective educational or clinical contexts. Section 4 reports the quantitative gains in narrative and pragmatic skills made by a group of 41 children, some in educational contexts and others in clinical settings, after having received the intervention. Finally, a discussion and conclusions are offered in Section 5.

2. THE MULTIMODAL NARRATIVE (MMN) INTERVENTION PROGRAM

2.1. General description

MMN is a multi-tiered intervention program intended to improve preschool children's oral language skills and directed to both TD children and children with neurodevelopmental disorders, such as autism or developmental language disorder.

The MMN program was developed by the three authors of this study in two phases following the principles of participatory research. First, a complete research-based prototype of the intervention was created, drawing from extensive research on narrative interventions directed at preschool- or school-aged children in both clinical and non-clinical settings (see Favot et al., 2021b, and Pico et al., 2021, Spencer & Petersen, 2020, for reviews). Second, to ensure that our research-based prototype was appropriately tied to real educational and clinical practice, it

was described, thoroughly discussed and revised during a five-session co-creation process involving 93 preschool teachers and SLTs actively employed in Catalan educational and healthcare contexts, as well as the authors ourselves (see ***** et al., under review). This systematic co-creation process served to ensure that the MMN program was grounded in evidence from both research and practice.

Importantly, a multi-tiered approach was adopted in accordance with international guidelines on educational and clinical interventions (e.g., Clark & Dockweiler, 2020; Ebbels et al., 2019). Specifically, the multi-tiered system of supports (MTSS) framework (Clark & Dockweiler, 2020) seeks to ensure that evidence-based practices are implemented in a way that maximizes achievement outcomes for every child, with support, whether instructional or behavioral, being increased in levels of intensity—or tiers—as the child’s needs become more serious. The lowest level of support (tier 1), also called *universal support*, is offered to large groups such as classes and is therefore not individualized. At higher levels, more tailored assistance is provided to smaller groups or individuals at tier 2, whereas students diagnosed with special education needs are offered personal attention or *intensive support* at tier 3 by SLTs.

The MMN program was designed to be applicable at two different tiers of support, the classroom (tier 1, universal support, with the interventionist being a teacher) and individual therapy sessions for children requiring intensive support (tier 3, where the interventionist is a therapist). Crucially, the MMN program is compliant with the guidelines regarding inclusiveness provided by the Catalan Education Department, which state that the educational system should include “methodological and organizational strategies that guarantee the active participation and learning of all students” (our translation; Dept. of Education, Catalan Government, 2015, p. 8).

Two main methodological novelties can be highlighted within the MMN program. First, in comparison with most narrative-based interventions, which focus almost exclusively on narrative structure, the MMN intervention include a pragmatic component because it trains children to detect and interpret characters’ emotions and perspectives. In other words, children are trained to understand and talk about not only the main narrative elements of a story, but also the characters reactions to those events. In other words, they are trained to reflect on how they would themselves feel if they were in a particular situation. Our assumption was that training children to recognize the emotions and perspectives of the characters in a narrative boosting would enhance not only their narrative skills but also their pragmatic skills.

Second, as its title implies, the MMN intervention fully incorporates a multimodal component, understood as the involvement of body movements in verbal communication. In MMN, multimodality goes beyond the mere use of gestures to enhance visualization of important narrative elements of the story, but also fully integrates the physical enactment of the stories.

Summarizing, MMN is an evidence-based program that incorporates strategies from previously validated narrative-based interventions such as the use of verbal and audiovisual support materials. However, MMN also includes three additional components that have not generally been formally incorporated into narrative interventions, namely multimodality, attention to pragmatic content and having an inclusive approach. The various support elements incorporated MMN are listed in Table 1. Some of the research providing evidence for the effectiveness of each is provided in parentheses.

Component	Implementation in the MMN program
Verbal support elements	<ul style="list-style-type: none"> • Structured linguistic modeling through a question-and-answer sequence (e.g., Bunning et al., 2017) • Structured linguistic modeling from a storyteller retelling the story (e.g., Vilà-Giménez et al., 2019) • Multiple prompting to encourage the child to participate (e.g., Spencer & Petersen, 2020) • Insightful feedback to minimize incorrect responses and provide extensions, repetitions and reformulations to generate a correct response (e.g., Mori & Cigala, 2016; Spencer & Petersen, 2020)
(Audio)visual support elements	<ul style="list-style-type: none"> • Video cartoons used for initial familiarization with a story (e.g., Demir et al., 2014) • Story icons and short animated videos (GIFs) to represent macrostructural and emotional elements of the story (e.g., Spencer & Petersen, 2018) • Video of a storyteller with a controlled narrative structure (e.g., Vilà-Giménez et al., 2019)
Multimodal support elements	<ul style="list-style-type: none"> • Instructed use of gestures to highlight the main macrostructural and emotional elements of the stories, as well as to structure the discourse (e.g., Demir et al., 2014; Spencer & Petersen, 2018; Vilà-Giménez et al., 2019) • Dramatization and story enactment integrating the whole body throughout the story (e.g., Nicolopoulou et al., 2015; Pronina et al., 2021) • Video of a storyteller including a controlled use of gestures and facial expressions to highlight the important information in the discourse (e.g., Vilà-Giménez et al., 2019) • Use of representational gestures to accompany the presentation of story icons (Spencer & Petersen, 2018)
Pragmatics	<ul style="list-style-type: none"> • Emotion identification throughout the intervention (i.e., at the

	<p>beginning of the story, after the problem, at the end of the story) (e.g., Gillam et al., 2014; Spencer & Petersen, 2018)</p> <ul style="list-style-type: none"> • Perspective-taking throughout the intervention, such that children express how they would react if they were the character (e.g., Dodd et al., 2011; Mori & Cigala, 2016; Pronina et al., 2021)
Inclusion	<ul style="list-style-type: none"> • Multi-tiered intervention with a tier 1 and tier 3 designs, following the MTSS guidelines (e.g., Clark & Dockweiler, 2019; Ebbels et al., 2019; Jimerson et al., 2016)

Table 1. Summary of the main supporting components incorporated into the MMN program. The grey boxes highlight those components that have been less frequently incorporated into narrative-based interventions.

Importantly, in order to monitor children’s learning session by session, the program includes two built-in dynamic assessment measures—a narrative retelling of the story with images and a set of comprehension questions with multiple prompts that are administered to each child individually at the end of each intervention session within the intensive support of the intervention (for more on dynamic assessment, see Bamford et al., 2022).

2.3. Design of the intervention and step-by-step protocol

Whether implemented in either the universal or the intensive support tier (classroom group instruction or individual therapy, respectively), the MMN program consists of a sequence of nine narrative intervention sessions in which three different stories are trained, all of them centering around a cartoon capybara called “Meloix”. The three wordless cartoons stories (“Meloix and the bath”, “Meloix and the bananas” and “Meloix and the bus”) were chosen from a series that is freely available online¹ and is aimed at 3- to 6-year-old children. The three stories contain the same macrostructural elements but offer increasing degrees of complexity.

¹ Cartoons were selected from the 26 cartoons in the *Chigüiro* series (specifically created by the Colombian Ministry of Education for preschool children (<http://maguare.gov.co/chiguero/>; Ivar da Coll, Maguaré Network). These cartoons represent short yet complete stories that follow the same narrative structure (the character encounters a problem, seeks a solution, and finds one), and because they feature events that preschool children could conceivably experience in their daily lives. Prior approval was received from the authors to use the cartoons.

Figure 1 shows a schematic representation of the structure of the MMN program as applied in either tier 1 or tier 3 contexts. Each Meloix story is the focus of three sessions (three stories × three sessions = nine sessions) following a specific step-by-step protocol. Each session starts with a four-step sequence of initial activities which includes watching first a wordless cartoon about Meloix and then a video of a storyteller recounting what happened to Meloix story. This is followed by a central activity that differs depending on the session and also the support tier (see the bottom rows in Figure 1). In what follows we explain the main features of the protocol used for each session.

