Applied Psycholinguistics (2025), **46**, e7, 1–33
doi:10.1017/S0142716425000013

CAMBRIDGE UNIVERSITY PRESS

ORIGINAL ARTICLE

Narrative skills of Catalan-Spanish bilingual children: macrostructural and microstructural development and assessment

Alondra Camus Torres and Melina Aparici

Departament de Psicologia Bàsica, Evolutiva i de l'Educació, Universitat Autònoma de Barcelona, Bellaterra, Spain
Corresponding author: Melina Aparici; Email: Melina.Aparici@uab.cat

(Received 26 June 2023; revised 20 December 2024; accepted 22 December 2024)

Abstract

This study investigates the development of narrative skills in Catalan-Spanish bilingual children, a rarely studied combination of languages in a bilingual context where neither language serves as a minority input, meaning both are widely used in the community. Seventy children aged 4 to 7 were assessed in both of their languages using the Multilingual Instrument Assessment of Narratives. The effects of language, age, and exposure on narrative macrostructure and microstructure were examined. Results indicate that both age and language influence these levels, while exposure affects specific microstructural measures (grammaticality, discourse markers, and code-switching). Certain aspects of narrative performance, such as comprehension questions, lexical diversity, MLCU, and subordination, develop in only one language, while others, including all other macrostructural measures, narrative length, MLCUmax, and code-switching, develop in both. Interestingly, children perform better in macrostructural aspects when narrating in Spanish, despite being schooled in Catalan and regardless of language exposure. However, in microstructural aspects, children show a disadvantage in grammatical accuracy in Spanish. These findings highlight the importance of considering age, exposure, and language of production when assessing language in bilinguals. The study contributes information on narrative development in Catalan-Spanish bilingual children, offering insights for assessment practices in bilingual populations.

Keywords: Bilingual children; Catalan; macrostructure; microstructure; narrative skills

How to assess narrative production in bilingual children has become an important matter in increasingly multicultural and multilingual societies. Firstly, it is essential to know this population's linguistic development as well as to better understand their skills. Secondly, this knowledge might also help distinguish between

differences in developmental patterns due to bilingualism and disorders in language development, thus avoiding an over- or underdiagnosis of language disorders (Tsimpli et al., 2016; Nieva et al., 2020). However, assessing language skills in bilingual children is a complex issue, since there are few or no assessment tools designed for bilinguals in all language combinations, and not all measures are comparable across languages (Gagarina et al., 2016). In this context, narrative production is a valuable tool to assess bilingual populations, as it is an ecologic measure of linguistic skills, as well as a predictor of children's future linguistic-cognitive performance, and reflects linguistic competence more accurately than tests, which typically consider isolated aspects of language (Acosta et al., 2013; Aparici, 2019). Furthermore, narrative evaluation allows multiple linguistic aspects to be assessed through relatively short language samples (Heilmann et al., 2010). In addition, it has been suggested that assessing narratives may be more appropriate and less biased against bilingual children than other assessment methods, as language tasks that require a cognitive component may draw on general language skills (Botting, 2002; Paradis, 2010). Thus, even if assessing and analyzing narratives does not solve all challenges when assessing bilingual children, it does provide a starting point for examining their language skills (Gagarina et al., 2016; Iluz-Cohen & Walters, 2012).

We have examined narratives in bilingual children speaking Catalan and Spanish, an understudied language combination in narrative research, with the purpose of contributing to knowledge on the development of narrative skills in different language combinations, thus providing insights that may improve the assessment of linguistic skills in bilingual children. In particular, we aim to describe the development of narrative skills at the macrostructural and microstructural levels, in both languages of Catalan-Spanish bilingual children, and to examine whether differences in performance arise when considering their exposure to both languages and the language of narration.

Research on narratives in bilinguals

As recently stated by Guo (2022), most studies on child language development have been based on monolingual speakers. While narratives have long been studied in different languages and cultures (e.g., Berman & Slobin, 1994), research on bilingual narratives has become more prominent only during the last decade, thus challenging the previous idea that there was limited exploration in this field (Gagarina et al., 2020; Nieva et al., 2020). Recent advancements in the field have led to a notable increase in studies on narratives with bilingual populations, covering a range of language combinations (e.g., Kupersmitt & Armon-Lotem, 2019; Lindgren & Bohnacker, 2020, 2022; Marini et al., 2019). This marks a shift from the previous emphasis on the Spanish-English combination in the US population (e.g., Squires et al., 2014).

Over the last decade, the development of the Multilingual Assessment Instrument for Narratives (MAIN) (Gagarina et al., 2012, 2015, 2019) has been particularly noteworthy, contributing to a renewed interest in children's narratives (De Cat, 2022) and fostering the study of bilingual populations. A number of studies

https://doi.org/10.1017/S0142716425000013 Published online by Cambridge University Press

have used this instrument to better understand the acquisition of narrative skills in children with different language combinations (e.g., English-Swedish, English-Hebrew, Vietnamese-English, Russian-Hebrew, and Finnish-Swedish). Additionally, three special journal issues have been published, along with a book focusing on narrative comprehension using MAIN[1]. A recent review by Lindgren et al. (2023) highlights the extensive use of MAIN, with 42 published studies investigating macrostructure, predominantly focusing on bilingual children. Nevertheless, there are still no published studies on the use of MAIN for bilinguals who have Spanish or Catalan as one of their languages.

Assessment of narrative macrostructure and microstructure

Studies on narrative skills measure macro- and/or microstructure, because both levels are necessary to adequately produce a narrative (Govindarajan & Paradis, 2019). Macrostructure refers to the organization of content in which the connection is achieved through an all-encompassing structure that follows an underlying narrative scheme (Paradis et al., 2011), expressed through a hierarchical structure known as Story Grammar (e.g., Labov, 1972; Stein & Glenn, 1979), which is a specific framework used to analyze narrative macrostructure. Microstructure refers to a variety of linguistic devices used to create cohesion, such as referential expressions to introduce or maintain the characters of the story, sentence structure, or use of connectives (Govindarajan & Paradis, 2019). A wide range of mechanisms are included in the evaluation of the microstructure of a narrative (e.g., general measures of length), as well as analysis of morphosyntactic and lexical resources, since a diversity of linguistic resources are used to achieve cohesion within a discourse (e.g., Altman et al., 2016; Caballero et al., 2020; Camus et al., 2022; Camus & Aparici, 2023).

In order to analyze narrative production in bilingual speakers, it is worth taking into account that microstructure varies from one language to another. In contrast, macrostructure is often considered to be universal across languages (e.g., Berman & Slobin, 1994). The macrostructure of a narrative, both in terms of expression and comprehension, is therefore expected to be relatively independent of the specific language experience (Hipfner-Boucher et al., 2015), even among the first and second languages (L1 and L2, respectively) of bilingual children (e.g., Gutiérrez-Clellen et al., 2008; Uccelli & Páez, 2007). However, recent studies have found a relationship between a child's language competence and the macrostructure of narratives (Bohnacker et al., 2020, 2022). Instead, there is a greater consensus that the microstructure would be subject to the particular linguistic experience and would not be transferred between languages (Boerma & Blom, 2017; Squires et al., 2014).

Available evidence suggests that detailed analysis of narrative macro- and microstructure in both languages could provide useful information for improving the quality of assessment in bilingual populations (Marini et al., 2019) and contribute to drawing a comprehensive linguistic profile that would impact rehabilitation (Thordardottir et al., 2015). Nevertheless, in order to adequately describe the linguistic profile of bilingual children, it is important to also collect detailed information of their linguistic history through valid methods, including parental questionnaires (Boerma & Blom, 2017).

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Assessment of narrative macrostructure and microstructure with MAIN

Research on bilingual populations using MAIN has tended to analyze measures at the macrostructural level: story structure, structural complexity, internal state terms (IST), and story comprehension (e.g., Bohnacker & Gagarina, 2020, 2022; Kunnari et al., 2016; Maviş et al., 2016; Roch et al., 2016). However, measures are more diverse at the microstructural level. This is because both the specific aspects and type of measure depend on the particular features of the language under study and the specific focus of the authors (Gagarina et al., 2012).

These diverse microstructural tools include productivity measures, such as the total number of word tokens (TNW) (e.g., Altman et al., 2016; Gagarina, 2016) or story length in number of C-units (LCU) (e.g., Pham et al., 2019; Otwinowska, Mieszkowska et al., 2020). Grammatical complexity measures have also been studied, such as mean length of utterance (MLU) or C-units (MLCU) (e.g., Otwinowska, Opacki et al., 2020), and mean length of the three longest C-units (MLCUmax) (e.g., Altman et al., 2016). Lexical measures are also common, such as number of different words (NDW) (e.g., Kapalková et al., 2016; Rodina, 2017) or type-token ratio (TTR) (Otwinowska, Mieszkowska et al., 2020). Finally, a range of morphosyntactic measures have also found research interest, such as the subordination index, the grammaticality index (e.g., Dam et al., 2020; Pham et al., 2019), subordinate sentence types (Dam et al., 2020), and morphological and syntactic errors (e.g., Altman et al., 2016; Dam et al., 2020; Otwinowska, Mieszkowska et al., 2020). In addition, some studies have focused on analyzing aspects of cohesion, such as the introduction and maintenance of referents (e.g., Andreou et al., 2022; Fichman & Altman, 2019; Fichman, Walters, Melamed et al., 2020; Lindgren et al., 2022) and the overuse of referential markers (e.g., Otwinowska, Opacki et al., 2020). Certain studies have analyzed measures of language use specific to bilingualism, such as code-switching (e.g., Altman et al., 2016). Another approach has been to develop a system of microstructure assessment specific to the language at stake; for instance, Krasnoshchekova & Kashleva (2019) created a system for analyzing Russian narratives considering four main measures: morphosyntax, reference, syntactic complexity, and vocabulary.

