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READING DEVELOPMENT IN ITALIAN MONOLINGUAL AND BILINGUAL CHILDREN
WITH A MIGRATION BACKGROUND

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Coordinator: Prof. Stefan Rabanus

Signature Stefan Rabanus

Supervisor: Prof. Chiara Melloni

Signature Chiara Melloni

Supervisor: Prof. Maria Vender

Signature Maria Vender

Doctoral Student: Dr. Sara Cavaglià

Signature Sara Cavaglià

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Abstract

The present dissertation aims to investigate how monolingual and bilingual children with a migration background who are acquiring literacy in Italian perform in reading predictors and reading skills. The motivation behind this research stems from the challenges that this bilingual population faces when dealing with diagnoses of reading impairments. Unlike other bilingual groups, bilingual children with a migration background begin to be consistently exposed to the community language, also their language of formal instruction, upon entering kindergarten or school. Before that age, these children are mainly exposed to their family language, which is typically a minority language lacking official support or recognition in society. Such a fragile linguistic context, often accompanied by socioeconomic disadvantage, can lead these children to start formal schooling with an incomplete mastery of the language of instruction. Crucially, this low proficiency in turn affects the trajectory of literacy acquisition, causing bilingual children with a migration background to lag behind their monolingual peers. Consequently, this atypical reading development path can have significant implications for the diagnosis of reading impairments. In fact, using reading assessments standardised on monolingual populations – assessments that may not capture bilingual children’s linguistic vulnerabilities – can lead to overdiagnosis of reading impairments. Conversely, adopting a ‘wait-and-see’ approach, expecting spontaneous improvement in linguistic and reading skills, may result in underdiagnosis of reading disabilities and prevent children from benefitting from timely intervention. Adding to this complex scenario, very few studies have investigated linguistic and reading skills in bilingual preschoolers or beginning readers acquiring literacy in Italian.

Previous research in other languages and with older populations has shown that specific metalinguistic skills are reliable predictors of subsequent reading acquisition, even in bilingual children. This is because, unlike literacy, these skills begin to develop early, even before the onset of formal reading instruction, as they are acquired spontaneously as part of typical language development. Furthermore, a detailed investigation of the socioeconomic context has proven essential for understanding school outcomes in bilingual children with a migration background.

Building on these premises, three original studies are presented. Study 1 is a longitudinal study examining how preschool performance in pre-reading skills among monolingual and bilingual children with a migration background predicts later reading outcomes. Study 2 is an intervention study aimed at exploring the short- and long-term effects of a didactic intervention focused on

phonological awareness, administered to monolingual and bilingual kindergarteners. Finally, Study 3 analyses the profile of reading and reading-related abilities in monolingual and bilingual first graders, as well as the effects of phonological training on concurrent phonological and reading skills.

Overall, the results presented in this dissertation confirm the relationship between preschool performance in language tasks and later reading skills. They also suggest that bilingual children at risk for reading impairment can be identified even before school entry, provided that metalinguistic and socioeconomic factors are adequately assessed. In addition, reading predictors with a central role in reading development (i.e., phonological awareness) can be effectively enhanced both in preschoolers and emergent readers, producing positive effects on both phonological and literacy skills.

Introduction

Reading is a unique human ability. Through written language, human beings communicate, exchange ideas, narrate and expand their knowledge of the world. Crucially, adequate literacy skills are at the basis of academic success. In typically developing contexts, such skills are acquired effortlessly by very young children, if explicitly taught. However, some individuals might struggle in their reading acquisition path, either due to specific reading impairments, such as developmental dyslexia, or to a limited competence in the language in which literacy should be acquired. This is often the case of bilingual individuals with a migration background.

Mainly comprising first- and second-generation immigrants, this population presents heterogeneous linguistic profiles, but it is typically characterized by a substantial exposure to the family language during its first years of life, which is then gradually reduced in favour of the community language (Montrul, 2012). This initial limited exposure to the community language, which is often the only language in which bilinguals with a migration background receive formal education, together with other social and cultural factors, may hamper the early stages of reading acquisition, causing children with this linguistic profile to lag behind their monolingual peers (Cummins, 1979b; Ginsborg, 2006; Verhoeven, 1990). If not adequately identified, such initial difficulties might lead to a risk of misdiagnosis of reading impairments (Bedore and Peña, 2008; Deponio et al., 2000; Paradis, 2007a; Samson and Lesaux, 2009).

In today's increasingly cosmopolitan world, where migratory phenomena are on the rise and an ever-growing number of children are learning literacy in a second language, it is of utmost importance to develop screening protocols capable of correctly discriminating between initial reading difficulties due to limited proficiency in the language of instruction or caused by actual impairments. Supporting bilingual children with a migration background starting from the very onset of their formal education is the most effective way to ensure equal opportunities for their future development.

Building on these premises, the present dissertation includes a literature review and three original studies developed around three main goals: (i) to gain a clearer reading and reading-related abilities profile of bilingual beginning readers acquiring literacy in their community language; (ii) to design early screening protocols focused on reading predictors; and (iii) to create didactic interventions aimed at supporting pre-reading skills, such as phonological awareness. The primary motivation behind the present studies, in addition to the urgent need to develop

adequate assessment tools for the target population, was the limited research on reading acquisition in languages other than English, particularly in bilingual contexts and at the early stages of reading acquisition.

Overview of the dissertation

The present dissertation is organized as follows.

Chapter 1 presents a review of the literature on reading acquisition in typical learners and in fragile bilingual populations. Adopting the Simple View of Reading as a theoretical framework (Gough and Tunmer, 1986; Hoover and Gough, 1990), the chapter illustrates how reading comprehension can be explained as the product of decoding and language comprehension, and it examines the components underlying these processes. After that, we explore what it means to learn to read in a community language that is different from the family language, and the implications for bilingual populations with a migration background.

Chapter 2 focuses instead on the linguistic predictors of reading skills and on the didactic interventions targeting these predictors. After a brief overview, early linguistic predictors are analysed in depth. The second part of the chapter presents and compares existing studies on phonological training.