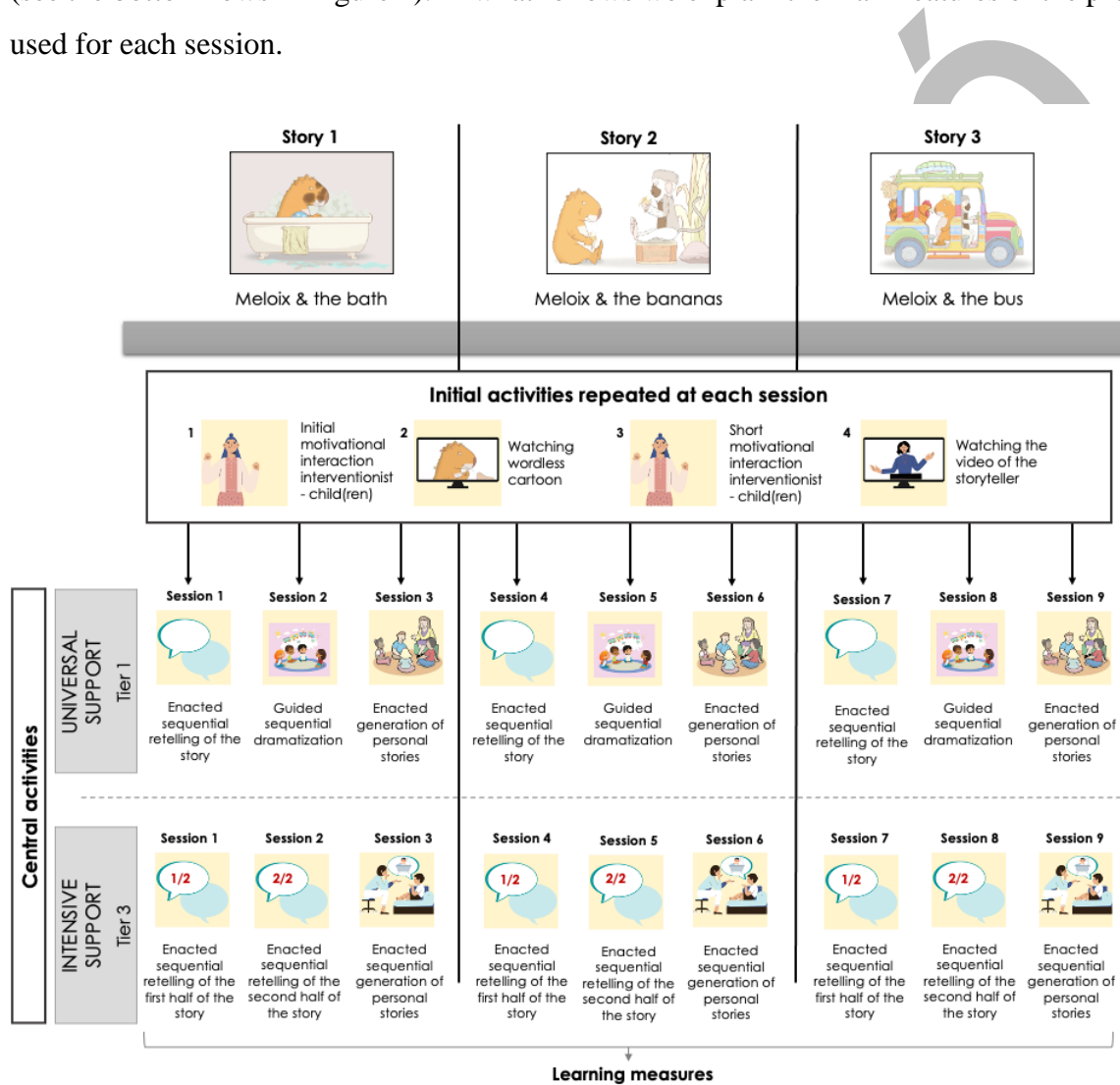


Figure 1. Structure of the nine-session MMN program. Each set of three sessions is devoted to one of the three Meloix stories. Each of the nine sessions is preceded by the sequence of four activities in the central rectangle. The subsequent activities for each session differ depending on whether it is being conducted in tier 1 (universal support) or tier 3 (intensive support)

2.3.1. Initial sequence of activities

As seen in Figure 1, an initial sequence consisting of four short activities is repeated at the beginning of every session, in both tiers. This sequence is meant to ensure that each child understands the story and is also exposed to a model of multimodal storytelling. First, the interventionist (teacher or therapist, depending on the tier) carries out a short motivational interaction with the child(ren) in which she explains the aims of the session. They then watch the wordless cartoon, which lasts about two minutes. Next, the interventionist engages the child in a second short interaction in which the child(ren) say whether they liked the story or not. Finally, they watch a video of a storyteller verbally recounting the story depicted in the cartoon while enacting it (see Figure 2 for examples), a process lasting between 1.5 and 2.5 minutes. This four-step introductory sequence is followed by the central activity prescribed in the program protocol for that session and tier.



Figure 3. Examples of different multimodal cues used by the storyteller. Panel 1 shows an example of a manual gesture representing an important element in the story, in this case a ball. Panel 2 shows an example of a manual gesture emphasizing an important moment of the story (e.g., the presentation of the main character). Panel 3 shows a facial expression accompanied by a manual gesture to represent one of the character's emotions (e.g., *being angry*).

2.3.2. First session

For each story, the central activity of the first session consists of an *enacted sequential retelling of the story* which is performed through a question-and-answer sequence between the

interventionist and the child(ren). The goal of the interventionist’s prompting and feedback sequences is to help the child(ren) discern the main macrostructural elements of the narrative as well as the protagonists’ emotions and perspectives at each point in it. Each macrostructural element or emotion is elicited by a question from the interventionist that is always accompanied by a set of three visual and multimodal cues, namely a GIF (i.e., short animated video) of that specific moment in the story, an icon and a specific set of gestures made by the interventionist. For example, for the story “Meloix and the bath”, when the interventionist asks the child(ren) about the problem that Meloix confronts (a dirty ball), she shows them an image of Meloix with the dirty ball and an icon symbolizing “problem” (an exclamation mark in a red-colored circle), and simultaneously performs a gestural configuration on the part of the interventionist representing “problem” (frown, hands on hips). Figure 3 shows examples of macrostructural narrative elements and emotions and the icons and gesture sets that accompany them.

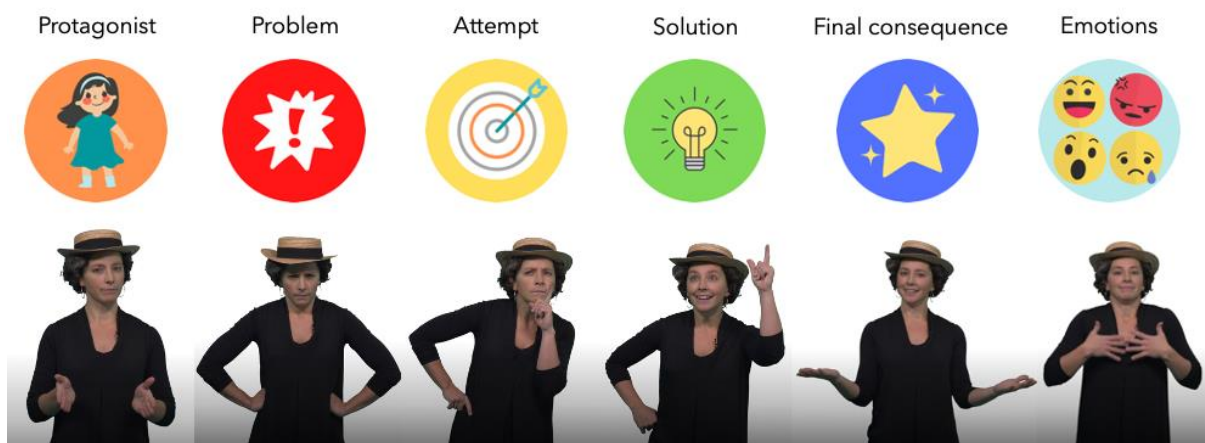


Figure 3. Story icons and gesture sets associated with macrostructural narrative elements and emotions.

When child(ren) answer the prompt question, the interventionist gives them verbal feedback that is accompanied by extensions and repetitions, thus providing a more complete linguistic model. Crucially, when providing feedback, the interventionist enacts the macrostructural elements and the character’s reactions to them, and then asks the child(ren) to do the same.

Table 2 shows an example of the protocol followed for each question in first session, the enacted sequential retelling. In this case the interventionist-to-child(ren) interaction centers on the problem that Meloix encounters in the story. The protocol for tier 1, universal support (where the interventionist is a teacher working with a classroom group) is given in the left-

hand column, while the protocol for tier 3, intensive support (where interventionist is a therapist working with one child) is given in the right-hand column. Note that one main difference between the two columns is the degree of verbal support offered by the interventionist. While in the universal support (classroom context - tier 1, left) the interventionist asks the class a question and children in the class answer, in the intensive support (therapy context - tier 3) the story is further unpacked and reconstructed: first, the interventionist asks and answers all the questions herself and then repeats the process, but with the child providing the answers. The other main difference is the amount of content dealt with in the session. In the classroom context the interventionist goes through the full story content, whereas in the therapy context the session deals with only the first half of the story, which covers the introduction of the main character, his initial emotion, the problem encountered and Meloix’s reaction after encountering the problem.