Previous findings on narrative macrostructure and microstructure in MAIN studies

Studies using MAIN have addressed the development of narratives in bilingual children growing up with varied language combinations, along with the effects of language of narration and exposure effects. These studies have mainly investigated macrostructural aspects, but some studies have also addressed microstructural features. MAIN studies have primarily focused on bilingual children aged 4 to 7, with fewer studies including children aged 8 or above, as noted in the review by Lindgren et al. (2023). An age effect was observed in most of the assessed macrostructural measures (e.g., Bohnacker, 2016; Gagarina, 2016; Maviş et al., 2016). Regarding story structure, development was generally identified between ages 3–4 and 6–7 (e.g., Bohnacker et al., 2022; Fiani et al., 2022; Roch et al., 2016), as well as regarding story comprehension (e.g., Bohnacker et al., 2020; Gagarina et al., 2020;

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Haddad, 2022; Lindgren & Bohnacker, 2020). However, some studies suggest that by age 5–6, children were able to answer most comprehension questions, possibly reaching a plateau by these ages (e.g., Bohnacker & Lindgren, 2021; Gagarina et al., 2020; Lindgren, 2019, 2022). Also, age-related effects in structural complexity (e.g., Bohnacker et al., 2022; Fiani et al., 2022) and use of internal state terms have also been noted (e.g., Fiani et al., 2022; Kawar et al., 2023). As for microstructure, Kawar et al. (2023) reported that older children produced longer texts; while in addition, Dam et al. (2020) found a correlation between age and the measures of grammaticality and syntactic complexity in bilingual children aged 3–8 years.

Several studies have compared bilinguals' performances in the two languages. Most of them found a similar performance at the macrostructural level in both languages, according to the review by Lindgren et al. (2023). Specifically, this similarity was observed in story structure (e.g., Altman et al., 2016; Bohnacker et al., 2022; Fiani et al., 2022; Fichman, Walters, Armon-Lotem et al., 2022), story complexity (e.g., Altman et al., 2016; Bohnacker et al., 2022; Kunnari et al., 2016), and story comprehension (e.g., Bohnacker et al., 2020; Kapalková et al., 2016; Kunnari & Välimaa, 2020; Lindgren & Bohnacker, 2020; Rodina, 2017). However, some studies have found differences between the languages, with higher scores in the L1, regardless of whether it was the societal language (e.g., Kapalková et al., 2016; Roch & Hrzica, 2020; Tribushinina et al., 2022). In these cases, the differences might potentially be attributed to lower language proficiency in the second language. The study by Lindgren & Bohnacker (2022) was an exception, revealing differences among German-Swedish bilinguals, where performance in the societal language (Swedish) was higher than in the home language (German) in story structure.

On the other hand, microstructural measures, such as lexical and morphosyntactic skills, should be more language-specific and less predisposed to transfer (e.g., Roch et al., 2016; Rodina, 2017). For instance, Dam et al. (2020), when studying Vietnamese-English bilingual children, found out that age displayed a higher correlation with measures of grammaticality and syntactic complexity in English than in Vietnamese. They also reported that language can influence performance differently depending on age. In English, older children exhibited higher grammaticality and greater syntactic complexity compared to younger children. However, in Vietnamese, although they demonstrated increased syntactic complexity with age, there was no corresponding increase in grammaticality. Altman et al. (2016), in their study on English-Hebrew bilingual children, also reported language differences for microstructure features. They observed that performance in L1 (English) outperformed that in the L2 (Hebrew) for TNW, word types, MLCU, and MLCUmax. Moreover, differences were observed in the types of errors made in each language.

Also, Rodina (2017) found significant differences for some lexical and morphosyntactic measures among Norwegian-Russian children, such as TNW, total number of verbs, and MLU. However, other measures remained invariant across languages, including lexical diversity, total number of nouns, and total number of C-Units. Similarly, Gagarina (2016) (Russian-German) and Kunnari et al. (2016) (Finnish-Swedish) reported a similar performance in TNW and in number of C-Units in the two languages of bilingual children.

The exploration of language exposure's impact on bilingual children's narratives, as measured mainly by Length of Exposure (LoE) and Age of Onset (AoO), has been

https://doi.org/10.1017/S0142716425000013 Published online by Cambridge University Press

more limited, and studies on this topic have led to mixed results, as highlighted in the review by Lindgren et al. (2023). Haman et al. (2017) studied Polish-English bilingual children aged 4 to 7, examining the impact of cumulative language exposure. Their findings indicated a positive effect of cumulative exposure on Polish story structure, suggesting that increased language exposure contributes to enhanced narrative skills. However, the study did not examine the other language of the children (English). On the contrary, Bohnacker et al. (2022) observed no impact of LoE and daily language exposure to Swedish (majority language) on the macrostructure in Turkish-Swedish bilingual children. Similarly, in Lindgren & Bohnacker (2022) exposure to German (home language) did not show any effects on macrostructure in German-Swedish bilingual children. In terms of microstructure, studies are scarce. In the study by Altman et al. (2016), LoE did not emerge as a strong predictor of higher proficiency. An analysis of covariance conducted in this study, considering various microstructure variables with LoE as an intervening factor, revealed that only sentence length (MLCU and MLCUmax) was impacted by LoE.

Finally, several studies using MAIN have examined how the elicitation mode—telling, retelling, or model story—can influence narrative assessment, both in story comprehension and story structure. According to Lindgren et al. (2023), studies by Roch et al. (2016), Otwinowska, Mieszkowska et al. (2020), and Wehmeier (2020) found that children achieved significantly higher scores in retelling compared to telling for story comprehension. However, Kunnari & Välimaa (2020) and Maviş et al. (2016) did not find significant differences. In terms of model story, Blom & Boerma (2020) and Gagarina et al. (2020) observed that younger children demonstrated better comprehension when they first listened to a model narrative, although this effect tended to disappear in older children due to ceiling effects. Regarding story structure, Roch et al. (2016) found a significant, albeit small, difference favoring retelling, a finding also reported by Otwinowska, Mieszkowska et al. (2020), Kuvač Kraljević et al. (2020), and Wehmeier (2019). However, Kunnari et al. (2016) and Maviş et al. (2016) reported no significant differences, while Sheng et al. (2020) noted higher scores in retelling only for children at risk of DLD. This suggests that the elicitation mode can influence both story structure and comprehension, although results are mixed, possibly due to differences in sample sizes and the stories used.

Sociolinguistic context

The particular sociolinguistic context of the language combination under study is the coexistence of two official languages in Catalonia, an autonomous region within Spain. Catalan and Spanish are typologically similar, pro-drop Romance languages with around 85% lexical and grammatical similarity (Ethnologue, 2019). Although the official language of schooling is Catalan, with Spanish being taught as a subject, both languages are widely used by the population. In this sense, there is virtually no population consisting of monolingual Catalan speakers, nor is there a minority language (i.e., a language spoken exclusively in the home environment) (Serrat et al., 2021). Therefore, it is common for children to have a simultaneous bilingualism

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profile, meaning native or native-like proficiency in both languages, where one may be the dominant language. However, it is also common to find children with a sequential bilingualism profile, referred to children whose home language (L1) is Spanish and who learn Catalan mainly upon entering the school system, developing Catalan as their second language (L2) or non-dominant language. In both cases, factors such as LoE and percentage of daily exposure to Catalan and Spanish may vary from one individual to another. In addition, Catalonia has a large immigrant population, first or second generation, with various native languages; consequently, many children have an L1 other than the official languages, leading to a wide range of bilingual profiles (Camus & Aparici, 2020).

Until recently, there were no narrative evaluation instruments that allowed the simultaneous assessment of Catalan and another language in a multilingual context in which virtually the whole child population is bilingual (Camus & Aparici, 2020). As a starting point, we aim to analyze the usual language combination in Catalonia (i.e., Catalan-Spanish), thus contributing to establish narrative development profiles for this population and, thus, to their assessment.

The present study

This study aims to contribute to the growing knowledge of the development of narrative skills in bilingual children from different linguistic backgrounds, by examining an understudied language combination—Catalan and Spanish—with the ultimate goal of providing guidelines for assessing and stimulating narrative skills in this population.