Chapter 3 presents the first original study, *Predicting emerging reading skills: a longitudinal study on monolingual and bilingual preschool children acquiring literacy in Italian*. This longitudinal study followed a sample of monolingual and bilingual children from their final year of kindergarten to 2nd Grade, assessing linguistic predictors of reading skills during preschool, and measuring reading skills in 1st and 2nd Grades. The aim of this study was to investigate the predictive value of preschool language skills on subsequent literacy performance across the two populations.

Chapter 4 illustrates our second study, *Phonological awareness in monolingual and bilingual preschool children: short- and long-term effects of a didactic intervention*. Building on the same sample as in Study 1, the research was designed to measure the effectiveness of phonological training on phonological awareness and later reading skills in both monolingual and bilingual preschoolers.

Chapter 5 focuses on the third and final study, *Supporting emerging reading skills: effectiveness of phonological training in multilingual primary school classes*. The study aimed to provide a clearer profile of reading and reading-related abilities of monolingual and bilingual first graders acquiring literacy in Italian, an understudied population in the literature. Besides, an intervention focused on phonological skills was proposed to a selected subgroup to evaluate its effects on both phonological awareness and literacy components.

Finally, a comprehensive summary of the entire work is provided at the end of the dissertation (Chapter 6), highlighting its main findings, limitations, and directions for future research.

Chapter 1 – Foundations of literacy acquisition in typical and fragile bilingual populations

1.1. Reading and reading acquisition

Reading is the ability to extract meaning from written language. Despite this apparently simple definition, reading requires the simultaneous involvement and coordination of various processes and components, including language and context knowledge, memory skills, and additional cognitive as well as motor resources. Given the multivariate nature of reading, it is not surprising that this ability has been investigated from multiple perspectives in recent years.

From a linguistic perspective, one of the most influential and widely adopted frameworks for defining reading abilities – and more precisely, reading comprehension – is the Simple View of Reading (SVR; Gough and Tunmer, 1986; Hoover and Gough, 1990). According to this model, reading comprehension is the product of two main components: decoding and language comprehension. Decoding is defined as the ability to convert print symbols into language units (Gough and Tunmer, 1986). In fluent readers, the decoding process is fast and accurate; as a result, decoding abilities are typically measured in terms of reading speed and accuracy. Language comprehension, by contrast, is defined as ‘the ability to attribute semantic meaning to spoken words’ (Melby-Lervåg and Lervåg, 2014, p. 410), and is what enables readers to extract information from print.

The ultimate goal of reading instruction is, therefore, to help children become fluent readers who can easily access the information contained in written text. To achieve this, children must progress through a series of decoding stages that enable them to convert increasingly larger portions of print, while simultaneously developing adequate language comprehension skills, which are essential for managing more cognitively and linguistically complex tasks.

1.1.1. Decoding acquisition

As explained by Gough and Tunmer (1986), decoding is the ability to convert print symbols into language units. This definition entails that learning to read means understanding that arbitrary written symbols represent speech sounds – phonemes, in alphabetic orthographies; syllables,

in syllabic orthographies, and so on. Unlike oral languages, this mapping is not learnt spontaneously, but requires explicit instruction and continuous practice.

According to the developmental theory by Frith (1986), children progress through three phases in the acquisition of orthographic skills. In the first stage, known as the logographic phase, children are able to recognise specific words – such as their own name – by their overall visual shape or by salient features. With increased exposure to print, they transition to the alphabetic phase, in which orthographic representations of letters are associated with their corresponding sounds and then blended together. Finally, children reach the orthographic phase, where larger units of print (e.g., syllables or morphemes), or even whole words, are instantly and automatically recognized. The more automatic this process becomes, the less effort is required for decoding, thereby freeing up cognitive resources for comprehension.

The reading acquisition model hypothesised by Frith (1986) was further elaborated by Ehri (1995, 2005). The main contribution of the latter author is the division of Frith's alphabetic phase into two distinct phases, in order to capture in greater detail the stages children go through while acquiring reading. The first phase postulated by Ehri (1995, 2005) and defined as *pre-alphabetic*, roughly corresponds to the logographic phase hypothesised by Frith (1986). In this phase, children are able to read salient or frequent words not by accessing their orthographic content, but rather their visual information – similarly to what happens when expert readers encounter highly visually salient written words, such as famous brand names. To support this hypothesis, the author reports findings showing that even children who had not yet received explicit reading instruction were able to read the word *Pepsi* if written in its typical font, even when spelled incorrectly (Masonheimer et al., 1984).

After acquiring basic reading principles, but before reaching an automatized decoding, children go through a *partial alphabetic* and a *full alphabetic* phase, which in Frith's model (1986) were synthesised into a single alphabetic phase. During the former, children start to identify and remember some of the letters included in salient words, typically those at the beginning and at the end. Consequently, they may be able to read correctly familiar words such as *spoon*, but may make mistakes with less familiar words sharing initial and final letters with more salient ones, such as *spin*. This risk becomes more limited in the third phase, the *full alphabetic* phase: here children become able to associate written and oral forms of phonemes more consistently and apply the conversion rule to read words correctly. Finally, in the *consolidated alphabetic* phase, grapheme-phoneme mappings become so automatic after extensive exposure to print that

readers gradually build an orthographic mental lexicon, allowing for fast and accurate access to written words (orthographic phase in Frith's (1986) framework).

Frith's (1986) and Ehri's (1995, 2005) models effectively explain the developmental path of decoding acquisition, but do not account for how the conversion of written symbols into spoken language actually occurs. A more comprehensive account of how print is converted into language with varying degrees of automaticity is provided by the Dual Route Cascaded model, proposed by Coltheart and colleagues (2001). According to this computational model, word recognition can occur via two distinct pathways: the grapheme-phoneme conversion route and the lexical route. Through the former, readers apply grapheme-phoneme conversion rules to associate single letters or groups of letters (in alphabetic systems) with their corresponding sounds. This parsing strategy is necessary when encountering unfamiliar words or pseudowords (i.e., nonwords constructed according to the phonotactic rules of a given language).