SESSION ONE	
Tier 1, universal support (classroom)	Tier 3, intensive support (therapy)
1. Visual presentation	
<p>Interventionist presents the icon symbolizing “problem” and an illustration from the story on the computer screen next to the GIF and enacts the gestures signaling “problem”</p> <p>Interventionist: <i>Look, this icon means that we will be talking about the problem in the story.</i></p>	
2. Question and answer	
<p>Teacher asks a comprehension question: <i>What problem did have?</i></p> <p>Children answer the question: <i>He got dirty.</i></p>	<p>Therapist asks a comprehension question and immediately answers it: <i>What problem did Meloix have? He got dirty because he was playing with his ball and the ball fell into the mud.</i></p> <p>Questions and answers only apply to the first half of the story.</p> <p>Therapist asks the same sequence of comprehension questions, but this times waits for the child to answer.</p> <p><i>Therapist: What problem did Meloix have?</i> <i>Child: He got dirty.</i></p> <p>This process is repeated for all questions related to the first half of the story.</p>
3. Feedback and enactment	

Interventionist provides feedback, enacts the action or emotion related to the question and encourages the child(ren) to do the same.	
Interventionist: <i>Exactly, Meloix got dirty because he was playing with his ball and the ball fell into the mud. Can you show me what happened to him?</i>	
4. Reiteration	
The process is repeated for all questions related to the story.	This process is repeated for all questions related to the first half of the story.

Table 2. Example of the protocol followed for each question in the enacted sequential retelling, for both support tiers. The example focuses on the protagonists’ problem.

2.3.3. Second session

The central activity during the second session of each story is different depending on the support tier. As mentioned above, for the intensive support (therapy context - tier 3) the second session consists of the same enacted sequential retelling activity, this time focusing on the second half of the story, which centers on Meloix’s attempt to solve the problem, the solution he comes up with, the final consequences and his final reaction.

For the universal support (classroom context - tier 1), the central activity for session two consists of a *guided sequential dramatization* of the story involving the full group of children. The procedure is as follows. The teacher first tells the class that the story is going to be told collectively and asks children to form pairs, with one member of each pair serving as the storyteller and the other acting out the role of Meloix. The teacher asks the same comprehension questions as in Session 1, and while the child acting as a storyteller answers the question, the child representing Meloix enacts the situation. Pairs take turns going to the front of the class and performing for their classmates in response to questions from the teacher. After the full story has been retold sequentially in this fashion, the teacher asks for two volunteers to retell and enact the whole story in front of the classroom. Table 3 shows an example of the protocol followed for each question (the example focuses on the protagonist’s feeling at the beginning of the story).

SESSION TWO	
Tier 1, universal support (classroom)	Tier 3, intensive support (therapy)

<p>Visual presentation: interventionist presents the story icon and GIF displayed on screen and uses gestures to enact it.</p> <p>Teacher: <i>Look, this icon means that we will be talking about the problem Meloix had in the story.</i></p>	<p>Same enacted sequential retelling activity as in the first session, but focusing on the second half of the story.</p>
<p>Question: Teacher asks a comprehension question</p> <p>Teacher: <i>How was Meloix feeling at the beginning of the story?</i></p>	
<p>Dramatized answer: Pairs of children answer the question, with one child providing a verbal answer and the other acting it out.</p> <p>A: <i>He was feeling happy</i></p> <p>B <i>makes facial expression and body gestures signaling happiness.</i></p> <p>This process is repeated for all questions related to the story but with a different pair of children each time.</p>	
<p>Complete dramatization: Two volunteers retell and enact the whole story in front of the class.</p>	

Table 3. Example of the protocol followed in the two support tiers in the second session.

2.3.4. Third session

The central activity of the third session for each story consists of first the interventionist, then the child(ren) generating and acting out personal stories. We conceive this activity as a narrative generalization activity that links Meloix's experiences of first to a personal experience recounted by the interventionist, then to the personal experiences of the children, with the interventionist's performance serving as a model for the child(ren) to follow. First, the interventionist says that she is going to talk about something that once happened to her which was very similar to what happened to Meloix in the story. She then recounts the incident (for which she has an example written story displayed on screen) while enacting the macrostructural elements of the story and the emotions she experienced. This initial step is common to both tiers, that is, both classroom and therapy settings.

What follows, however, differs depending on the tier. Table 4 below summarizes the differences. In the tier 1 context, after the teacher recounts and enacts her own personal story, she asks the children whether they have experienced something similar. If so, they are invited to stand in front of the class and recount and enact their story. In the tier 3 context, on the other hand, after the therapist completes her narrative performance, she works with the child to retell the same story using a question-and-answer methodology whereby the therapist asks questions about her story (simultaneously displaying corresponding icons on a computer screen) and the child answers them. Once this is finished, the entire procedure is repeated for a personal experience as recounted by the child, under guidance from the therapist.

SESSION THREE	
Tier 1, universal support (classroom)	Tier 3, intensive support (therapy)
<p>Interventionist’s personal story: interventionist generates and acts out her personal story</p> <p><i>Last weekend my family and I went to a park. I was very happy because I was eating some delicious chocolate ice cream. It was so sunny outside that my ice cream started melting, and I spilled it on my white shirt. My shirt turned brown because of all the chocolate ice cream on it! I was very angry because my shirt was ruined! Since my t-shirt was sticky and covered in ice cream, I decided to go home and change it. In the end, I was happy again because I was wearing a clean shirt and I would be able to enjoy the rest of the afternoon at the park.</i></p>	
<p>Children’s personal story generation: Teacher asks children to recount and enact their own personal stories in front of their classmates.</p> <p>Interventionist: <i>Do you want to tell your story to us? Remember to also tell it with your body!</i></p> <p><i>Children take turns recounting and acting out their personal stories in front of the class.</i></p>	<p>Question and answer: Therapist asks the child a comprehension question about her personal story such as <i>What happened to me in the park?</i></p> <p>Child answers: <i>The ice cream melted on your shirt.</i></p>
	<p>This process is repeated with questions focused on all the narrative elements of the therapist’s personal story.</p>
	<p>Child’s personal story generation: Child recounts a similar personal experience, with prompting from the therapist if necessary.</p>
	<p>Question and answer: Therapist asks the child a comprehension question about their personal story such as <i>What happened to you at the park?</i></p> <p>Child answers: <i>I got dirty while playing football.</i></p>

	This process is repeated for all questions related to the child's personal story.
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Table 4. Example of the protocol followed in the two support tiers in the third session.

2.3.6. Administration of the MMN intervention

The recommended frequency of implementation of the intervention differs according to the support tier, with three weekly 20-to-30-minute sessions (one story per week) over three weeks recommended for the universal support (classroom context - tier 1) implementation, and one weekly session over nine weeks recommended for the intensive support (therapy context - tier 3) implementation.

3. STUDY 1: ASSESSING THE FEASIBILITY OF THE MMN PROGRAM

It will be recalled that the present article will report the results of two separate studies related to the MMN program. In Study 1, a group of preschool teachers and SLTs were asked to assess the feasibility of the MMN intervention after they had piloted the program in their respective professional practice.

3.1. Methods

3.1.1. Participants

A group of 93 teachers and SLTs working with preschool- and school-aged children underwent five sessions of collaborative training² in how to implement the MMN program. Upon completion of the final training session, participants were asked whether they would be willing to pilot some MMN intervention sessions with the children they were working with at that time and then complete a feasibility questionnaire based on their experiences. Thirty-one agreed to participate.

² This training course, entitled 'Let's improve oral abilities during preschool years: An inclusive multimodal intervention program for the improvement of oral abilities', was organized by the Catalan Government's Education Department.

Table 5 shows the professional profiles of the 31 participants in Study 1, who were all at the time living and working in Catalonia, Spain.

	Number of participants (%)
Gender	
Female	31 (100%)
Profession	
Preschool teacher	15 (48.4%)
Speech–language therapist	11 (35.5%)
Language-specialized teacher	4 (12.9%)
Psychologist	1 (3.2%)
Employing institution	
Public preschool	15 (48.4%)
Public education support service for children with hearing and language needs	11 (35.5%)
Public center for child development and Early Care	3 (9.7%)
Private speech-therapy service	2 (6.4%)

Table 5. Professional profile of the participants in Study 1

All 15 participating teachers implemented the intervention with their usual classes of 5-year-old children, although one of them additionally implemented it with a group of 4-year-olds. Altogether, a total of 329 preschool children were exposed to MMN program in their classrooms. As for the 16 SLTs, they implemented the intervention individually to a total of 41 children, whose ages ranged from 3 to 9, although most (30) were 4- and 5-year-olds.

3.1.2. Materials

The MMN program’s feasibility was evaluated using an online version (posted on the Google Forms platform) of the feasibility questionnaire reproduced in Appendix A, which follows Teresi et al.’s (2021) *Guidelines for designing and evaluating feasibility pilot studies*. The questionnaire was divided into different subsections to evaluate the three aspects of feasibility,

namely adherence (whether the professionals were able to implement the intervention consistent with instructions), acceptability (how suitable, satisfying and attractive they felt the intervention to be), and engagement (whether children undergoing the intervention were actively engaged in the activities and able to understand the materials).

3.1.3. Procedure

The 31 participants were given the following instructions. First, they were asked to implement as a minimum the first three sessions (corresponding to the first Meloix story) of the nine comprising the full MMN program within the subsequent six weeks. Second, they were specifically assured that they could make changes in the MMN procedure if they felt they were necessary to maintain the engagement of the children they were working with in the intervention. Finally, the participants were asked to fill in a short online feasibility questionnaire after they had terminated their partial or complete implementation of the MMN intervention program.