Faced with the challenge of assessing bilingual children in the clinical field, we focused on defining parameters of typical development in the two languages of these children to contribute to accurate linguistic assessments (Dam et al., 2020), as this represents a novel language combination within the existing body of narrative research. In order to set the scene for future research on the identification of potential clinical markers in this type of population, we focused on analyzing microstructure features in both languages. While earlier research often concentrated only on the L2 (Gagarina et al., 2012), it is important to acknowledge that several recent studies investigate both languages (e.g., Fiani et al., 2022; Fichman, Walters, Armon-Lotem et al., 2022). Therefore, at the macrostructural level, our analysis was based on the measures proposed in MAIN, while at the microstructural level we analyzed several measures of productivity, syntactic complexity and grammar, and lexicon. We decided to focus on children aged 4 to 7 years, since this is a period of life in which significant advances in narrative development occur, and to which MAIN is particularly sensitive (Berman & Slobin, 1994; Bohnacker & Gagarina, 2022).

Identifying the aspects that are invariant across languages at both the macro- and microstructural levels would allow a clinical assessment in one of the two languages when instruments are not available in both languages (or when there are time constraints). Furthermore, it would be useful to define the bilingual profiles in which these performance similarities between languages are found (e.g., whether only in bilinguals with a specific language dominance and exposure or across the board).

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In this context, the main objectives of the current study were (1) to analyze the typical development of narrative skills at the macro- and microstructural level in both languages of Catalan-Spanish bilingual children through MAIN, together with a parental language background questionnaire, and (2) to compare performances when considering the language of narration (Catalan and Spanish), age (preschoolers—4-5 years and primary school pupils—6-7 years), and reported language exposure to Catalan and Spanish. More precisely, the following research questions were posed:

- How does language of narration (Catalan and Spanish) affect the performance in narrative macro- and microstructure?
- How does age (preschoolers—4-5 years and primary school pupils—6-7 years) affect the performance in narrative macro- and microstructure?
- How does the interaction between age and language of narration influence narrative macro- and microstructure?
- How does reported language exposure affect the performance in narrative macro- and microstructure?

Based on previous findings on narrative performance in bilingual children, we expect to find a similar performance at the macrostructural level in both languages. The story grammar knowledge, particularly as captured by story complexity, should be relatively invariant across the two languages of a bilingual child (e.g., Altman et al., 2016; Kunnari et al., 2016). On the other hand, microstructural measures such as lexical and morphosyntactic skills should be more language-specific and less predisposed to transfer (e.g., Roch et al., 2016; Rodina, 2017). Furthermore, we expect an age effect in most macro- and microstructural measures assessed in both languages (e.g., Bohnacker, 2016; Gagarina, 2016; Maviş et al., 2016), as well as an interaction of age and language in certain microstructural measures (Dam et al., 2020). We do not expect to find significant effects of language exposure on the macrostructure (Bohnacker et al., 2022; Lindgren & Bohnacker, 2022), although there might be some effects on microstructure (Altman et al., 2016).

Method

Participants

A total of 80 bilingual Catalan-Spanish children with typical language development aged from 4;2 (4 years and 2 months) to 7;11 (7 years and 11 months) participated in the study. All children were recruited from public schools located in Catalonia which follow a similar curriculum. The following criteria were considered: (1) being aged between 4;0 and 7;11 years, (2) with no history of learning difficulties, hearing impairment, language disorder, attention deficit hyperactivity disorder (ADHD), or autism spectrum disorder (ASD), (3) being Spanish-Catalan bilinguals with a minimum of 2 years of regular and frequent exposure to each language (i.e., several times a week), and (4) having good comprehension and being fluent in both languages. This specific profile was confirmed by both teachers' and parents' reports, who did not express any concerns about the children's development. Ten

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participants were excluded from the sample, four who failed to respond in one language and six who did not produce one of the narratives due to school closures during the COVID-19 pandemic. This led to a final sample of 70 participants.

Following the data obtained from the *Language background questionnaire for parents* (see section "Materials"), all children were born in Catalonia and were continuously exposed to Spanish and Catalan before turning 3 years of age. All participants used both languages regularly at the time of data collection. All parents reported that their children had a good or very good ability in producing and understanding both Catalan and Spanish. None of the children were L2 speakers of Spanish or Catalan, meaning they had not acquired another language (i.e., from immigration backgrounds) before the target languages. Four children were also exposed to another language at home (Russian, Italian, English, and French, respectively), but they were also exposed to Spanish and Catalan at home. The rest of the parents who marked "other" language exposure did so because their children got English lessons.

Participants belonged to two groups according to their age and schooling level: thirty preschoolers (mean age = 5;2 years) attended kindergarten and forty primary school pupils (mean age = 7;1 years) attended the first or second year of primary school. There were no significant differences observed among groups in socioeconomic status (SES) and exposure to both languages. Maternal education was used as a proxy for SES (Psaki et al., 2014), with an average of 14.57 years of maternal schooling (Standard Deviation SD = 2.77) for the preschoolers group and 14.26 years (SD = 3.06) for the primary school pupil group.

Reported language exposure was assessed through the aforementioned parental questionnaire on the basis of biographical data and language use, both in and outside the family, from each child's birth to testing time (see Table 1 for more details on the groups' age and language exposure). Questionnaire data were available for all 70 children. The construction of the reported language exposure measure was based on two parameters of each language (Catalan and Spanish): Length of Exposure (LoE) in months, and proportion of Exposure (P). It is important to note that the sum of the two proportions may not equal 100% as some children might be exposed to a third language. The language exposure index (Ei) for each child was calculated using the formula: $E_i = (LoE_{Catalan,I} \times P_{Catalan,i}) - (LoE_{Spanish,I} \times P_{Spanish,i})$. Each participant was measured multiple times for their exposure to both languages, meaning the language exposure index scale varied among individual participants but remained consistent within each participant. The mean difference in language exposure was 1.40 (SD = 22.48), with values ranging from -56.50 to 50.80 and with no statistically significant differences in language exposure between Catalan and Spanish ($t = .74$, $p = .462$). A positive E_i reflects higher exposure to Catalan, while a negative E_i means a higher exposure to Spanish (see Appendix I).

Materials

The *Language background questionnaire for parents*, adapted from Gagarina et al. (2019), was used to collect information on participants' age, language background, percentage and age of language exposure, and SES data.

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https://doi.org/10.1017/S0142716425000013 Published online by Cambridge University Press

Table 1. Characteristics of the participants: age, length of exposure, and percentage of language exposure

				Length of exposure				Percentage of language exposure					
		Chronological age		Catalan		Spanish		Catalan		Spanish		Other	
Group	N	*M (SD)*	*Range*	*N*	*Range*	*N*	*Range*	*M (SD)*	*Range*	*M (SD)*	*Range*	*M (SD)*	*Range*
Pre-schoolers (PRE)	30	62 (5.7)	50-71	56 (13.8)	50–71	61 (8.2)	50–71	50.2 (10.4)	40–75	43.4 (13.7)	20–50	6.4 (9.8)	0–30
Primary school pupils (PRI)	40	85 (6.7)	72–95	78 (13.6)	72–95	83.5 (9.7)	72–95	49.3 (12.9)	43–75	46.0 (15.9)	20–67	4.7 (8.2)	0–25

Note: Other: languages other than Catalan and Spanish.

The Spanish (Ezeizabarrena & García del Real, 2020) and Catalan (Camus & Aparici, 2020) versions of *MAIN* (Gagarina et al., 2019) were used to assess the children's narratives. MAIN was designed to assess the production and comprehension of narratives in the same individual across different languages and with different modes of elicitation (i.e., telling, retelling, and model story) (Gagarina et al., 2020). MAIN contains four stories designed to be comparable in pairs regarding cognitive and linguistic complexity, macrostructure, microstructure, cultural appropriateness, and robustness. Although it has not yet been standardized, its systematized procedures can be used for assessment, intervention guidance, and research purposes. To date, it has been adapted into more than 80 languages and continues to expand.

Procedure

This research was approved by the Ethical Committee of Universitat Autònoma de Barcelona. All parents signed an informed consent form and completed a language background questionnaire before the administration of MAIN to their children. Children also gave their verbal consent at the beginning of the assessment.

Two stories of MAIN ("Cat" and "Dog") were used to test children's narrative production. All children were individually tested in a quiet room at their school using a narrative retelling procedure. After an initial period of warm-up conversation or play, the children were instructed to carefully listen to a story read by the evaluator and supported by MAIN pictures. The children were asked to retell the story once the evaluator had finished telling it. Pictures were visible before and during retelling only for the children, without shared visual attention with the evaluator. Finally, the children had to answer ten comprehension questions. The entire sequence of images was visible to both the evaluator and the child while answering the comprehension questions.

The data were collected in two sessions (one per language), which were between seven to ten days apart. The stories were counterbalanced across languages. Also, the order of the task administration was counterbalanced, with one-half of the children doing the task first in Catalan and then in Spanish and the other half in the opposite order. A native speaker tested each language. The children's narratives were recorded using a digital voice recorder and then transcribed to be analyzed.

In addressing missing data, it is important to note that all missing values primarily pertain to descriptive characteristics and do not impact the variable's object of statistical analysis. Only one instance of missing data was identified in the measure of lexical diversity (VOCD), affecting 14 out of 140 narrations. This specific case relates to narratives with a length below the designated threshold of 50 words, a prerequisite for VOCD calculation.