The lexical route, by contrast, relies directly on the orthographic input lexicon – the part of the mental lexicon where orthographic forms are stored. These forms are then associated with their phonological output and semantic representation, allowing readers to decode whole words both quickly and accurately. This route is typically employed with familiar and frequent words, as well as with irregular words whose correct decoding would be compromised if processed solely through grapheme-phoneme conversion. As Frith (1986) had already hypothesized, children at the very beginning of formal reading instruction are only able to rely on the grapheme-phoneme conversion route. At this stage, all written stimuli are treated as novel words, and beginning readers must depend on their emerging knowledge of print symbols and their conversion into phonemes to take their first steps in reading. With increasing exposure to print, their orthographic lexicon gradually expands, and recognition of words becomes progressively more automatic.

Beyond these decoding strategies, which are shared across languages, there are also orthography-specific aspects that may influence the acquisition of decoding. These are usually referred to as orthographic transparency, granularity and availability (Goswami, 2010). Orthographic transparency refers to the complexity of the rules governing grapheme-phoneme mapping. In orthographically transparent languages such as Italian or German, letters (or specific groups of letters) typically show a one-to-one mapping with phonemes, resulting in high consistency and predictability in grapheme-phoneme conversion. In Italian, for example, even though the grapheme <c> can be associated with two different phonemes (/k/ and /tʃ/), its correct pronunciation can be systematically deduced from the orthographic context: it is realized as the plosive velar /k/ when followed by a back or central vowel (/u/, /o/, /ɔ/, /a/), and as the

postalveolar affricate /tʃ/ when followed by a front vowel (/i/, /e/, /ɛ/). Beginning readers, therefore, only need to learn this contextual rule and then apply it consistently. By contrast, in orthographically opaque languages, grapheme-phoneme mapping often follows one-to-many and many-to-one relations. For instance, in English, one of the most opaque languages, the digraph <th> can represent both /ð/ (*this*) and /θ/ (*think*), even when followed by the same vowel /ɪ/. At the same time, the diphthong /aɪ/ can be represented either by the grapheme <a>, as in *cave*, or by <ai>, as in *faith*. As a result, children learning to read in a transparent orthography can rely more consistently on the grapheme-phoneme conversion route in the early stages, whereas this is not the case for learners of an opaque orthography. Consequently, learning to read in an opaque orthography generally requires a longer period of instruction: for example, children acquiring English take more than twice as long as their peers learning a transparent orthography to reach comparable levels of accuracy (Seymour et al., 2003).

Another orthography-related aspect that can influence decoding acquisition is granularity, which refers to the smallest unit on which an orthographic system is based (Vender and Guasti, 2020). In alphabetic languages, such as English or Italian, these units are letters, whereas in syllabic languages, like Japanese, they are syllables. As noted by Goswami (2010), the number of mappings a child needs to learn in a syllabic orthography is higher than in an alphabetic one, since the number of syllables is always greater than the number of letters in any language.

One final aspect concerns orthographic availability. According to Goswami (2010), this concept refers to how easily beginning readers can access the phonological units of a given language. Larger phonological units, such as syllables, are typically available to children even before the onset of formal reading instruction, whereas smaller units (e.g., phonemes) are not (Anthony et al., 2002; Treiman and Zukowski, 1996). Children learning to read in a syllabic orthography such as Japanese will therefore have faster access to these units in their written form compared to children learning letter-phoneme correspondences in an alphabetic orthography. Similarly, children acquiring literacy in a transparent phoneme-based orthography such as Italian are at an advantage compared to those learning an opaque phoneme-based orthography such as English, due to the irregularities of the latter's grapheme-phoneme mapping.

Taken together, these orthographic characteristics play a crucial role in shaping how children approach and master the decoding process. Understanding their influence is essential not only for explaining cross-linguistic differences in reading acquisition but also for interpreting the specific challenges faced by bilingual children learning to read in languages that differ in their orthographic depth. When these dimensions are considered jointly, it becomes possible to

conceptualize a continuum of ease of acquisition defined by the combined effects of transparency, granularity, and availability.

On this hypothetical three-dimensional continuum of ease of acquisition based on transparency, granularity and availability, Italian would be placed among the most accessible languages in terms of decoding. As we have seen, grapheme-phoneme conversion in Italian is highly transparent and predictable, with minimal granularity, whereby lower availability of phoneme-level units is compensated for by the shallow orthography. This is confirmed by experimental evidence showing that children learning to read in a transparent orthography reach about 90% of accuracy in reading assessments by the end of 1st Grade, whereas those learning in an opaque orthography reach only around 70% (Seymour et al., 2003). Nevertheless, despite initial differences in acquisition timing and strategies, all typically developing learners eventually achieve the same level of fluency in decoding. Early linguistic and extra-linguistic factors that predict later success in decoding will be discussed in more detail in Chapter 2.

1.1.2. Language comprehension acquisition

As emerged from Section 1.1.1, the decoding mechanism requires explicit instruction to be acquired, plus an extensive exposure to print to become automatic. The requirement of explicit instruction differentiates decoding from language comprehension, the other factor included in the Simple View of Reading equation (Gough and Tunmer, 1986; Hoover and Gough, 1990). Oral language comprehension is a multicomponent ability that, unlike decoding, begins to develop long before formal reading instruction as part of the typical language acquisition process (National Institute for Literacy, 2008). Evidence has shown that vocabulary, grammatical knowledge, verbal working memory, and inferential skills all contribute to predicting language comprehension abilities (Lervåg et al., 2018).

A more detailed analysis of the linguistic predictors of reading comprehension will be provided in the following chapter. For the time being, it is worth noting that the relative predictive power of decoding and language comprehension on reading comprehension has been shown to vary according to the transparency of the orthography investigated. In a longitudinal study on English, for instance, Storch and Whitehurst (2002) found that print knowledge and phonological awareness were more adequate predictors than oral language in beginning readers, attributing a greater importance to decoding. In Italian, instead, Tobia and Bonifacci (2015) found that oral language comprehension was the best predictor for reading comprehension across all primary

school years. This difference, also confirmed crosslinguistically (Florit and Cain, 2011), can lead to diverse reading processes and reading acquisition paths. Adequate oral language skills are crucially foundational to academic success (Roth et al., 2002); however, these can become even more relevant for beginning readers of a transparent orthography. As will be discussed in more detail in Section 1.3, these prerequisites are often not met by bilingual children with a migration background, whose language competence is frequently lower than that of their monolingual peers.