3.1.4. Statistical analyses

The responses to the online feasibility questionnaire were obtained from all 31 participants and then analyzed in R (R Core Team, 2021). Two types of analyses were performed. First, descriptive statistics including percentage, mean, standard deviation, median, minimum, maximum and range were calculated from the raw data. Next, responses were separated into two groups according to the participant's profession, such that teachers constituted one group and SLTs the other. This enabled us to carry out the second set of tests, which were intended to detect any significant differences in responses across groups. For this purpose we ran a chi-square test for each question with a categorical response, and a Mann-Whitney U test for each question that included numerical answers.

3.2. Results

Descriptive data from the results from the feasibility questionnaire are provided in Table 6. It will be seen that participants had a generally positive reaction to the MMN intervention procedure. Regarding how many sessions they had implemented (three, six or nine), overall the distribution was fairly even among the three options, although teachers had implemented

either three or nine—none had implemented six. The average duration of intervention sessions was similar in both groups, around 28 minutes, showing that participants' experience had been consistent with the recommended time (20-30 minutes) for each session. Importantly, only two participants (both SLTs) reported having made changes while implementing the sessions, but these changes were only minor (see Discussion section for more details).

Second, regarding the acceptability of the program, the average rating by participants on a 1 to 7 scale (with 7 indicating “most positive reaction” and 1 “most negative reaction”) was 5.75 for “I liked the intervention program”, 5.93 for “it was easy to implement” and 6.16 for “the strategies employed were effective”.

Third, regarding the degree of engagement in the activity on the part of children being exposed to it, participants reported that a majority of children actively participated verbally (96.9%) and multimodally (78.1%). In addition, the average response by participants on a scale of 1 to 7 about whether they perceived an improvement in children's narrative and pragmatic skills after the intervention was 5.03.

Finally, comparison of the teachers' and SLTs' responses revealed no significant differences between them in any of the categories, suggesting that feasibility indicators did not differ across professional contexts. See Table 7 for the quantitative results.

Question	Teachers	SLTs	Total
Adherence			
1. How many sessions did you implement, three, six or nine?	three: 7 (43.8%) six: 0 (0%) nine: 9 (56.2%)	three: 14 (34.1%) six: 15 (36.6%) nine: 12 (29.3%)	three: 21 (36.8%) six: 15 (26.4%) nine: 21 (36.8%)
2. What was the average duration of the sessions in minutes?	$M = 29.06$; $SD = 6.38$; $Med = 30$; $Min = 15$; $Max = 40$; $Range = 25$	$M = 27.44$; $SD = 11.99$; $Med = 30$; $Min = 10$; $Max = 40$; $Range = 30$	$M = 27.89$; $SD = 10.69$; $Med = 30$; $Min = 10$; $Max = 40$; $Range = 30$
3. Did you have to make any changes to the intervention?	No: 16 (100%) Yes: 0 (0%)	No: 14 (87.5%) Yes: 2 (12.5%)	No: 30 (93.75%) Yes: 2 (6.25%)
Acceptability			
4. Did you like implementing the intervention?	$M = 5.69$; $SD = 1.20$; $Med = 6$; $Min = 3$; $Max = 7$; $Range = 4$	$M = 5.78$; $SD = 1.11$; $Med = 6$; $Min = 3$; $Max = 7$; $Range = 4$	$M = 5.75$; $SD = 1.12$; $Med = 6$; $Min = 3$; $Max = 7$; $Range = 4$
5. Was it easy to implement?	$M = 6.12$; $SD = 0.89$; $Med = 6$; $Min = 4$; $Max = 7$; $Range = 3$	$M = 5.85$; $SD = 1.30$; $Med = 6$; $Min = 2$; $Max = 7$; $Range = 5$	$M = 5.93$; $SD = 1.19$; $Med = 6$; $Min = 2$; $Max = 7$; $Range = 5$
6. Were the strategies used in the intervention effective?	$M = 5.91$; $SD = 1.25$; $Med = 6$; $Min = 3$; $Max = 7$; $Range = 4$	$M = 6.26$; $SD = 0.83$; $Med = 6$; $Min = 4$; $Max = 7$; $Range = 3$	$M = 6.16$; $SD = 0.97$; $Med = 6$; $Min = 3$; $Max = 7$; $Range = 4$
Engagement			
7. Did the majority of children participate orally?	No: 0 (0%) Yes: 16 (100%)	No: 1 (6.25%) Yes: 15 (93.75%)	No: 1 (3.1%) Yes: 31 (96.9%)

8. Did the majority of children participate multimodally?	No: 4 (25%) Yes: 12 (75%)	No: 3 (18.75%) Yes: 13 (81.25%)	No: 7 (21.9%) Yes: 25 (78.1%)
9. Did you perceive an improvement in the children's narrative and pragmatic skills after implementing the sessions?	$M = 4.78; SD = 1.18;$ $Med = 5; Min = 2; Max = 7;$ $Range = 5$	$M = 5.12; SD = 1.11;$ $Med = 5; Min = 2; Max = 7;$ $Range = 5$	$M = 5.03; SD = 1.13;$ $Med = 5; Min = 2; Max = 7;$ $Range = 5$

Table 6. Descriptive statistics for responses to each item in the feasibility questionnaire

Question	Statistical result
Adherence	
1. How many sessions did you implement, three, six or nine?	Mann-Whitney U = 364, $p = .502$
2. What was the average duration of the sessions in minutes?	Mann-Whitney U = 331, $p = .964$
3. Did you have to make any changes to the intervention?	$\chi^2(1) = 2.195, p = .139$
Acceptability	
4. Did you like implementing the intervention?	Mann-Whitney U = 339.5, $p = .835$
5. Was it easy to implement?	Mann-Whitney U = 300, $p = .602$
6. Were the strategies used in the intervention effective?	Mann-Whitney U = 378, $p = .371$
Engagement	
7. Did the majority of children participate orally?	$\chi^2(1) = 0.01, p = .922$
8. Did the majority of children participate multimodally?	$\chi^2(1) < 0.001, p = 1$

9. Did you perceive an improvement in the children's narrative and pragmatic skills after implementing the sessions?	Mann-Whitney U = 385.5, $p = .298$
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Table 7. Results of the chi-square tests and Mann-Whitney U tests assessing the difference between teachers' and SLTs' responses.

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4. STUDY 2: ASSESSING THE PRELIMINARY EFFECTIVENESS OF THE MMN PROGRAM

The aim of Study 2 was to evaluate the preliminary effectiveness of the MMN program as implemented partially or fully by the same teachers or SLTs who took part in the feasibility study described above, with effectiveness being measured in improved narrative and pragmatic skills on the part of children who had been exposed to the intervention. Effectiveness was measured by comparing the results of a pre-test and a post-test. However, the experimental design differed slightly depending on the tier in which the tests were administered. Specifically, for the tier 1 (classroom) children, we used a between-subjects clustered randomized controlled trial involving two separate groups, one which had received MMN intervention acting as the experimental group and another which had not been exposed to the intervention acting as the control group (their normal classroom activities took place as usual). By contrast, for the tier 3 (therapy) students, no control group was involved. Complementarily, two secondary aims were to obtain measures of retention (in terms of children's continuation in the study) and fidelity to intervention protocols on the part of the teachers, as assessed by the participants themselves and also by the research team.

4.1. Methods

4.1.1. Participants

Seven of the participants from Study 1, two of them teachers and the remaining five SLTs, volunteered to pilot the full nine-session MMN intervention program in their respective professional contexts. This implied a total of 41 preschool-aged children being exposed to the program, 31 of them TD children in a classroom context (10 girls, $M_{age} = 5.65$; $SD = 0.29$) and ten of them special needs children in a clinical setting (5 girls, $M_{age} = 4.88$; $SD = 0.68$). All were Catalan-Spanish bilinguals living in Catalonia. The TD children were recruited from a public school in the city of L'Hospitalet de Llobregat. Clinical participants were recruited through their habitual therapist from either a private speech therapy service ($n = 4$) or centers affiliated with the Catalan government and offering child development and early care service ($n = 4$) or services for children with hearing and language needs ($n = 2$). To be considered for the study, children in the clinical group had to meet the following inclusion criteria: 1) having been officially diagnosed with (or at risk of) developmental language disorder or autism, in

accordance with a transdiagnostic approach (see Astle et al., 2022); 2) having a vocabulary of at least 50 functional words; 3) being able to systematically produce two-word combinations; and 4) receiving weekly individualized intervention sessions. For both groups of children, parents gave prior written consent for their children to participate in the study.

All sessions by all participants were video-recorded.

It is important to mention that there were no dropouts in this study, either among the professionals executing the intervention or among the children receiving it. In other words, the retention rate was 100%.

4.1.2. Materials and coding procedures

Children’s narrative and pragmatic skills were measured at pre- and post-intervention with a set of three tasks (see Figure 4).