Narrative macro- and microstructural assessment

Narrative macrostructure. The macrostructure was assessed according to the following MAIN measures (Gagarina et al., 2019):

Story Structure [SS]. This measure evaluates the production of the three episodes that constitute the story, based on the number of components (1 point

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each) comprised in each episode (five components). These components are: Internal State Terms (IST) as the initiating event (an internal state term that sets the events of the story in motion); goal (an expression of the protagonist's intention on how to deal with the initiating event); attempt (an indication of an action to obtain the goal); outcome (a statement describing if the goal was reached following the attempt); and IST as reaction (a statement defining how the protagonist(s) feels or thinks about the outcome). Children can obtain up to 15 points for the presence of these components, plus a further 2 points by adding a setting (information about the time and place that events took place). Thus, the maximum score is 17 points.

Structural Complexity [SC]. This determines the level of complexity of each of the three abovementioned episodes of the story, classifying them according to the presence of the following elements: Goal (G), Attempt (A), and Outcome (O). Each episode was coded as one of the following types of sequences of components: attempt-outcome (AO), goal-attempt (GA), goal-outcome (GO) and goal-attempt-outcome (GAO); episodes lacking one of these combinations were coded as no sequence (Bohnacker et al., 2022; Fiani et al., 2022; Lindgren & Bohnacker, 2022). Following Fiani et al. (2022), the number of points awarded for each sequence reflected the level of complexity: 0 points for no sequence (e.g., O only), 1 point for an AO sequence (the least complex), 2 points for a GA or GO sequence, and 3 points for a full GAO sequence (the most complex). The total scores for each narrative were then calculated, with a maximum score of 9 points.

Internal State Terms [IST]. It refers to the total number of words tokens describing the state of the characters, including perceptual state terms (e.g., *see, feel*), physiological state terms (e.g., *hungry, tired*), consciousness terms (e.g., *awake, asleep*), emotion terms (e.g., *sad, happy*), mental verbs (e.g., *want, think*) and linguistic verbs (e.g., *say, call*). Tokens were used to capture the overall frequency of use of these terms in the narratives.

Comprehension Questions [CQ]. This measure evaluates the answers to ten comprehension questions about the story: three questions concerning Goals (e.g., *Why does the cat jump?*), six questions related to the understanding of IST (e.g., *How does the boy feel? Why?*), and one last question concerning Theory of Mind (e.g., *Will the boy be friends with the cat? Why?*). One point is granted for each correct answer, with a maximum score of 10.

Narrative microstructure. In this study, we analyzed 9 microstructural measures that, according to previous studies, have shown to be sensitive to changes related to age, language, and/or exposure, or which can be potentially useful to distinguish between children with typical development and children with developmental language disorder (DLD). For instance, length of narrative was observed to develop with age (Kawar et al., 2023); lexical diversity (e.g., Kapalková et al., 2016; Hipfner-Boucher et al., 2015; Rezzonico et al., 2015) and code-switching (Iluz-Cohen & Walters, 2012) and showed differences by language of narration; (un)grammatical productions and measures of syntactic complexity have been associated with differences both by age and language (e.g., Dam et al., 2020; Lenhart et al., 2022). Measures such MLCU and MLCUmax have been reported to be influenced by LoE (Altman et al., 2016). Furthermore, studies have indicated that measures such as lexical diversity (e.g., Altman et al., 2016; Iluz-Cohen & Walters, 2012;

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Tsimpli et al., 2016) and grammaticality (e.g., Rezzonico et al., 2015) were worse in DLD than in TD bilingual children.

The following measures were evaluated:

Total number of Words [TNW]. Length of the narrative in number of words.

Mean length of C-Unit [MLCU]. Calculated dividing TNW by the total number of C-Units.

Mean length of three longest C-Units [MLCUmax]. Calculated in number of words.

Subordination index [SI]. Calculated by dividing the number of subordinate clauses by the number of C-Units.

Ungrammatical C-Units. Proportion of C-Units containing at least one error out of the total number of C-Units. The errors considered, based on Altman et al. (2016), include incorrect usage or omission of articles, pronouns, prepositions, verbs, incorrect gender or number agreement, as well as lexical errors and other grammatical errors. For instance: "*i el nen recuperar la pilota*" (and the boy get the ball back; verb auxiliary omission in Catalan: infinitive instead of periphrastic past form "va recuperar," *has got*), "*quería atraparla pero se hechó daño*" ((he) wanted to catch her but got hurt; overregularization of the simple past tense formed with the stem of the past participle form for the verb to do in Spanish; "hechó" instead of "hizo"), "*quería coger la mariposa"* ((he) wanted to catch 0 the butterfly; omission of preposition "a", *to,* in Spanish).

Coordinating conjunctions. Conjunctions syntactically connecting clauses in coordinate complex sentences. In Spanish and Catalan, these include: *y/i "and," o "or," ni "nor," pero/però "but."*

Discourse markers. Intersentential, parenthetical connectives that help connect and/or organize discourse fragments (cohesive devices). In Spanish, for instance: *a continuación "next," después "afterwards," primero "first," entonces, "then," al principio "at the beginning," mientras tanto "meanwhile," al final "at the end," de repente "suddenly," sin embargo "however."*

Lexical diversity. D index, a mathematical algorithm to calculate vocabulary diversity, implemented in CLAN (CHILDES, Mac Whinney et al., 2000) under the name of vocd-D.

Code-switching. Number of words produced in a language other than the language tested. For instance, using "*sentado"* instead of "*assegut" (sitting)* in a Catalan narrative.

To analyze the narratives at the microstructural level, clauses that were not story-related were excluded (i.e., unrelated statements or questions), as well as disfluencies such as false starts, filled pauses, repetitions, and revisions.

Transcription and scoring of narrative samples

All narratives were transcribed using CHAT conventions (CHILDES, Mac Whinney et al., 2000) by native speakers of Spanish and Catalan and then analyzed and scored according to the scoring[2] procedures of MAIN (Gagarina et al., 2019). The first author independently checked all transcripts for transcription errors. The transcripts were segmented into C-Units according to Loban's criteria[3] (Loban, 1976). To determine the reliability of transcription, we used the formula

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[agreements divided by agreements plus disagreements multiplied by 100] (Castilla-Earls et al., 2015). Based on this formula, inter-rater reliability was 97.2%.

Narratives were analyzed and scored at the macrostructural level considering story structure, structural complexity, internal state terms, and comprehension questions and at the microstructural level considering the aforementioned measures of productivity, syntactic complexity and grammar, and lexicon. As for microstructural measures of TNW, MLCU, MLCUmax, and D index, CLAN programs were used to obtain the data. 20% of the samples were randomly selected, ensuring an equal distribution between Catalan and Spanish samples, to be transcribed, coded, and scored by the second author and compared to the original. Any word or CHAT symbol that was omitted or replaced by a different one was counted as a disagreement. To determine the reliability of the scoring for each variable that was manually coded, the Kappa index (k) value was calculated, with the following results: Subordination k = .78, Ungrammatical C-Units = .80, Discourse markers k = 1, Coordinating conjunctions k = .96, Code-switching k = .80, indicating a substantial level of inter-rater agreement. To determine the reliability of the scoring for each MAIN measure assessed, the Kappa index (k) value was calculated, with the following results: for Story structure k = .89, Structural complexity k = .84, Internal state terms k = .97, and Comprehension questions k = .93, indicating an almost perfect level of inter-rater agreement. Disagreements between evaluators were discussed and resolved, and on a few occasions, minor adaptations were made to the scoring system.

Statistical analyses

We applied the generalized estimating equations (GEE; Hardin & Hilbe, 2013) procedure to manage the correlated data. This variation was expressed in the random intercept. The advantages of this procedure are twofold: first, it allows the existence of correlated data by means of various working covariance matrices; and second, other types of outcome distribution are available, beyond the normal distribution. Children's performance was analyzed using GEE procedure in which the main effect of language of narration (Catalan and Spanish) was assigned to the within-subject level, whereas the main effect of age (preschoolers—4–5 years and primary school pupils—6–7 years) was assigned to the between-subject level. A within-between interaction effect was tested as well. A reported language exposure covariate was added to the analysis as control variable.

The measure of effect was presented through Wald's χ^2, based on the Wald test (Wald; 1943), which is similar to the F test in ANOVA models (the larger the value, the better). The marginal means are shown followed by a ranking sign, namely, Latin letters for the marginal mean ranking from the lowest mean to the highest. The continuous effect of the language exposure covariate is shown in the unstandardized regression coefficient (b), while standardized coefficients are not available for the two-level analysis. Additional correlations were conducted only when a significant effect of reported language exposure was observed, to better understand this effect. Specifically, the reported language exposure score was correlated with the measure that showed a significant result, using a 2x2 correlation matrix. This matrix considers each language of narration (Catalan and Spanish) and

https://doi.org/10.1017/S0142716425000013 Published online by Cambridge University Press

each age group (preschoolers and primary school pupils) separately. In the current study, the choice of the better model for each variable was based on model comparison (Normal/Gamma distribution vs. Poisson/Negative Binomial distribution), which uses as an indicator the Akaike Information Criterion (AIC) for nested models: the smaller the value, the better. All analyses were conducted using SPSS V.28.0.