To sum up, typically developing children acquiring literacy in a transparent orthography, such as Italian, are expected to achieve a high level of fluency even after relatively limited exposure to explicit instruction. Over the years, various assessment protocols have been developed to measure reading proficiency in Italian in terms of decoding and comprehension, and to provide validated thresholds for objectively determining literacy levels (*Prove MT*, Cornoldi and Colpo, 1998; *DDE-2*, Sartori et al., 2016). These offline protocols are generally designed to assess lexical and sublexical reading skills via word, nonword and text reading tasks, in which speed, accuracy and comprehension are measured manually in terms of syllables per second, number of reading errors, and accuracy of comprehension answers, respectively.

In parallel, research on reading investigation has sought online measures capable of capturing more subtle individual differences in reading performance. Eye-tracking is one of the most widely used techniques (Nilsson Benfatto et al., 2016; Mézière et al., 2023), as it allows researchers to collect not only fine-grained measures of decoding and comprehension but also behavioural, cognitive, and physiological responses to reading stimuli. However, large-scale administration of these protocols is often impractical, given the technical complexity of the settings and the expertise required. Moreover, very young children may not feel comfortable in the laboratory environment needed for such assessments.

The following section introduces an innovative methodology for assessing reading skills, namely, finger-tracking. We will examine how this technique enables the collection of fine-grained data on reading performance in an intuitive and user-friendly environment, and why it can be considered a valid tool for evaluating literacy even in large-scale studies involving young children.

1.2. ReadLet: finger-tracking methodology for data collection on reading decoding and comprehension

For the present study, data on decoding and comprehension were collected using *ReadLet*, a web application developed as part of the homonymous project by the Institute for Computational Linguistics of the National Research Council (CNR)¹. The application supports the collection and structure of behavioural reading data by administering short narrative texts displayed on an ordinary tablet. Specifically, *ReadLet* is designed to record finger movements of users, who are instructed to point to the text while reading either silently or aloud. In the case of aloud reading, the application captures both the voice and the corresponding finger-pointing pattern. At the end of each text, participants are asked to answer multiple-choice comprehension questions; both the time taken to answer the questions and the answers themselves are also captured by the application. The collected data are then sent to a centralized service for post-production, where they are encrypted and anonymized to meet the required privacy standards. Additionally, the audio recordings and finger-tracking data are time-aligned with the text (Ferro et al., 2018; Marzi et al., 2020). In detail, the application is able to map the continuous movement of the reader's finger on the touchscreen and reconstruct its position at any time during reading. Ultimately, *ReadLet* provides (i) the reading time for each letter, syllable, word, and sentence in the text, (ii) the time taken to answer each question, (iii) the number of correct answers (Marzi et al., 2022).

The correlation between finger and eye movement in scene exploration has emerged in recent research on visual perception analysis (Lio et al., 2019). As for reading, finger-pointing to keep track of words and text has been traditionally and anecdotally encouraged by teachers in the first stages of reading acquisition, and its fundamental function has been confirmed by scientific empirical evidence: this gesture helps learners to focus on print, to match voice to print, and has a strong correlation with phonemic and syllabic awareness, critical skills for beginning readers (Uhry, 2002; Mesmer and Lake, 2010). Starting from these premises, the study conducted by Crepaldi and colleagues (2022) has shown that voice, eye fixations, and finger-tracking correlate in adults' silent and aloud reading, especially at the level of syntactic boundaries, with the finger movement acting in the prosodic domain as pace maker and place holder. Although direct comparison between eye-tracking and finger-tracking data from children has not been performed so far, studies with *ReadLet* carried out on younger populations have highlighted correlations between finger paths and reading strategies, with clear effects of word length and

¹ The experimental protocol of the *ReadLet* project has been approved by the CNR Committee for Research Ethics (Ethical Clearance Statement n. 0037523/2021).

frequency on tracking time (Marzi et al., 2020, Taxitari et al., 2020). Specifically, Marzi et al. (2020) analysed tracking times of typical and atypical readers from 3rd to 6th Grade while reading words with different frequency and length embedded in narrative texts. Their aim was exploring reading strategies of typical and reading-impaired children, and how these strategies were affected by word length and frequency. As observed by the authors, typical beginning readers were positively affected by word frequency, resulting in more familiar words processed in shorter times; however, this effect significantly decreased across grades, as a result of a growth in the orthographic lexicon. Intuitively, the opposite effect was observed for word length. Interestingly enough, atypical readers were also affected by word length and frequency, but this effect did not decrease in later grades. Besides providing new insights in reading strategies of typical and atypical readers, these findings concurred in the validation of *ReadLet* as a powerful tool for the collection of fine-grained data on reading decoding.

Reading strategies from other linguistically vulnerable populations have also been examined through finger-tracking methodology. Mazzarino and Marzi (2023) compared the reading strategies exhibited by monolingual and bilingual children with a migration background, examining the impact of word length and frequency across grades (2 to 5). Their findings aligned with those of Marzi et al. (2020), in that bilingual children – similarly to reading-impaired children – showed a greater influence of word length and frequency on tracking times than monolinguals, although this effect decreased in later school years. Moreover, the authors explored how the two groups processed morphologically complex words. By calculating the difference between the tracking time of the final letter of the stem and the initial letter of the inflectional ending, they observed that this time lag was greater for bilingual children, indicating additional time spent on the beginning of the inflectional ending. According to the authors, this finding suggests the implementation of a morpheme-based reading strategy that bilingual children may adopt to reduce the cognitive load associated with morphologically complex words, which are typically long and less frequent.