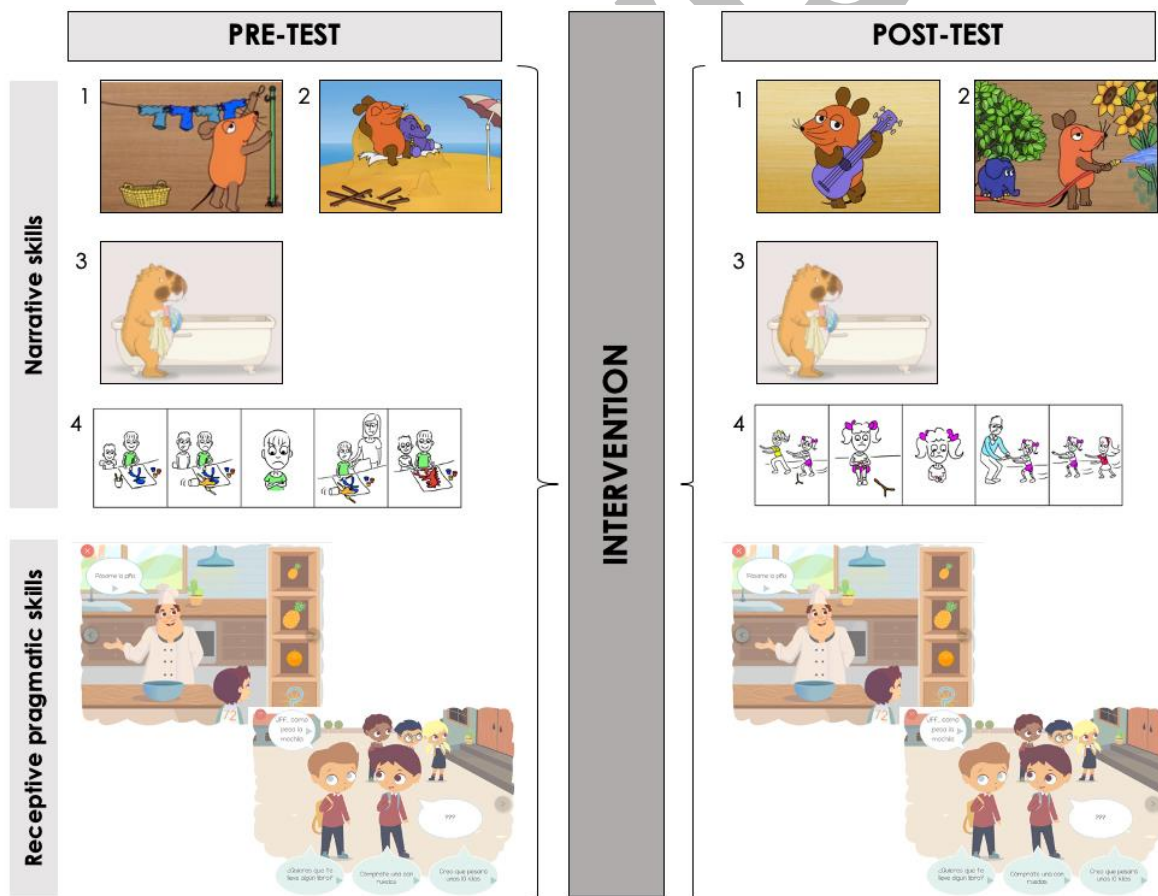


Figure 4. Visual prompt materials from pre- and post-intervention tasks

Narrative skills were assessed with a set of narrative retelling tasks in which children were asked to retell seven stories, each one depicted in an animated cartoon. The children were already familiar with one of the stories from the MMN intervention (“Meloix and the bath”) and it was used in both pre- and post-tests. However, the other six stories were all different and novel to the children. Three of them were used in the pre-test and the three others in the post-test.

The sequence of activities in the pre- or post-test was as follows. In all cases, children were tested individually by one of the researchers, who showed visual prompts—either a cartoon or a comic-like sequence of drawings—for the child’s storytelling on a laptop computer. The child was first shown the visual prompt and was then asked to tell the story depicted in the cartoon or comic sequence. The first two stories were wordless cartoons about a mouse and his elephant friend³ (see Figure 3, images 1 and 2 at top of both columns), an important difference between them being that the first one featured only the mouse, the main character, while the second featured two characters, the mouse and the elephant. Next, the child viewed the familiar cartoon of “Meloix and the bath” and was asked to recount the story (image 3 in both columns in Figure 3). The last retelling activity used a comic-like sequence of four pictures from the CUBED assessment tool (Petersen & Spencer, 2016; images 4 in the two columns of Figure 3). Here the researcher first told the story, making reference to the pictures, and then asked the child to retell it.

Each narrative retelling was coded by the first author for narrative macrostructure using a 0 to 6 coding scale adapted from Demir et al., (2014), depending on whether the child included all main elements of the story. Perspective-taking was also coded using a scale adapted from Dodd et al., 2011, according to whether children included descriptions of emotions and mental terms in their retellings (see Appendices B and C for the coding criteria).

To detect possible gains in pragmatic skills after the intervention, children were administered the 77-item PleaseApp tool (Andrés-Roqueta et al., 2024 & under review), which evaluates a child’s comprehension of various pragmatic concepts through eight subtests focused on figurative language, story ordering, referentiality, indirect requests, humor, gesture-speech integration, politeness and complex intentions. Children’s responses were subsequently coded as either correct or incorrect.

³ Taken from the open-access website <https://www.wdrmaus.de/filme/mausspots>

A third assessment procedure, this time intended to assess learning taking place *during* the MMN intervention, was carried out, in this case only to children in tier 3, that is, in the clinical setting. Administered by the therapist at the end of the first and second session for each of the three Meloix stories (thus in sessions 1, 2, 4, 5, 7 and 8), the assessment procedure consisted of a set of comprehension questions about the story plot. The child's answers were coded on the spot by the same therapist as either correct or incorrect.

Finally, to evaluate the fidelity of participants to the instructions they had been given about how to implement the MMN intervention program, the first and second authors watched the video recordings from each intervention session to verify that professionals had adhered to the MMN intervention protocol (see Appendix D). Additionally, after each intervention session, professionals were asked to fill out a four-item treatment fidelity checklist to confirm that they had closely followed the intervention protocol (see Appendix E).

4.1.3. Procedure

4.1.3.1. Pre- and post-intervention assessment

Children were tested individually before and after the nine-session MMN intervention program in a silent room in their respective schools or therapy centers to ensure that they were in a familiar space. Tasks were administered mostly by the first author, accompanied by a research assistant at the school. To prevent children from becoming fatigued, the tasks were administered in two separate sessions of 20-30 minutes each, the first for the narrative retelling task and the second the PleaseApp pragmatic skills task. During task administration, and regardless of their response, children were always given positive feedback, and a break was allowed whenever a child seemed tired or their attention wandered.

4.1.3.2. MMN intervention

The procedure used for the nine intervention sessions corresponds to what is described above in Section 2. It is important to recall that the 31 participants in piloting the MMN intervention program had all taken part in training sessions and were therefore skilled in the implementation of the intervention protocols.

4.1.4. Statistical analyses

To assess whether any improvement in children's narrative and pragmatic skills in the course of MMN intervention program, a set of Generalized Linear Mixed Models (GLMM) was run using the *lme4* package (Bates et al., 2015) in R. In each analysis, the dependent variable was the score on the task under study. Specifically, for narrative skills, we first analyzed the child's scores on the trained story, separating the macrostructure perspective-taking scores, and then generated a composite score for the four retellings. TEST (with two levels: pre-test and post-test) was included as a fixed factor in the model. Additionally, in the models for tier 1, CONDITION (with two levels: experimental and control) was included as a fixed factor, together with the two-way interaction with TEST. For the session-by-session learning measure in tier 3 (i.e., comprehension questions about the story), the dependent variable was the percentage of correct responses. SESSION (with six levels: Sessions 1, 2, 4, 5, 7, 8) and RESPONSE (with two levels: correct response, incorrect response), as well as their two-way interaction, were set as fixed factors. In all models, the random-effects structure included by-participant varying intercepts. Finally, for all significant effects and interactions, we carried out post-hoc pairwise comparisons with Bonferroni correction using the *emmeans* package (Lenth, 2021), and also including a measure of effect size (via Cohen's *d*).

We further analyzed two complementary measures of fidelity, one based on observations performed by two members of the research team using a 1–7 Likert scale while viewing video-recordings of intervention sessions taking place and the other a self-assessment conducted by the interventionists themselves. For the external evaluation by the two researchers, we calculated the mean and standard deviation of scores assigned to each session, while for the self-assessed measures, we calculated fidelity as a percentage.

4.2. Results

4.2.1. Skill gains after the intervention: Tier 1 (universal support)

First, the results of the GLMM model of the narrative macrostructural skills for the trained story showed no main effects of TEST ($p = .101$) or CONDITION ($p = .077$), revealing no significant gains in macrostructure in either of the groups. Nevertheless, the two-way interaction between TEST and CONDITION was found to be significant ($\chi^2(1) = 6.68, p = .01$). The post-hoc comparisons showed a) that the experimental group improved from pre-test to

post-test ($d = .98, p = .007$), while the control group did not ($p = .37$); and b) that at post-test, the experimental group was significantly better than the control group ($d = -1.42, p = .007$).