Results

The results of preschool and primary school children's narrative performance at the macro- and microstructural levels are presented below. Table 2 provides descriptive statistics (means, SD) of macrostructural and microstructural measures according to age (preschoolers and primary school pupils) and language of narration (Catalan and Spanish).

Narrative macrostructure

Narrative macrostructure was assessed following the MAIN measures (Gagarina et al., 2019), as described in the previous section. Table 3 presents the GEE results for each macrostructural measure by age, language of narration, the interaction of both factors, and the effect of exposure.

Story Structure [SS]. The SS measure was analyzed as a count variable (range = 0–17), following a Poisson distribution. There were main effects of age (Wald $\chi^2 = 11.68, p < .001$) and language of narration (Wald $\chi^2 = 8.10, p = .004$), but no interaction between factors. The significant effect of age showed that primary school pupils outperformed preschoolers (Estimated Marginal Means—EMM: 9.88 vs. 8.03). The language of narration effect indicated that there were more SS elements in Spanish than in Catalan narratives (EMM: 9.37 vs. 8.47). There was no main effect of exposure.

Structural Complexity [SC]. This measure was analyzed as a count variable (range = 0–9) following a Negative binomial distribution. The results showed a main effect of age (Wald $\chi^2 = 8.60$, p .003), indicating that preschoolers scored lower in SC than primary school pupils (EMM: 2.73 vs. 3.79), but no main effect of language of narration and no interaction between factors was observed. There was no main effect of exposure.

Internal State Terms [IST]. This measure was analyzed as a count variable following a Negative binomial distribution. We observed main effects of age (Wald $\chi^2 = 6.47, p = .011$), as well as language of narration (Wald $\chi^2 = 6.81, p = .009$), but no interaction between factors. The age effect showed that older children outperformed the younger ones (EMM: 6.46 vs. 5.09). The language of narration effect indicated that more IST were produced in Spanish than in Catalan (EMM: 6.22 vs. 5.29). There was no main effect of exposure.

Comprehension Questions [CQ]. This measure was analyzed as a count variable (range = 0–10) following a Poisson distribution. The results showed main effects of age (Wald $\chi^2 = 10.71$, $p = .002$) and language of narration (Wald $\chi^2 = 4.28$, $p = .039$), as well as a significant interaction between age and language of narration (Wald $\chi^2 = 8.31$, $p = .004$). The age effect showed that older children

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Table 2. Descriptive statistics (mean, SD) of macrostructural and microstructural categories according to age and language of narration

Macrostructural category	Age	N	Catalan *M (SD)*	Spanish *M (SD)*
Story structure (SS)	PRE	30	7.77(2.84)	8.33(2.40)
	PRI	40	9.30(2.88)	10.48(2.32)
Structural complexity (SC)	PRE	30	2.67(1.69)	2.80(1.65)
	PRI	40	3.80(2.21)	3.78(2.20)
Internal State Terms (IST)	PRE	30	4.77(3.04)	5.47(2.26)
	PRI	40	5.90(2.75)	7.05(2.55)
Comprehension questions (CQ)	PRE	30	8.33(1.75)	9.13(1.17)
	PRI	40	9.58(.64)	9.50(.68)
Microstructural category	**Age**	**N**	**Catalan *M (SD)***	**Spanish *M (SD)***
Total number of words (TNW)	PRE	30	78.80(32.63)	73.10(27.75)
	PRI	40	98.38(28.52)	97.00(21.35)
MLCU	PRE	30	7.06(1.24)	7.20(1.39)
	PRI	40	8.17(1.31)	7.31(1.03)
MLCUmax	PRE	30	7.60(2.00)	10.96(2.55)
	PRI	40	9.01(1.99)	11.90(2.21)
Subordination index (SI)	PRE	30	.19(.14)	.28(.18)
	PRI	40	.27(.17)	.24(.14)
Ungrammatical C-units	PRE	30	1.07(1.11)	1.43(1.25)
	PRI	40	.45(.64)	1.65(1.63)
Discourse markers	PRE	30	1.20(1.81)	1.10(1.03)
	PRI	40	1.25(1.37)	1.78(1.78)
Coordinating conjunctions	PRE	30	6.47(3.81)	6.50(3.04)
	PRI	40	6.10(3.05)	7.10(2.94)
Lexical diversity	PRE	30	23.07(5.31)	29.75(9.17)
	PRI	40	25.98(5.87)	27.36(7.83)
Code-switching	PRE	30	1.13(1.98)	2.17(3.02)
	PRI	40	.50(1.54)	.55(1.04)

Note: PRE: Pre-schoolers, PRI: Primary school pupils.

outperformed younger ones (EMM: 9.54 vs. 8.73). The language of narration effect indicated that a higher CQ score was obtained in Spanish than in Catalan (EMM: 9.28 vs. 8.98). The interaction effect showed that preschoolers had lower scores than primary school pupils in Catalan (EMM: 8.32 vs. 9.58) but not in Spanish, and that

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Table 3. Macrostructural categories according to age, language of narration, their interaction (GEE results, distribution, marginal means, and standard errors), and reported language exposure

Macrostructural category	Distribution	Age			Language of narration			Age x Language of narration					Reported language exposure
									PRE		PRI		
		Wald	PRE	PRI	Wald	CAT	SPA	Wald	CAT	SPA	CAT	SPA	b
Story structure (SS)	Poisson	11.68***	8.03[a] (.39)	9.88[b] (.36)	8.10**	8.47 [a] (.34)	9.37[b] (.28)	.40	7.77 (.51)	8.33 (.43)	9.30 (.45)	10.48 (.36)	.000 (.001)
Structural complexity (SC)	Negbin	8.60**	2.73 [a] (.22)	3.79[b] (.28)	.025	3.20 (.23)	3.24 (.22)	.10	2.67 (.30)	2.80 (.30)	3.80 (.35)	3.77 (.34)	−.001 (.002)
Internal State Terms (IST)	Negbin	6.46**	5.09 [a] (.40)	6.46[b] (.34)	6.81**	5.29 [a] (.35)	6.22[b] (.29)	.09	4.76 (.54)	5.46 (.41)	5.90 (.43)	7.05 (.39)	.001 (.001)
Comprehension questions (CQ)	Poisson	10.71**	8.73 [a] (.22)	9.54[b] (.09)	4.28*	8.98 [a] (.16)	9.27[b] (.12)	8.31**	8.32[a] (.31)	9.12[b] (.20)	9.58[c] (.10)	9.50[bc] (.11)	.001 (.001)

*Note.*CAT: Catalan, SPA: Spanish, PRE: Pre-schoolers, PRI: Primary school pupils, b: unstandardized regression coefficient.
*p < .05. **p < .01. ***p < .001.
Latin letters for marginal mean ranking by pairwise comparisons with Bonferroni correction, where "a" means the lowest mean. Marginal means are predicted probabilities.

performance in Spanish was higher than in Catalan in preschool children (EMM: 9.12 vs. 8.32) but not in primary school pupils. No main effect of exposure was observed.

Narrative microstructure

The microstructure analysis of narratives included 9 measures (see Method for details). Table 4 presents the GEE output for each microstructural measure by age, language of narration, the interaction of both factors, and the effect of exposure.

Total number of Words [TNW]. This measure was analyzed as a count variable following a Negative binomial distribution. The analysis revealed a main effect of age on TNW (Wald $\chi^2 = 11.96$, $p < .001$), with no observed main effect of language of narration or interaction between factors. Thus, primary school pupils created longer narratives than preschoolers (EMM: 97.76 vs. 75.78). There was no main effect of exposure.

MLCU and MLCUmax. These measures were analyzed as continuous variables following a Gamma distribution. We observed main effects of age (MLCU Wald $\chi^2 = 5.48$, $p = .019$, MLCUmax Wald $\chi^2 = 5.06$, $p = .024$) and language of narration (MLCU Wald $\chi^2 = 6.62$, $p = .010$; MLCUmax Wald $\chi^2 = 116.52$, $p < .001$) for both measures. The age effect showed that older children outperformed younger children in MLCU (EMM: 7.74 vs. 7.13) and MLCUmax (EMM: 10.37 vs. 9.11). The language of narration effect indicated that MLCU was higher in Catalan than in Spanish (EMM: 7.63 vs. 7.23), but MLCUmax was higher in Spanish than in Catalan (EMM: 11.38 vs. 8.30). A significant interaction between age and language of narration in MLCU (Wald $\chi^2 = 10.31$, $p = .001$) was observed, indicating that preschoolers had lower MLCU than primary school pupils in Catalan (EMM: 7.05 vs. 8.17) but not in Spanish and that MLCU of primary school pupils was higher in Catalan than in Spanish (EMM: 8.17 vs. 7.32). There was no main effect of exposure.

Subordination index [SI]. Analyzed as a continuous variable following a Normal distribution. All three main effects were insignificant. However, the interaction between age and language of narration was significant (Wald $\chi^2 = 9.56$, p .002), indicating that preschoolers had a lower SI when producing Catalan narratives than when producing Spanish narratives (EMM: .19 vs. .28), and when compared to primary school pupils in Catalan (EMM: .19 vs .27) but not in Spanish. There was no main effect of exposure.