Slower text reading times and poorer comprehension skills also emerged in a finger-tracking study conducted by Marzi et al. (2023), who focused on second graders. As in the previous sample, these bilingual children were more affected by word length and frequency effects; this was also the case for morphologically complex words, where the morpheme-based reading strategy suggested by Mazzarino and Marzi (2023) did not emerge in this bilingual sample. As proposed by the authors, this could be attributed to the generally poorer reading performance

displayed by bilingual children, especially in the initial grades, as widely demonstrated by traditional studies (Verhoeven, 1990; see Section 1.3.3).

Taken together, these findings provide evidence for the extremely fine-grained and versatile nature of data obtained through the finger-tracking technique, which can offer detailed insights not only at the sentence or word level, but also at the sublexical level.

This thread of research showed how finger-tracking measures can serve as a proxy for eye-tracking data, especially in beginning readers, but avoiding the laboratorial setting that is needed to perform eye-tracking studies. The advantages of this technology extend also to the user-friendly nature of the application, which runs on a common tablet, while still allowing for the collection of detailed behavioural data, both for decoding at the sublexical, word, and text level, and for comprehension (Crepaldi et al., 2022). Additionally, the automatic recording offered by the application allows for avoiding human mistakes in time recording, something that cannot be completely ruled out in paper-and-pencil tests. For the purpose of the present research, an original protocol specifically designed for 1st Grade students was elaborated in collaboration with researchers from the *ComPhys Lab* (National Research Council). The protocol included both words and nonwords to be read in isolation, and short narrative texts with comprehension questions. Further details on the design of the protocol are provided in Chapter 3, while protocol's materials can be found in Appendix B.

1.3. Reading acquisition in fragile bilingual populations

1.3.1. From bilingualism to bilingualisms

The traditional idea that dominated research on bilingualism for many years – namely, that bilingual individuals are essentially two monolinguals in one person – has been systematically changed since Grosjean (1989). In his work, the author criticizes the assumption that the ‘ideal’ bilingual is an individual with perfectly balanced competence in two languages, conceived as separate systems with no interference. He also highlights how a long line of research has frequently compared bilinguals to monolinguals, taking the latter as the ‘norm’ and the former as a linguistic exception. Applying a monolingual standard to the investigation of bilingual competence has led to a series of negative consequences, resulting in an inaccurate and inconclusive scientific perspective on this linguistic identity.

The alternative definition of bilinguals proposed by Grosjean remains one of the most widely adopted in the literature: bilinguals are ‘those people who use two or more languages in their everyday lives’ (Grosjean, 1989, p. 4). This definition frames bilingualism as a continuum rather than a categorical dimension, acknowledging the great variability in individuals’ language proficiency, use, and exposure across different contexts and recognizing that bilinguals need not have perfectly balanced proficiency in both languages, but rather vary in competence and use across contexts.

As Montrul (2012) points out, a number of factors come into play in defining bilingualism, including age of acquisition of the languages, degree of language use, and sociopolitical status of the languages spoken. The interaction of these factors gives rise to a wide variety of multilingual profiles.

Considering the age of acquisition factor, first exposure to the two languages can occur either from birth or later in life. When dual language experience begins at birth or before the age of three, it is typically defined as simultaneous bilingualism, with both languages considered L1s (Paradis, 2007b). If a second language is acquired after this period, the situation is referred to as sequential bilingualism, which is further distinguished as early (acquired before puberty) or late (acquired after puberty; Armon-Lotem and Meir, 2019). A long line of research has highlighted the crucial role of age of acquisition in determining language proficiency (Johnson and Newport, 1989; DeKeyser, 2000; Hakuta et al., 2003), with simultaneous or early sequential bilinguals performing better than late bilinguals on a variety of linguistic and cognitive measures.

Nevertheless, among the variables influencing bilinguals’ language proficiency, the role that each language assumes over the lifespan should also be considered. According to the degree of use, or dominance, a language can be regarded as primary or secondary. This factor may or may not be related to the age of acquisition. For example, if an initially monolingual individual acquires a second language later in life, their first language will likely remain their primary language, while the second will remain secondary. Conversely, in bilingual children who are exposed to one language in the family context in their early years and to the majority language at the onset of formal schooling, the latter often becomes the primary, or dominant, language, despite being acquired later (Garraffa et al., 2023). The distinct roles assumed by the two languages in such cases – where the first (but secondary) language is primarily used within the family domain and the second (but primary) language is used for societal interactions – often lead to unbalanced proficiency. It is not uncommon, in fact, for these children to develop competence

in everyday conversational topics in their first language, but a broader and more abstract proficiency in the second language, due to extensive exposure in formal educational contexts.

These two distinct scopes of language competence were formalised by Cummins (1979a). According to the author, the language knowledge needed to engage in everyday conversations is referred to as Basic Interpersonal Communicative Skills (BICS), while the vocabulary and contextual knowledge involved in more abstract or cognitively demanding language use constitutes the Cognitive Academic Language Proficiency (CALP). Whereas the set of language skills included in the former is acquired spontaneously by children through meaningful interaction with other speakers – in the absence of language impairments – the latter can only be acquired in presence of rich and varied input, typically that found in academic contexts.

Bilingual children with a migration background, as mentioned before, typically receive formal education only in the community language of their host country. It is therefore very likely that their competence in the family language is limited to BICS.

As for the community language, the picture is slightly more complex. As just mentioned, bilingual children with a migration background receive their education in this language and are therefore expected to develop proficiency in the CALP as well. However, this is often not the case, or at least the development of the two sets of language competences proceeds at a different pace. As reported by Cummins (2008), there is a time gap between the acquisition of the fluency necessary for everyday conversations and the achievement of the same level of proficiency in academic language. Specifically, whereas BICS are generally acquired within two years of substantial exposure and use of a language, CALP takes between five and seven years to develop.

This was also empirically confirmed by Marx and colleagues (2017), who showed that bilingual 9th-grade students in German schools struggled with listening comprehension tasks involving academic texts, while their performance improved considerably when texts dealt with everyday topics. Interestingly, the same pattern was reported for monolingual German students.