Second, the model assessing narrative perspective-taking reported significant effects for TEST ($\chi^2(1) = 7.26, p = .007$) and CONDITION ($\chi^2(1) = 7.14, p = .008$), which suggested that there were significant differences from pre-test to post-test, regardless of CONDITION ($d = .589, p = .03$), and that the experimental group had higher scores compared to the control group, regardless of the time of testing ($d = -.69, p = .012$). The two-way interaction was also significant ($\chi^2(1) = 5.24, p = .022$). The post-hoc results showed that children's introduction of perspective-taking elements within the story increased from pre-test to post-test ($d = 1.18, p = .001$), while there was no increase in the control group ($p = 1$). Additionally, the interaction showed that at post-test, the experimental group outperformed the control group ($d = -1.28, p = .001$) (see Figure 5).

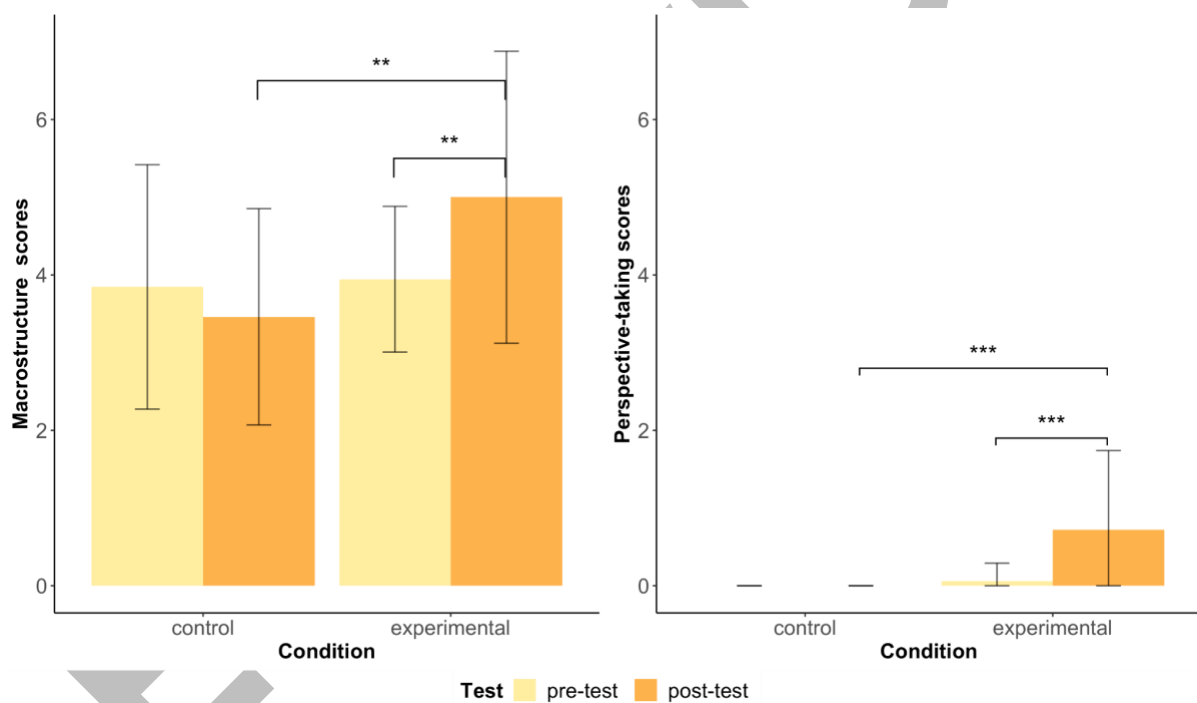


Figure 5. Mean narrative macrostructure and perspective-taking scores for the trained story broken down by TEST (pre-test and post-test) and CONDITION (control and experimental). Asterisks represent significant differences: * stands for $p \leq .05$; ** stands for $p \leq .01$; and *** stands for $p \leq .001$.

When assessing narrative macrostructural skills of all stories, we did not observe any significant main effect of TEST ($p = .811$) or CONDITION ($p = .229$). The two-way interaction was found to be nearly significant ($p = .074$). As for narrative perspective-taking, the model showed a main effect of CONDITION ($\chi^2(1) = 4.14, p = .042$), but not for TEST ($p = .252$). Despite the significant main effect, the pairwise comparison for CONDITION did not reveal significant results ($p = .051$). However, the two-way interaction between TEST and CONDITION was found to be significant ($\chi^2(1) = 7.84, p = .005$). The post-hoc comparison showed that at post-test, the perspective-taking scores from the experimental group were significantly higher than those in the control group ($d = -1.56, p = .002$) (see Figure 6).

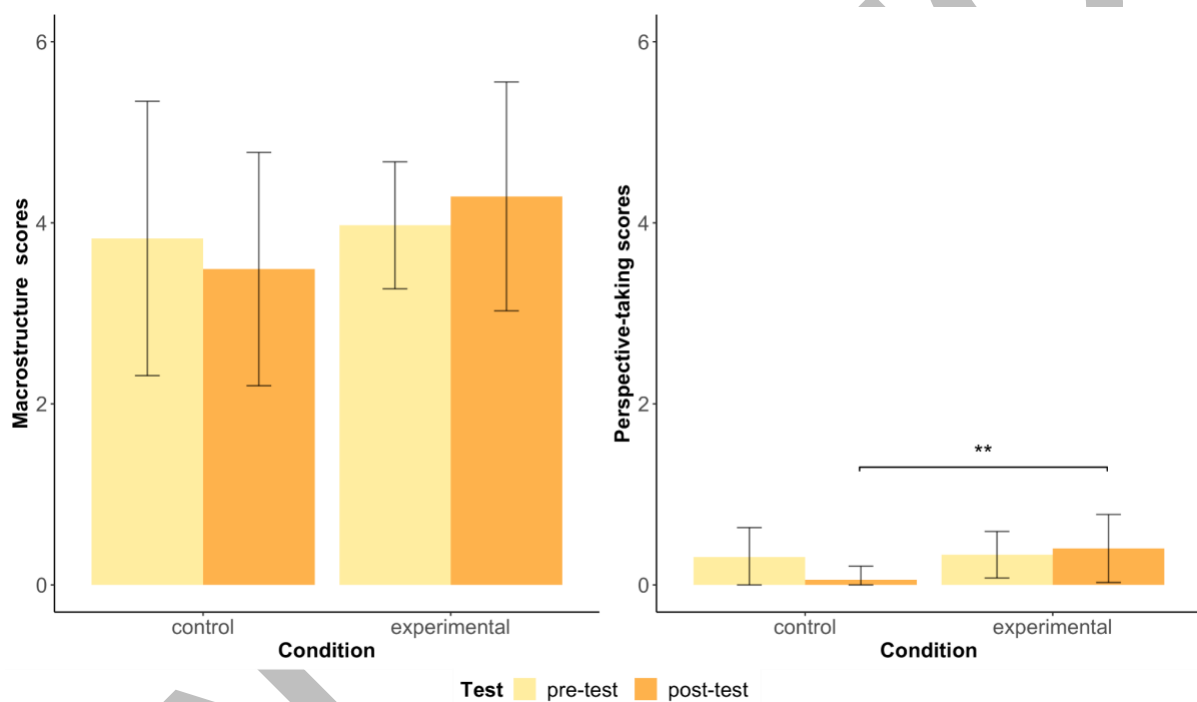


Figure 6. Mean scores for all stories broken down by TEST (pre-test and post-test) and CONDITION (control and experimental). Error bars represent standard deviations. Asterisks represent significant differences: * stands for $p \leq .05$; ** stands for $p \leq .01$; and *** stands for $p \leq .001$.

In terms of pragmatics, a significant main effect of TEST was reported ($\chi^2(1) = 33.88, p < .001$), indicating a significant improvement from pre-test to post-test ($d = 1.94, p < .001$). A main effect of CONDITION was also found to be significant ($\chi^2(1) = 7.91, p = .005$), suggesting that the experimental group was significantly better than the control group ($d = -1.81, p = .009$). In addition, the two-way interaction between TEST and CONDITION was found to be significant ($\chi^2(1) = 6.14, p = .013$). The post-hoc comparisons showed that the experimental group significantly improved from pre-test to post-test ($d = 1.74, p < .001$), while the control group

did not show any improvements ($p = .250$), and that at post-test the experimental group was significantly better than the control group ($d = -2.45$, $p = .001$) (see Figure 7).