Ungrammatical C-Units. This measure was analyzed as a count variable following a negative binomial distribution. No main effect of age was observed, but a main effect of language of narration (Wald $\chi^2 = 18.348$, $p < .001$) indicates that, when producing Spanish narratives, children produced more ungrammatical C-Units than when producing Catalan narratives (EMM: 1.52 vs. 0.70). There was also an interaction between age and language of narration (Wald $\chi^2 = 9.22$, $p = .002$): primary school pupils produced fewer ungrammatical C-Units in Catalan narratives than in Spanish ones (EMM: 0.44 vs. 1.59), and fewer than preschoolers in Catalan (EMM: 0.44 vs. 1.05) and in Spanish (EMM: 0.44 vs 1.39) narratives. Also, a main effect of exposure was observed ($b = 0.11$, $p = .016$), which indicated that children with higher Catalan exposure produced more ungrammatical C-Units. For better understanding of this effect, we correlated the language exposure score

https://doi.org/10.1017/S0142716425000013 Published online by Cambridge University Press

Table 4. Microstructural categories according to age, language of narration, their interaction (GEE results, distribution, marginal means, and standard errors), and reported language exposure

Microstructural category	Distribution	Age			Language of narration			Age x Language of narration					Reported language exposure
									PRE		PRI		
		Wald	PRE	PRI	Wald	CAT	SPA	Wald	CAT	SPA	CAT	SPA	b
Total number of words (TNW)	Negbin	11.96***	75.78[a] (4.91)	97.76[b] (3.45)	1.43	87.82 (3.82)	84.36 (3.15)	.70	78.63 (5.82)	72.99 (4.99)	98.51 (4.84)	97.02 (3.27)	.001 (.001)
MLCU	Gamma	5.48*	7.13[a] (.21)	7.74[b] (.15)	6.62*	7.63[b] (.15)	7.23[a] (.15)	10.31**	7.05[a] (.22)	7.19[a] (.25)	8.17[b] (.20)	7.32[a] (.16)	.001 (.001)
MLCUmax	Gamma	7.94*	9.11[a] (.34)	10.37[b] (.27)	118.98***	8.30[a] (.24)	11.38[b] (.29)	2.30	7.58 (.35)	10.93 (.45)	9.02 (.31)	11.91 (.34)	.001 (.001)
Subordination index (SI)	Normal	.56	.23 (.02)	.26 (.02)	.63	.24 (.02)	.25 (.02)	9.56**	.19[a] (.02)	.28[b] (.03)	.27[b] (.03)	.24[ab] (.02)	.000 (.001)
Ungrammatical C-units	Negbin	1.25	1.14 (.16)	.94 (.12)	18.30***	.70[a] (.11)	1.52[b] (.16)	9.22**	1.05[b] (.22)	1.39[b] (.21)	.44[a] (.09)	1.59[b] (.23)	.011* (.004)
Discourse markers	Negbin	1.51	1.10 (.20)	1.44 (.17)	1.19	1.16 (.18)	1.37 (.15)	1.46	1.14 (.29)	1.07 (.18)	1.22 (.20)	1.67 (.23)	.013** (.005)
Coordinating conjunctions	Negbin	.04	6.47 (.53)	6.60 (.38)	1.90	6.25 (.41)	6.83 (.36)	1.27	6.46 (.68)	6.50 (.55)	6.10 (.48)	7.10 (.46)	.000 (.001)
Lexical diversity	Gamma	.10	26.26 (1.04)	26.68 (.89)	9.91**	24.80[a] (.70)	28.26[b] (1.06)	5.88*	23.09[a] (1.05)	29.86[b] (1.83)	26.02[b] (.91)	27.34[b] (1.20)	.002 (.001)
Code-switching	Negbin	14.20***	1.41[b] (.38)	.39[a] (.10)	2.67	.60 (.16)	.90 (.18)	1.36	1.00 (.30)	1.92 (.53)	.37 (.15)	.41 (.10)	−.025* (.012)

*Note.*CAT: Catalan, SPA: Spanish, PRE: Pre-schoolers, PRI: Primary school pupils, b: unstandardized regression coefficient.
*p < .05. **p < .01. ***p < .001.
Latin letters for marginal mean ranking by pairwise comparisons with Bonferroni correction, where "a" means the lowest mean. Marginal means are predicted probabilities.

with the ungrammatical C-Units in each language of narration separately, among preschoolers and primary school pupils (a 2 by 2 correlation matrix). We observed for the former a lower number of agrammatical C-units in Catalan if exposure to Catalan was higher (r = −.392, p = .032) but not in Spanish, whereas primary school pupils produced more ungrammatical C-Units in Spanish if exposure to Catalan dominated (r = .429, p = .006) but not in Catalan.

Discourse markers. This measure was analyzed as a count variable following a Negative binomial distribution. There were no main effects of age or language of narration, nor interaction between them. However, there was a main effect of exposure (b = .013, *p* .005), meaning that children with higher exposure to Catalan showed an increased use of discourse markers. For better understanding of this effect, we correlated the language exposure score with the discourse markers in each language of narration separately, among preschoolers and primary school pupils. The correlations were not significant for preschoolers in either Catalan (r = .285, p = .127) or Spanish (r = .433, p = .005). However, there was a significant correlation for elementary children in Spanish (r = .051, p = .789). This suggests that, with higher exposure to Catalan, primary school pupils produced more discourse markers in Spanish narratives, but not in Catalan (r = .149, p = .358).

Coordinating conjunctions. This measure was analyzed as a count variable following a Negative binomial distribution. There were no main effects or interaction observed as for age and language of narration. Furthermore, there was no main effect of exposure.

Lexical diversity. This measure was analyzed as a continuous variable following a Gamma distribution. No main effect of age was observed, but there was a main effect of language of narration (Wald $\chi^2 = 9.91$, $p = .002$). This showed that children produced a higher D index in Spanish narratives than in Catalan ones (EMM: 28.26 vs. 24.80). A significant interaction between age and language of narration was found (Wald $\chi^2 = 5.88$, $p = .018$), whereby preschoolers had a lower D index in the Catalan narratives than in the Spanish ones (EMM: 23.09 vs. 29.86) and lower than primary school pupils in Catalan (EMM: 23.09 vs. 26.02) and in Spanish narratives (EMM: 23.09 vs. 27.34). No main effect exposure was observed.

Code-switching. This measure was analyzed as a count variable following a negative binomial distribution. A significant main effect of age was observed (Wald $\chi^2 = 14.20$, $p = <.001$), indicating that preschoolers made more code-switching than primary school pupils (EMM: 1.41 vs. 0.39). No main effect of language of narration or interaction between these factors was found. There was a main effect of exposure (b = −.025, p = .041) meaning that children with higher exposure to Catalan decreased the production of code-switching. For better understanding of this effect, we correlated the language exposure score with the code-switching produced in each language of narration separately, among preschoolers and primary school pupils. The correlations were significant for preschoolers in Catalan (r = −.393, p = .032) and in Spanish (r = −.487, p = .006), meaning that with higher exposure to Catalan they produced less code-switching in both languages. On the other hand, primary school pupils showed a significant correlation in Spanish (r = −.467, p = .002) but not in Catalan (r = −.294, p = .066), suggesting that, with higher exposure to Catalan, primary school pupils produced less code-switching in Spanish, but not in Catalan.

https://doi.org/10.1017/S0142716425000013 Published online by Cambridge University Press

Discussion

This study has provided detailed information on the development of narrative skills in both languages of Catalan-Spanish bilingual children, a scarcely studied combination and a good case study of a bilingual context where neither language serves as a minority input, meaning both are widely used in the community and not restricted to home settings. It has also contributed to improving language assessment in bilingual populations by exploring differences and similarities in narrative performance between languages, using different but comparable stimuli in the subjects' two languages through MAIN (Gagarina et al., 2012, 2019). Finally, it has added a new language combination to the existing body of MAIN research, contributing to the considerable number of studies that have already analyzed other language combinations (e.g., Andreou et al., 2022; Fichman, Walters, Armon-Lotem et al., 2022).

We have traced the development of narrative skills at the macrostructural and microstructural level, as a function of the language of narration (Catalan and Spanish), age (preschoolers—4–5 years vs. primary school pupils—6–7 years), and reported language exposure (to Catalan and Spanish). We found that both age and language of production had an impact on the macro- and microstructural levels, but the exposure effect only impacted performance at the microstructural level. Results showed that narrative performance at both macro- and microstructural levels improved with age. Nevertheless, certain aspects of these levels developed in both languages while some others developed only in one language. For instance, some aspects were already mastered in preschool in one language (usually Spanish) and only developed in primary school for the other language (usually Catalan). Also, different patterns were observed in some measures as a function of exposure. Children with higher exposure to Catalan produced more ungrammatical C-Units but code-switched less than children with lesser exposure to Catalan. Specifically, primary school pupils produce more ungrammatical C-units in Spanish. However, regardless of the amount of exposure to each language, children showed a better performance on macrostructural aspects when narrating in Spanish than in Catalan, despite their language of schooling being Catalan. However, for microstructural aspects, children showed a disadvantage in grammatical accuracy when narrating in Spanish.