The slow pace at which CALP is acquired has clear consequences for the academic trajectories of bilingual children with a migration background: as we will see in the next section, in the Italian context, limited competence in the language skills required by the school system affects the school progress and outcomes of this vulnerable population.

The third variable to be considered is the sociopolitical status of the languages spoken by a bilingual individual. In this respect, languages are typically classified as majority and minority languages. A majority language is usually widely spoken within society, officially recognized, and protected by political authorities; it often coincides with the language of formal education. Minority languages, by contrast, may sometimes enjoy official recognition (as in the case of German in the Alto Adige region of Italy), but more often the term refers to languages spoken by small groups of individuals who have settled in a country through migration. Following Montrul (2012), majority and minority languages stand in a power relationship, with important societal and political implications. This is precisely the context in which children of migrant parents, consistently exposed to the family language in early childhood, may eventually develop greater proficiency in the majority language, sometimes at the expense of their minority language (Lambert, 1975).

The population just described is precisely the focus of the studies conducted for the present dissertation. Before outlining the linguistic and reading acquisition profile of these bilingual children, a few terminological clarifications are necessary. Since investigating the political implications that are intrinsically connected with the terms *majority* and *minority language* would fall beyond the scope of this work, we will instead adopt the terms *community language* and *family language*. From this point onward, the term *community language* will refer to the language most widely spoken in the society in which the children in our samples are immersed, which in this case is Italian. *Family language*, by contrast, will refer to the heterogeneous set of languages to which our participants have been exposed from birth within their family environment. As will be discussed in greater detail in the chapters dedicated to the empirical studies, this terminological choice is particularly appropriate for the bilingual children in our sample, as most of them have been exposed to both Italian and their family language since birth. Adopting a definition that simply denotes the contextual roles of the two languages, without introducing *a priori* political or proficiency assumptions, was deemed the most suitable option for our methodological approach.

1.3.2. Bilingualism in migration background contexts

From a linguistic perspective, bilingual children with a migration background constitute a highly heterogeneous population. This group typically includes first- and second-generation immigrants who have been extensively exposed to their family language during their early years, followed by a shift toward the community language after the beginning of formal education. Due

to the scope of the present dissertation, only second-generation immigrants will be considered, namely, children who were born and raised in the host country.

According to the variables influencing bilingual profiles proposed by Montrul (2012), bilingual children with a migration background are generally either *simultaneous bilinguals*, if they have been exposed to the community language from birth, or *early sequential bilinguals*, if exposure to the second language begins with kindergarten or school onset. These are typically the conditions that allow the development of native-like proficiency in a language. However, unlike other cases of simultaneous or early sequential bilingualism – where both languages are equally supported and represented within the society (e.g., French and English in Québec and Spanish and Catalan in Catalonia) – such proficiency may not be achieved by bilingual speakers with a migration background, or at least not in both of their languages.

As with monolingual children, bilingual children with a migration background typically receive parental linguistic input primarily (or exclusively) in one language, namely their family language, during the first years of life. Provided that no language impairments are present, children acquire this language through meaningful exchanges with their caregivers. However, once they begin attending kindergarten or school, their exposure shifts dramatically in favour of the community language. They start having daily interactions with teachers and monolingual peers, as well as receiving formal reading instruction in the community language. Consequently, their language dominance gradually shifts toward the community language – a process typically completed during adolescence (Kohnert et al., 1999) – and is often accompanied by a progressive decline in family language competence, which becomes restricted to limited use within the home environment. The abrupt change in language exposure thus has measurable consequences on both languages spoken by these bilingual individuals.

In the present Section, an overview of the current situation of students with a migration background living in Italy is provided. We will then examine how this status affects language competence, both in the family and in the community language. Finally, the influence of non-linguistic factors on migrant children's language competence will be considered.

1.3.2.1. Bilingual children with a migration background attending schools in Italy

The Italian situation does not represent an exception to the picture just outlined. According to the most recent official report of the *Ministero dell'Istruzione e del Merito* (August 2024), based

on data from the 2022/23 school year, children with a migration background attending schools of any grade in Italy represent 11.2% of the total student population. This proportion has shown a constant increase since the first official data available (0.6% in 1983/84), a trend that has continued in more recent years as well (the percentage of migrant children was 10.3% in 2020/21; report published in July 2022). The countries from which most of these children's families originate are Romania (16.3%), Albania (13.0%), and Morocco (12.5%), followed at much lower percentages by China, Ukraine, and Egypt. In the Veneto region in northern Italy, where our investigations took place, the percentage of students with a migration background is slightly higher than the national mean, namely 15.2%. The vast majority of these children are second-generation immigrants, i.e., children born in Italy from migrant families (71.2%).

A rather worrying aspect widely documented in official reports on migrant students' educational trajectories concerns the discrepancy between these children and Italian children in school delay. In the 2022/23 school year, 7.9% of Italian students showed a delay in their academic progression, compared with 26.4% of migrant students. This gap is particularly pronounced in higher grades: at high school level, percentages were 16.0% and 48.0%, respectively. Notably, these proportions were not substantially different from those reported in the previous investigation (7.5% for Italian students and 26.9% for students with a migration background).

Such discontinuous school trajectories are also reflected in migrant students' scores on national assessment tests. The INVALSI (*Istituto Nazionale per la Valutazione del Sistema Educativo di Istruzione e Formazione*), for instance, evaluates competencies in Italian and mathematics in Grades 2, 5, 8, 10, and 13. According to the most recent report published by INVALSI on the 2025 tests (INVALSI, 2025), migration background was among the factors negatively affecting students' performance. This effect was observed across all grades, although with an oscillating pattern: in 2nd Grade, first-generation migrant children scored 19.5% lower than Italian children in the Italian test, and second-generation migrants 17.3% lower. The gap decreased in 5th Grade (15.7% and 9.7%, respectively), but increased again in 8th Grade (22.6 and 13.3%). A consistent decrease was then observed in 10th and 13th Grades, where first-generations migrants showed gaps of 19.2 and 9.7% respectively, and second-generation migrants of 9.0% and 8.6%. Despite improvements in both groups, the performance gap between Italian and migrant students persists until the end of compulsory schooling.