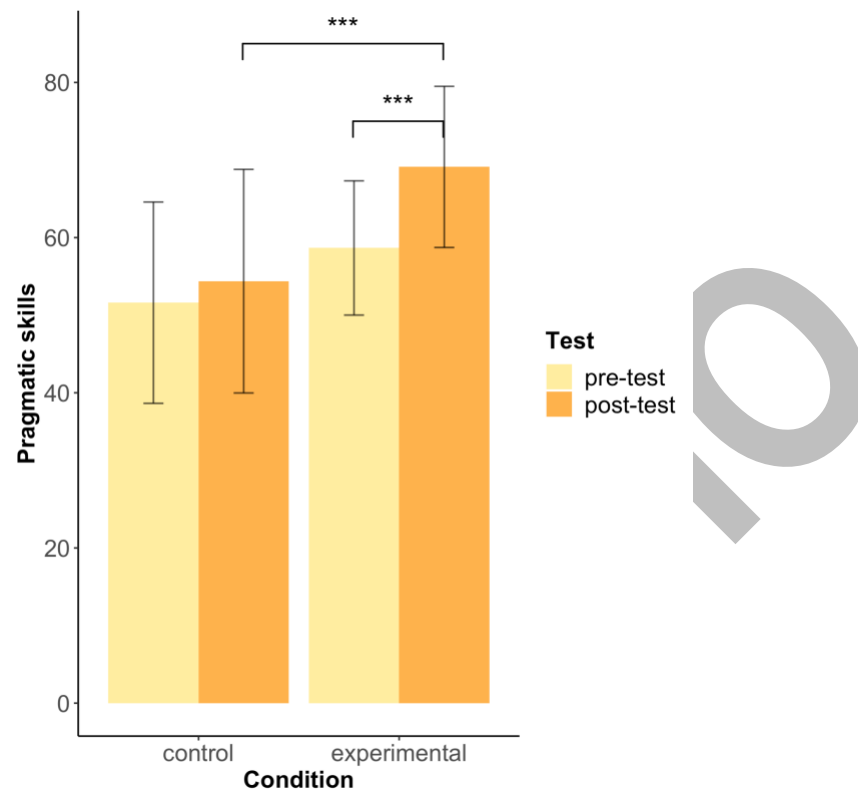


Figure 7. Mean scores for pragmatic skills broken down by TEST (pre-test and post-test) and CONDITION (control and experimental). Error bars represent standard deviations. Asterisks represent significant differences: * stands for $p \leq .05$; ** stands for $p \leq .01$; and *** stands for $p \leq .001$.

4.2.2. Skill gains obtained after and during the intervention: Tier 3 (intensive support)

Regarding narrative skills, the model assessing the trained story reported a significant main effect of TEST for narrative macrostructure ($\chi^2(1) = 19.29$, $p < .001$), suggesting significant improvements from pre-test to post-test ($d = 1.96$, $p = .002$), while there was no main effect for narrative perspective-taking ($p = 1$). The model assessing all stories showed a significant main effect for macrostructure ($\chi^2(1) = 38.25$, $p < .001$), indicating a significant improvement from pre-test to post-test ($d = 2.77$, $p < .001$), while no significant effect was found for perspective-taking ($p = .774$) (see Figure 8).

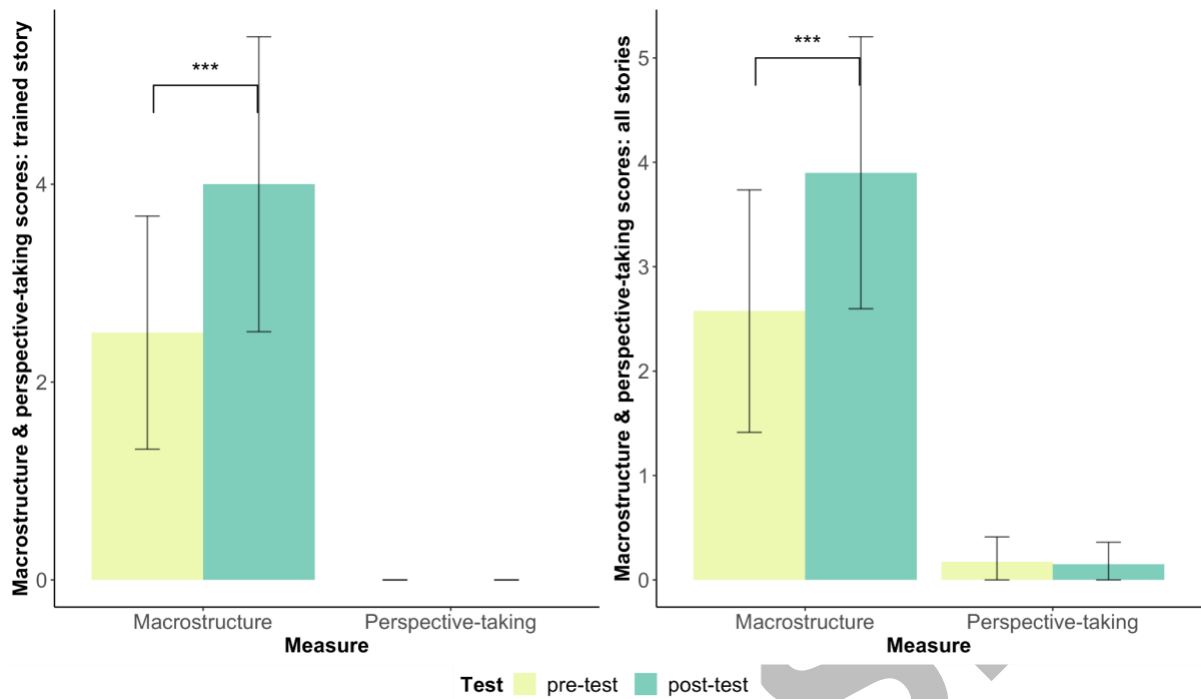


Figure 8. Mean scores for all stories and the trained story broken down by the narrative measure used (narrative macrostructure skills and narrative perspective-taking skills) and by TEST (pre-test and post-test). Error bars represent standard deviations. Asterisks represent significant differences: * stands for $p \leq .05$; ** stands for $p \leq .01$; and *** stands for $p \leq .001$.

The model assessing pragmatic skills showed a significant main effect of TEST ($\chi^2(1) = 23.43$, $p < .001$), which indicated major improvements from pre-test to post-test ($d = 2.16$, $p < .001$) (see Figure 9).

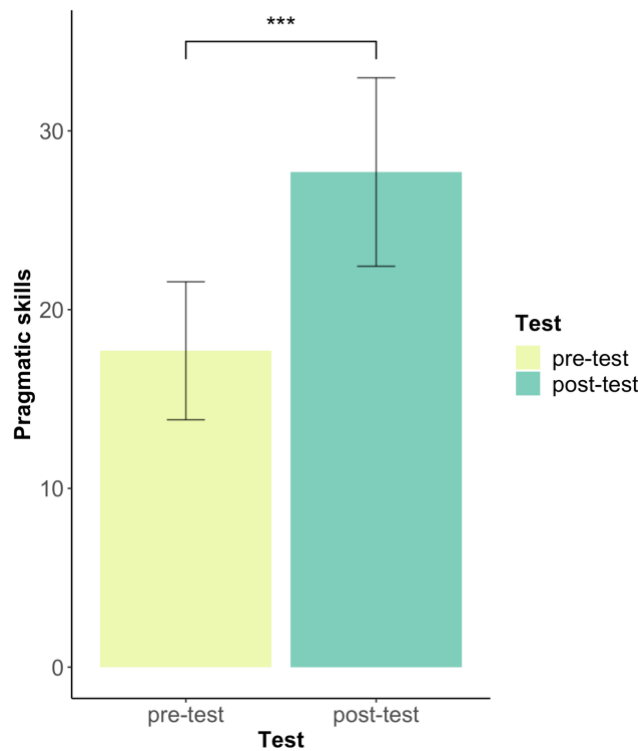


Figure 9. Mean scores for pragmatic skills broken down by TEST (pre-test and post-test). Error bars represent standard deviations. Asterisks represent significant differences: * stands for $p \leq .05$; ** stands for $p \leq .01$; and *** stands for $p \leq .001$.

Finally, the model assessing the session-by-session learning measure (i.e., comprehension questions about the story) only showed a main effect of RESPONSE ($\chi^2(8) = 13867.56, p < .001$). The post-hoc comparisons suggested that children gave more correct answers than incorrect answers ($d = 22.2, p < .001$). No main effect of Session was found to be significant ($p = 1$) nor was the two-way interaction between RESPONSE and SESSION ($p = .068$).

4.2.2. Intervention fidelity

Assessments of fidelity to intervention protocols on the part of participants by the research team and by professionals showed convergent results. First, results of the researchers' evaluation of fidelity (measured on a 1–7 Likert scale) showed that participants were judged to have followed the intervention protocol appropriately ($M = 6.79; SD = 0.64$; for teachers: $M = 6.17; SD = 1.17$; for SLTs: $M = 6.93; SD = 0.38$). Second, results of participants' self-evaluation using a binary yes/no score showed that 100% of the teachers and SLTs believed that they had

followed the intervention protocol closely and had successfully used the set of recommended strategies regarding story enactment and positive feedback.