Overall, these findings underline the importance of considering age, language of production, and exposure when assessing language development in bilingual children. Below we discuss in detail the main findings of the study for each of the research questions posed, in terms of their contribution to the existing literature on the development of narrative skills in bilingual populations.

Language

At the macrostructural level, we expected to find a similar performance in Catalan and Spanish narratives, since previous studies showed that macrostructure develops similarly in both languages of bilingual children (e.g., Altman et al., 2016; Fiani et al., 2022; Fichman, Walters, Armon-Lotem et al., 2022). Moreover, it has been suggested that the structural complexity of stories should be relatively invariant

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across the two languages (e.g., Gagarina et al., 2016; Rodina, 2017). Indeed, we found that children performed similarly in structural complexity in both languages, as previously observed in language combinations such as Swedish-English (Bohnacker, 2016), and Finnish-Swedish (Kunnari et al., 2016). In contrast, we observed a better performance in Spanish over Catalan narratives when it came to the other macrostructural measures: story structure, internal state terms, and comprehension questions. These results are similar to those of Roch et al. (2016), who reported an advantage of one language over the other on all macrostructural measures. Kapalková et al. (2016) and Tribushinina et al. (2022) also found an advantage of one language over the other on story structure, and Bohnacker (2016) reported a language-specific advantage in comprehension. However, almost all of these previous studies examined a majority language and a minority language in children with a sequential bilingual profile and reported advantages of the majority language over the minority language (Pesco & Kay-Raining, 2016). The one exception was a study by Lindgren & Bohnacker (2022), which found that a better performance of story structure was observed in the societal language compared to the home language.

With regard to microstructure, we expected differences between Catalan and Spanish narratives, since the skills involved should be more language-specific and less predisposed to transfer (e.g., Roch et al., 2016; Rodina, 2017). Nonetheless, we found a language effect only in certain measures. Catalan narratives had a higher MLCU than Spanish narratives for primary school pupils, while Spanish narratives had a longer MLCUmax and higher lexical diversity for preschoolers. However, Spanish narratives contained more ungrammatical C-Units than Catalan narratives for primary school pupils. The other measures behaved similarly in both languages: total number of words (as Gagarina et al., 2016 found for Russian-German, and Kunnari et al., 2016 for Finnish-Swedish), subordination index, coordinating conjunctions, discourse markers, and code-switching.

Altogether, our findings on narrative measures point to the fact that complexity of story structure, total number of words, subordination index, connectivity devices, and code-switching does not vary depending on the language of assessment. This suggests that these aspects could be evaluated in either of the languages of these bilingual children. On the contrary, the other macrostructural measures and some microstructural measures (i.e., those referred to morphosyntactic complexity, lexical diversity, and ungrammaticality) show differences as a function of what language the children are assessed in.

Findings suggest a complex scenario at the microstructural level, without a regular advantage in performance for a particular language, since some measures favor Catalan narratives and others favor Spanish narratives. It seems that the advantages of some measures displayed in Catalan narratives are restricted to the primary children group, in which children have been attending school in Catalan for longer, whereas the advantages shown by some measures in Spanish are associated only with the preschool years.

However, at a macrostructural level, Spanish holds an advantage in most measures, which is surprising given that schooling is in Catalan. One possible explanation for this is the sociolinguistic context in which these children grow up, in which they have had more access to stories in Spanish than in Catalan (movies,

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series, books, TV). Another result that reinforces this possible explanation is that in Spanish no differences are found between preschoolers and primary school pupils in comprehension, while in Catalan there are differences. This finding suggests that in Spanish they have developed the ability to understand stories earlier. Perhaps this also contributes to explaining why preschoolers show greater lexical diversity in Spanish than in Catalan.

Age

Our expectation was to find an effect of age on most of the macro- and microstructural measures in both languages (e.g., Bohnacker, 2016; Gagarina, 2016; Maviş et al., 2016). Indeed, we found a better performance in the older group for all macrostructural measures, suggesting a development in story structure, structural complexity, internal state terms, and comprehension from preschool to the early grades of primary school. However, this pattern was not always observed in both languages. Specifically, in comprehension, preschoolers exhibited lower scores than primary school pupils in Catalan, although not in Spanish. When narrating in Spanish, preschoolers seem to have already achieved a high level of proficiency in comprehension questions, with no room for improvement. This is consistent with the findings from Gagarina et al. (2020), who suggest that children aged five are able to answer most comprehension questions of MAIN, but thereafter their development plateaus. However, studies examining how the elicitation modality influences comprehension generally suggest that performance is better after listening to the story, since retelling or model story modalities are easier than comprehension without listening the story first (Gagarina & Bohnacker, 2020).

Moreover, some studies have found a task effect, where MAIN Cat/Dog picture sequences were easier as compared to Baby Birds/Baby Goats (Bohnacker et al., 2020; Lindgren & Bohnacker, 2020). Hence, employing different story sequences might yield different results. Additionally, it has been suggested that conducting an analysis of individual comprehension questions enables the detection of patterns which are not evident in overall scores (Lindgren & Bohnacker, 2020). Therefore, the exclusive use of Cat and Dog sequences in our study and the analysis based on the total score may influence the obtained results.

At the microstructural level, our expectations were partially observed. We found that narrative length in TNW increased with age in both languages. Also, primary school pupils outperformed preschoolers in terms of MLCUmax and code-switching in both languages. In the case of MLCU, this occurred in Catalan narratives but not in the Spanish ones. As this measure reflects how information is organized in discourse, a higher MLCU resulting in longer and more densely packed CU might be favored by the language of schooling, leading to denser discourse units primarily in Catalan narratives.

In the cases of lexical diversity and subordination index, age effects also manifested in interaction with language but in an unexpected way: children had reached the same level of performance in Spanish narratives at the first age group than in Catalan narratives at the older age group, thus showing no improvement

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with age in the case of Spanish. This points to an earlier mastery of these aspects in Spanish than in Catalan.

Altogether, these results support the idea that the microstructural level of narratives is more specific to the language and less likely to be influenced by transfer. This underlines the need to assess these aspects in each language (e.g., Roch et al., 2016; Rodina, 2017). On the other hand, the age effects observed in both languages of narration point to a parallel development in the two languages in the case of story structure, structural complexity, internal state terms, TNW, and code-switching.

In contrast, no significant age-related differences were found in either language regarding discourse markers. Also, we observed that these devices showed a low frequency of use across age groups. These results suggest that these might develop later on in life, as found by studies with older children and adolescents (Aparici et al., 2021; Rosado et al., 2021). In fact, virtually no types of discourse markers have been observed in our narratives, with the exception of temporal and early developing markers as reported by studies on young children's narratives (e.g., Berman, 1998), such as "then," "afterwards," etc. Coordinating conjunctions did not show age-related differences either. However, in this case, the device was widely used across age groups, suggesting it is the main mechanism these children use for connectivity. It is well known that coordination precedes subordination as the predominant syntactic mechanism of discourse connection (Auza, 2013; Berman, 1998; Hess & González, 2013; Sebastián & Slobin, 1994). Nonetheless, it has previously been reported that between the ages of 5 and 9 children increase the use of subordination and decrease the use of coordination (Sebastián & Slobin, 1994). This has not been observed in our study. This could be because the developmental change of our participants may still be in progress, considering that our older participants are 7-year-olds.

Exposure

As predicted, there was no effect of exposure in any macrostructural measure in either language of production. Some studies on macrostructure using MAIN measures in bilingual children have studied bilingualism factors like language exposure (Bohnacker et al., 2022; Haman et al., 2017; Lindgren & Bohnacker, 2022) and language dominance (Fiani et al., 2022; Fichman, Walters, Armon-Lotem et al., 2022). Similar to our results, Bohnacker et al. (2022) observed no influence of length of exposure (LoE) or daily language exposure to the majority language (Swedish) on macrostructure in Turkish-Swedish bilingual children. Consistent with Lindgren & Bohnacker (2022), exposure to the minority language (German) did not show any effects on macrostructure in German-Swedish bilingual children. In contrast, Haman et al. (2017) found a positive association between cumulative exposure to languages (the time a person has spent exposed to a particular language throughout their life) and story structure in the minority language (Polish), suggesting that increased language exposure enhances narrative abilities in English-Polish bilingual children. Some other MAIN studies reported advantages for the majority language over the minority one in some measures (e.g., Kapalková et al., 2016; Roch et al.,

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2016), but our results cannot easily relate to these: Catalan or Spanish cannot be considered as minority languages, as both are official languages in Catalonia and are socially and culturally used in the region (Ortega, 2020). Children are raised in a socially bilingual environment, where they experience different degrees of exposure to two typologically similar languages, neither of which is considered a minority or heritage language (Serrat et al., 2021).

In addition to the studies conducted in contexts where one language is majoritarian, there are two studies in bilingual Lebanese Arabic-French children in Lebanon, where French and Lebanese Arabic are both majority languages. Fiani et al. (2022) have analyzed the relationship between macrostructure performance and bilingualism factors by using a language dominance index which considers aspects including age of onset, language exposure contexts before the age of four, current language skills, languages used at home and languages used outside the home during routine activities. The study found a limited impact of language dominance in story structure, structural complexity, and use of internal state terms. Fiani et al. (2020) also found no impact of dominant language in narrative comprehension abilities. The limited impact of bilingual factors in this context could be attributed to the continuous exposure to both languages, French and Lebanese Arabic, even in the school system, as both are majority languages in Lebanon (Fiani et al., 2022). Similarly, in our study, where both Catalan and Spanish are majority languages, we did not find significant effects of exposure at the macrostructural level. These findings reinforce the idea that in contexts where two languages are majority languages, the effects of bilingual features on narrative macrostructural skills may be mitigated.