The motivations behind these discrepancies lie in a variety of factors, among which the low socioeconomic status often displayed by migrant families and the migrant status itself play crucial roles. These aspects will be discussed in more detail in the following paragraphs. For the

time being, an overview of another key factor, namely language competence, will be provided for the Italian context.

As mentioned above, a central linguistic feature of bilingual individuals with a migration background is the extensive exposure to the family language in the first years of life, followed by a sudden shift towards greater exposure to the community language at school onset (Montrul, 2012). This typically results in imbalanced bilingualism, often characterised by proficiency in the family language restricted to everyday conversational topics, and by more specialized, academic competence in the community language, due to its predominance in the school environment. As hypothesised by Cummins (1979b; see Section 1.3.5), however, the development of the two languages is strictly interdependent. If children with a migration background do not receive sufficiently rich input in their family language during early childhood, they may struggle to develop adequate competence in the community language to sustain an effective academic trajectory – hence the data on school delay and national tests performance reported above.

To gain a clearer picture of the language habits of migrant families living in Italy, Cordin and Vender (2022) conducted a survey on more than one thousand migrant families in the Trentino region, in northern Italy, using a questionnaire. The questionnaire collected information on the languages spoken by people frequently interacting with the children, the languages spoken by the children themselves, the frequency with which these languages were used, and the linguistic input in both the family and community language deriving from school attendance or extracurricular activities such as sports, technology use, or time spent with friends.

Regarding language competence, the authors observed a marked gap between family and community language skills in migrant children. According to parents, only 62% of children understood the family language very well, and only 50% could speak it very well. The proportions were reversed for Italian, with 90% of children reported to understand and speak it very well. Literacy skills in the family language were found to be almost absent: only 17% of children were judged capable of reading and writing well. A similar imbalance emerged also in parent-child interactions: parents tended to use the family language more frequently when talking to the children, whereas children preferred the community language, even when speaking with their siblings.

Data from this questionnaire were then analysed in relation to the results of the GiADA test (*Gestione Interattiva delle Abilità di Apprendimento*, Erickson), which includes a word spelling task, and the TRPS test (*Test di Riconoscimento di Parole Senza Significato*, Zanzurino et al.,

2012), which includes a nonword reading task (Cordin et al., 2021). These tests were administered to Italian and migrant children attending the 2nd Grade. The first analysis compared the performance of Italian, first-, and second-generation migrant children on both tasks. Results showed that the Italian children outperformed migrant peers in word spelling, whereas no differences emerged for nonword reading, where all three groups performed similarly. These results align with those of Murineddu and colleagues (2006), who found significant differences between Italian and migrant students attending classes from 2nd to 8th Grade in word reading speed and accuracy, but no difference for nonword reading. The advantage in word reading may be attributable to the larger vocabulary of monolingual children, which facilitates rapid and automatic recognition of familiar words. When decoding relies solely on phoneme-grapheme correspondences, however, the groups tend to perform comparably. Comparable findings were also reported for bilingual readers from Grade 1 to 5 (Bonifacci and Tobia, 2016; Melloni et al., 2022).

Turning to possible correlations between language competence and spelling outcomes in migrant children, Cordin et al. (2021) found that children reported as having greater competence in their family language also achieved higher spelling scores. Furthermore, more extensive exposure to Italian at home appeared to benefit spelling performance only up to a threshold of 60-70% exposure.

According to the authors, these results highlight the need for systematic and synergistic support for children with a migration background attending schools in Italy. On the one hand, their linguistic and reading skills should be assessed and supported from the very beginning of their academic journey; on the other hand, efforts should be made to preserve and enhance their family languages. The findings show that richer competence in the family language can lead to better literacy outcomes. On this basis, families should be encouraged to provide more varied input in their home language, as this can also support the development of the community language. Schools, too, should be involved in such initiatives.

In Chapter 3, we will see that the results of a longitudinal study involving children from kindergarten to 2nd Grade provide further evidence of the difficulties that bilingual children with a migration background encounter at school onset, and that these difficulties are strongly related to their family and linguistic contexts. In the conclusive remarks of this dissertation, this issue will be reconsidered in light of our results and possible solutions will be put forward.

1.3.2.2. Linguistic competence in the family language in bilingual children with a migration background

Studies on various linguistic domains – phonetics and phonology (Au et al., 2002, Godson, 2004), vocabulary (Polinsky and Scontras, 2020), morphosyntax (Rothman, 2007, Montrul, 2018) – have consistently shown that bilingual speakers with a migration background generally exhibit lower proficiency compared to monolingual speakers of their family language. The extent to which this reduced competence results from incomplete acquisition of the family language grammar (Montrul, 2008) due to limited linguistic input, or from language attrition (Meisel, 2014), remains an open question. A comprehensive analysis of the linguistic features characterising the family language of bilingual children with a migration background lies beyond the scope of the present work, which instead focuses on their acquisition of linguistic and reading skills in the community language, Italian. What is evident, however, is that these children's competence in their family language is often not fully developed by the time the shift toward the community language occurs. This has crucial implications for the development of both languages – leading, on the one hand, to difficulties in attaining native-like proficiency in the family language, and, on the other, to potential consequences for the acquisition of the community language, as will be discussed in the following section.

1.3.2.3. Linguistic competence in the community language in bilingual children with a migration background

As already mentioned, bilingual children with a migration background typically begin to receive extensive exposure to the community language between the ages of three and six, when they start attending kindergarten or school. Previous exposure within the family or in other contexts is also possible, but school onset clearly marks the beginning of the shift toward community language dominance, both in terms of use and exposure. Given this early and consistent input, these children are likely to reach levels of language competence comparable to those of their monolingual peers within a relatively short period, with earlier exposure being associated with an earlier dominance shift (Paradis, 2007b). However, empirical research has yielded mixed results regarding bilinguals' competence in the community language.