5. DISCUSSION AND CONCLUSIONS

The main goal of the present study was to assess the feasibility and preliminary effectiveness of the novel multi-tiered MultiModal Narrative program. To this end, 15 preschool teachers representing support tier 1 and 16 SLTs representing support tier 3, all of them fully familiar with the intervention protocol, implemented the narrative program in their respective professional settings. They then completed a questionnaire regarding the feasibility of the program (Study 1). Separately, researchers carried out pre- and post-tests on 41 children to see whether the intervention had led to any gains in their narrative and pragmatic skills (Study 2).

The results of Study 1 showed positive outcomes in all three feasibility indicators (adherence, acceptability and engagement), with no significant differences between teachers and SLTs. With regard to adherence, professionals reported having implemented the intervention sessions following the intervention protocol, with an average timing of 20-30 minutes per session, and only two SLTs out of the 31 professionals reported having had to make small changes to the intervention. One of them stated that the enacted sequential retelling (involving first the therapist asking and answering the questions herself and then repeating the process but with the child answering) was too repetitive for the child who was undergoing the session (who at age 7 was a bit older than the target age of the intervention). For this reason, she did not implement the first sequence of her asking and answering all questions, but rather directly had the child answer the questions. The other said that in addition to having the story icons displayed on a computer screen, she also printed them.

Results from the acceptability measures indicated that both teachers and SLTs were satisfied with the intervention, liked implementing it and thought it was easy to implement and employed effective educational strategies. In our view, participants' positive endorsement of these strategies confirms findings from previous studies reporting about interventions that used similar educational strategies, such as the use of supplementary audiovisual materials and interactive activities (e.g., Bunning et al., 2017; Gillam et al., 2018; Spencer et al., 2015). It also suggests that the inclusion of the multimodal component was valuable. In this connection, our study is in line with studies that claim that multimodal skills need to be systematically

integrated into narrative interventions (e.g., Vilà-Giménez & Prieto, 2021). Importantly, the MMN intervention program described here adheres to the multimodal enrichment paradigm (Mathias & von Kriegstein, 2023), as it integrates multimodality with language learning.

Finally, in their feedback, a large majority of participants reported that the children undergoing the intervention showed a high degree of engagement, participating fully both verbally (98%) and multimodally (78%), and participants also perceived the intervention to have the capacity to improve children's narrative and pragmatic skills.

Intervention fidelity measures were also obtained in Study 2. Both external evaluations and self-assessed measures provided by the participants themselves indicated that they had followed the intervention protocol appropriately and applied the recommended set of strategies. Additionally, retention in the intervention program of both professionals and the children in their care was high, likely a reflection of the high degree of satisfaction experienced by the former and the high degree of engagement reported for the latter. In turn, these high fidelity and retention rates may have contributed to the positive outcomes obtained for Study 2, with significant improvements from pre-test to post-test in both support universal and intensive supports. While narrative macrostructure gains were observable in all children's productions of trained and untrained stories in the intensive support, children in classrooms only showed improvements when retelling the trained story. In line with this, we believe that it would also be of interest to assess gains in narrative microstructure to not only evaluate the incorporation of each macrostructural element, but also assess how children can construct a complex and cohesive narrative discourse. Results for narrative perspective-taking within narrative retellings were less clear, as only children in the classroom context showed improvement, suggesting that the identification of emotions and perspectives within narratives may be easier for this population than it is for clinical populations, who many require additional support to learn to talk about emotions in narrative discourse. Additionally, we observed that training children in perspective-taking could have an impact on pragmatic skills, measured independently, as children's pragmatic skills significantly improved in both classroom and therapy settings. Finally, when assessing performance on the session-by-session comprehension questions in the classroom setting, we observed that children were able to answer correctly to the questions more frequently than incorrectly. This learning measure might serve as a tool for therapists to quickly evaluate whether children are engaging properly with the intervention, and to determine which elements are causing most difficulty for a particular child.

All in all, the empirical gains in narrative and pragmatic measures obtained by children after receiving the intervention, together with the healthcare and educational professionals' positive assessment of the program and the high scores obtained regarding their faithful adherence to it, constitute a strong indication of the feasibility of the program. We believe that the positive outcomes are the result of the evidence-based nature of the intervention and the co-creation process that took place to design the intervention (see ***** et al., under review). This suggests that involving educational and clinical professionals in research can be highly beneficial, as it can ensure that educational and clinical interventions not only address professionals' and children's needs, but are also compatible with real implementation contexts (see e.g., Brett et al., 2014; Peters et al., 2013). In our view, having children receive an intervention implemented by their usual teacher or therapist in their habitual and natural context probably also contributed to the positive findings described here. Additionally, the MMN program was created following the ten principles for effective narrative intervention proposed by Spencer and Petersen (2020), a factor which no doubt contributed to its effectiveness. Crucially, these results inspire confidence about pursuing our next research goal, which is to fully validate the MMN program, thus making it the first scientifically validated narrative-based program available in Catalan. This is particularly important in the Catalan context, where professionals in the Catalan educational and healthcare sectors have long lamented the lack of standardized and validated materials in and for this language.

Some limitations in the present study need to be acknowledged. First, the sample sizes used in both Study 1 and 2 were small. Because the pilot implementation of the MMN program were contingent on the good will of volunteers, we were able to work with only 31 professionals and 41 children. Reluctance to participate on the part of teachers or therapists has several possible explanations. First, teachers are generally expected to follow a planned syllabus that has been scheduled since the beginning of the academic year, with little margin for modification. This may have deterred them from taking on a commitment to somehow fit the nine intervention sessions into their tight schedules. For their part, the speech or language SLTs with whom we had contact reported that most of the children they worked with did not meet all the inclusion criteria. Finally, participant recruitment was difficult in this context because it required first consent to participate from not only the professional who would implement the intervention but also direct authorization from each child's family.

A second limitation of the study was the lack of a control group for the tier 3 implementation, that is, in the clinical setting. Although different sequential learning measures were

administered, we cannot be certain that the improvements after receiving the intervention were direct effects of the MMN intervention rather than a learning or developmental effect. Given the above limitations, future large-scale implementation of the MMN intervention will need to involve larger numbers of participants and include control groups at both support tier levels.

In sum, the results of the present investigation highlight the value of assessing the feasibility of a novel educational and clinical intervention using multiple complementary measures. Crucially, these feasibility results will be helpful in reducing the chance of failure when the intervention is implemented on a larger scale in the Catalan health and educational contexts.

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APPENDICES

A. Feasibility questionnaire

Question	Response type
Adherence	
1. How many sessions did you implement?	Three options: “three”, “six” or “nine”
2. What was the average duration of the sessions (in minutes)?	Open question: number
3. Did you have to make changes to the intervention?	Yes/No
Acceptability	
4. Did you like implementing the intervention?	1-7 Likert scale (no—yes)
5. Was it easy to implement?	1-7 Likert scale (no—yes)
6. Were the strategies used in the intervention effective?	1-7 Likert scale (no—yes)
Engagement	
7. Did the majority of children participate orally?	Yes/No
8. Did the majority of children participate multimodally?	Yes/No
9. Did you perceive an improvement in the children’s narrative and pragmatic skills after implementing the sessions?	1-7 Likert scale (no—yes)

B. Scoring criteria for narrative macrostructure (adapted from Demir et al., 2014)

0	The retelling does not include any descriptive sequence.
1	The retelling includes one descriptive sequence (without any temporal sequence).
2	The retelling includes an action sequence (such as the main character and the problem).
3	The child produces an incomplete narrative that lacks two or more of the macrostructure elements (character, problem, attempt, solution, final).
4	The child produces an incomplete narrative that lacks one of the macrostructure elements (character, problem, attempt, solution, final).
5	The child produces a complete narrative that includes all macrostructure elements.
6	The child produces a complete narrative that includes all macrostructure elements and also adds details about the story.

C. Scoring criteria for narrative perspective-taking within narratives (adapted from Dodd et al., 2011)

0	The retelling does not include any emotion.
1	The retelling includes one emotion.
2	The retelling includes two or more emotions.
3	The retelling includes one emotion + its cause.
4	The retelling includes two or more emotions + the cause of at least 2 emotions.
+1	The retelling includes one mental term (such as <i>thinking, realizing, willing, wanting</i>).
+2	The retelling includes two or more mental terms (such as <i>thinking, realizing, willing, wanting</i>).

D. Evaluation of professionals' treatment fidelity from videorecordings

1. From 1 to 7, did the professional follow the intervention procedure (1 being that she did not follow any activity and 7 that she followed all activities and in the appropriate order)?
2. From 1 to 7, how do you perceive the overall session development in terms of fidelity to the treatment and control of the session by the professional (1 being very poor and 7 being excellent)?

E. Self-assessed treatment fidelity checklist

	Yes	No
1. I have followed the intervention procedure.		
2. I have used gestures and facial expressions to represent macrostructural and emotional elements of the story.		
3. I have asked the children to enact the main macrostructural and emotional elements of the story.		
4. I have used positive feedback accompanied by repetitions and explanations.		