We had predicted an effect of exposure for some microstructural measures, as lexical and morphosyntactic skills remain more language-specific and depend on the child's language exposure and use (Iluz-Cohen & Walters, 2012). This was confirmed overall, as the effects of exposure were found only in microstructural aspects. However, only few measures showed an exposure effect. Specifically, we observed that children with higher Catalan exposure produced more ungrammatical C-Units than children with less exposure. On the other hand, higher exposure to Catalan children used more discourse markers and code-switched less than children with less Catalan exposure. On all other measures, children showed similar performance regardless of their language exposure.

The impact of exposure on narrative microstructure has been understudied. However, Altman et al. (2016) revealed that only sentence length, MLCU, and MLCUmax were influenced by LoE in narratives of English-Hebrew bilingual children. Also, a recent study using MAIN by Fichman, Walters, Armon-Lotem et al. (2022) examines microstructural measures and language dominance in bilinguals. Their results show differences between language dominance groups for only a few measures: children with Hebrew DL produced higher lexical diversity in Hebrew than in Russian narratives, while no differences were observed for TNW, number of C-Units, and MLCU. As some authors have suggested (Fiani et al., 2022; Fichman, Walters, Armon-Lotem et al., 2022), we included in our study a variety of microstructural measures such as productivity, syntactic complexity and grammar and lexicon, but have found an effect of exposure only on ungrammatical C-Units, discourse markers, and code-switching. More studies on different language

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combinations are needed to provide information on the effect of exposure and language dominance, both to enrich our knowledge on bilingual narrative development, and to customize language assessment in bilingual children.

When observing the influence of exposure at the microstructural level, we found some measures where age and language of production showed a correlation with exposure. In particular, with higher exposure to Catalan: both preschoolers and primary school pupils tended to make fewer errors in Catalan narratives but not in Spanish; primary school pupils produced more discourse markers than preschoolers in Spanish narratives, but not in Catalan; and preschoolers produced less code-switching in both languages, while primary school pupils produced less code-switching in Spanish, but not in Catalan. Finally, at the macrostructural level, we found no correlations between exposure and age in any language of production.

It appears that, at the microstructural level, children with higher exposure to Catalan exhibited a better performance in the grammaticality of their narratives in Catalan but not in Spanish. This performance may be related to the type of exposure they get at school. However, the grammatical accuracy of narratives in Spanish do not seem to be influenced by this school exposure. On the other hand, the use of discourse markers and code-switching show age differences only in children with higher exposure to Catalan, and in some cases only in one language of narration. These results show the importance of the language of schooling in the evolution of some relevant aspects of narrative microstructure and suggest that certain measures of a language's microstructure may be more affected by the quantity (and maybe quality) of linguistic exposure received over a period of time.

Conclusions

This is the first study that uses MAIN measures to characterize narrative development in Catalan-Spanish bilingual children. We have provided a detailed description of narrative skills at both macro and microstructural levels, considering factors such as language exposure in children growing up with this language combination, thus contributing to the identification of profiles of narrative development in this population. This in turn contributes to language assessment in this population and possibly other bilingual populations.

First, this study finds that defining the parameters of typical development in the L1 and L2 of these bilingual children can serve as a basis for accurate linguistic assessment (Dam et al., 2020). Secondly, MAIN adds to the available assessment tools in one of the targeted languages, Catalan, which are otherwise scarce. Thirdly, the distinction provided in this study between aspects within the two languages that are subject to similarities and variations can contribute to the design and planification of linguistic assessment in this and other bilingual populations, especially those involving typologically close languages. Based on this distinction, we could differentiate those aspects that should be assessed in each language separately from those that can be assessed in any of the two languages.

Finally, this study adds to the body of literature featuring MAIN assessment of narrative skills in bilingual children and opens the possibility of using MAIN in Catalan and Spanish-speaking populations with developmental language disorders.

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This can help advance toward the ultimate goal of providing an instrument to distinguish typically developing bilinguals from bilinguals with developmental language disorder DLD (e.g., Lindgren et al., 2020; Gagarina et al., 2020; Pesco & Kay-Raining, 2016). However, further research is first needed on the identification of clinical markers in narrative production, and their potential to guide speech therapy evaluation and intervention in this population. Alongside research by Dam et al. (2020), results from this typically developing sample lay the groundwork for investigations of language disorders in this bilingual population.

However, it is important to point out that working with bilingual children presents challenges, due to the heterogeneity of profiles and language combinations. This can make it difficult to identify diagnostic profiles and generalize research findings (Nieva et al., 2020). Such a challenge may result in both overdiagnosis and underdiagnosis of language disorders, as some typically developing children exposed to multiple languages may experience similar difficulties to children with DLD (e.g., Marini et al., 2019). To achieve the goal of distinguishing typically developing bilinguals from bilinguals with developmental DLD, it is recommended to incorporate a narrative task alongside other assessment measures (Boerma et al., 2016), as using multiple tools for diagnosing DLD is essential (Boerma & Blom, 2017; Thordardottir et al., 2015).

Acknowledgments. We are grateful to the children who participated in this research and their parents, as well as to the teaching staff of schools (Escola Joan Miró and Escola El Vapor) for their collaboration. We would like to thank Paula Resina, Meritxell Ramoneda, Carlos Trillo, Nuria Dominguez, and Maria Berbel for their help in collecting and coding the narratives. We are also thankful to Dr. Gabriel Liberman and Dr. Iban Mañas for their invaluable statistical advice.

Replication package. All research materials, including recruitment materials, linguistic background questionnaire task instructions, as well as the data, instructions, and code required to reproduce all analyses, are available at: https://osf.io/9h2ze/. The full MAIN versions, including pictures and scoring protocols, are located on the MAIN website https://main.leibniz-zas.de and are accessible after registration.

Notes

1 See the special issue on narrative skills in bilingual children in *Applied Psycholinguistics (Gagarina et al., 2016),* the special issue on the acquisition of referentiality in children's narratives in *First Language* (Gagarina & Bohnacker, 2022), the special issue on storytelling in bilingual children in *Linguistic Approaches to Bilingualism* (Bohnacker & Gagarina, 2022), and the book *Developing narrative comprehension: Multilingual Assessment Instrument for Narratives* (Bohnacker & Gagarina, 2020).

2 Scoring was conducted by the authors and a speech therapist who was trained on the measures and scoring systems.

3 Each main clause and its subordinate clauses represent one C-unit (Loban, 1976).

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Appendix I. Distribution of participants according to language-reported exposure index (Ei)

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
−56.50	2	1.4	1.4	1.4
−48.50	2	1.4	1.4	2.9
−47.00	2	1.4	1.4	4.3
−43.50	4	2.9	2.9	7.1
−41.00	2	1.4	1.4	8.6
−29.96	2	1.4	1.4	10.0
−27.20	2	1.4	1.4	11.4
−24.58	2	1.4	1.4	12.9
−18.00	4	2.9	2.9	15.7
−15.84	2	1.4	1.4	17.1
−14.70	2	1.4	1.4	18.6
−13.77	2	1.4	1.4	20.0
−12.00	6	4.3	4.3	24.3
−10.00	2	1.4	1.4	25.7
−6.00	4	2.9	2.9	28.6
.00	46	32.9	32.9	61.4

(*Continued*)

https://doi.org/10.1017/S0142716425000013 Published online by Cambridge University Press

(*Continued*)

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
3.47	2	1.4	1.4	62.9
4.00	2	1.4	1.4	64.3
6.00	4	2.9	2.9	67.1
7.80	2	1.4	1.4	68.6
10.60	2	1.4	1.4	70.0
11.22	2	1.4	1.4	71.4
13.25	2	1.4	1.4	72.9
14.60	2	1.4	1.4	74.3
15.25	2	1.4	1.4	75.7
15.98	2	1.4	1.4	77.1
16.80	2	1.4	1.4	78.6
18.00	2	1.4	1.4	80.0
18.50	2	1.4	1.4	81.4
20.25	2	1.4	1.4	82.9
24.64	2	1.4	1.4	84.3
26.40	2	1.4	1.4	85.7
28.40	2	1.4	1.4	87.1
28.50	2	1.4	1.4	88.6
31.00	2	1.4	1.4	90.0
31.60	2	1.4	1.4	91.4
32.40	2	1.4	1.4	92.9
33.64	2	1.4	1.4	94.3
37.00	2	1.4	1.4	95.7
46.00	4	2.9	2.9	98.6
50.80	2	1.4	1.4	100.0
Total	140	100.0	100.0	

Cite this article: Camus Torres, A. & Aparici, M. (2025). Narrative skills of Catalan-Spanish bilingual children: macrostructural and microstructural development and assessment. *Applied Psycholinguistics*. https://doi.org/10.1017/S0142716425000013