Bello and colleagues (2023), for instance, found that preschool children aged between three and five, born to migrant parents and enrolled in Italian kindergartens, already displayed a larger vocabulary in the community language (Italian) than in their family languages. The authors

explain these findings by considering children's substantial exposure to Italian during the time spent at kindergarten, observing that those children who attended kindergarten for a reduced number of hours did not reach the same level of expressive vocabulary. Early differences in productive vocabulary were also reported by Harley (1992), who observed that early sequential bilinguals with English as L1 and French as L2, immersed in a French educational program, tended to use more generic terms than French monolinguals in a narrative task. Nevertheless, vocabulary growth among children exposed to the community language from an early age has been shown to proceed rapidly, with an estimated rate of 3.24 years of linguistic development per year of chronological age (Golberg et al., 2008).

Findings on bilinguals' language production at the phonological level have also been mixed. On the one hand, Guion (2003) and MacLeod and colleagues (2009) observed that early L2 speakers of Spanish and French did not differ from monolinguals of the same languages in vowel production. On the other hand, Flege and colleagues (1999) reported that early English speakers with Italian as their family language were rated differently from English monolinguals in an accent perception task.

Similarly, bilingual speakers appear to require the same amount of exposure to the community language as monolinguals to achieve comparable morphosyntactic competence – although this typically takes longer due to limited input (Jia, 2003). This likely explains why Spanish-English bilinguals were found to be less accurate than their English monolingual peers in grammaticality judgment tasks up to the 5th Grade (Gathercole, 2002).

Overall, these findings suggest that bilingual speakers exposed to the community language from an early age eventually catch up with their monolingual peers once they receive sufficient input, even though initial differences are frequently observed. Importantly, the quality and quantity of linguistic input – especially that provided within the school context – play a crucial role in supporting the development of vocabulary and of other language skills. Nonetheless, research has also shown that the home linguistic environment and socioeconomic status significantly contribute to children's proficiency in the community language.

1.3.2.4. Other influencing factors: socioeconomic status

Children from families with low socioeconomic status (SES), irrespective of language background, have been consistently shown to follow different linguistic developmental

trajectories compared to their middle-class peers (Hoff, 2013). In her work, Ginsborg (2006) outlines the main causal relationships between key characteristics of low SES and limited language proficiency. According to the author, the economic deprivation typically experienced by these families can negatively affect children's psychological development, with consequent repercussions on language acquisition. Parental education level is also a reliable predictor of children's future language skills. As highlighted by Parks and Smeriglio (1986), higher levels of parental education are associated with greater awareness of child development processes and a richer linguistic and cognitive stimulation in the home environment. Similarly, the quality of parent-child interactions – often less adequate in low-SES families – has been shown to predict language outcomes. Finally, the overall quality of the home environment, including the type and richness of language used by parents, appears to play an important role. These associations have also been supported by empirical evidence: a study comparing low- and middle-income African American and European American families found that SES significantly influenced expressive language development, with lower SES being associated with slower growth rates in this domain (Pungello et al., 2009).

1.3.2.5. Other influencing factors: migrant status

As we have seen, similar divergent linguistic developmental trajectories have also been observed in children whose family language differs from the community language. Crucially, these two disadvantageous conditions – low socioeconomic status and migration background – often coexist, resulting in weaker linguistic and academic outcomes for these populations. In their research on the effects of low SES on language skills (vocabulary, syntax, phonological abilities), Bello and colleagues (2024) confirmed that bilingual children with a migration background living in Italy and coming from single-mother families with low SES performed worse than their monolingual peers across all measures. Moreover, SES was found to be correlated not only with children's early vocabulary knowledge but also with their overall language learning process (Luo et al., 2021). Specifically, in children with a migration background who speak Spanish as a family language and English as a community language, SES uniquely contributes to explaining progress in both Spanish and English language acquisition. Interestingly, this effect was mediated by the home literacy environment (HLE), a factor widely recognised as a reliable predictor of successful language and reading development.

Comparable conclusions were reached by Eisenwort and colleagues (2018), who found that, despite generally reduced competence in both Turkish (the family language) and German (the

community language), children who were read to more frequently in Turkish by their parents performed better in both languages. Similarly, Novita and Kluczniok (2022) observed that HLE was positively correlated with the vocabulary of bilingual children; those from migrant families with less exposure to informal literacy activities showed smaller receptive vocabularies. In line with these findings, Valcárcel Jiménez and colleagues (2024) examined the role of HLE in detail on language abilities (vocabulary, phonological awareness, and letter knowledge) in preschoolers from migrant families who speak German as their community language. After dividing HLE into four facets – shared reading at home, number of books available, knowledge about children’s books, and parental attitudes towards literacy – the authors analysed the mediating role of these factors, as well as television exposure, between migration background and children’s language skills. Their findings revealed that all HLE facets acted as significant mediators, with lower quality of HLE associated with poorer language performance. Notably, television exposure was negatively correlated with both HLE factors and with language outcomes.

This overview provides further evidence that the traditional definition of bilinguals as ‘two monolinguals in one person’ is clearly inadequate, if not misleading. Individuals with a migration background who use one language at home and acquire a second language early in life in order to integrate into the host country and access formal education may not achieve full proficiency in either language. Nevertheless, both languages are likely to be used regularly throughout the individual’s lifespan. The limited language competence observed in both family and community languages among these individuals has been attributed to low socioeconomic status and other societal factors that typically affect migrant families. Delays in community language acquisition are particularly evident during the first years of formal education, when children begin to receive extensive exposure to this language. However, numerous studies have shown that bilinguals with a migration background eventually catch up with their monolingual peers in terms of linguistic competence, provided that the input they receive is sufficiently rich and sustained to promote a shift in language dominance towards the community language.

Nevertheless, this initial linguistic gap can have a substantial impact on bilingual children’s early educational experience. In this dissertation, we will examine how reading acquisition is negatively influenced by limited language competence, with particular attention to the need for designing screening and intervention protocols tailored to this vulnerable linguistic population.

1.3.3. Reading acquisition in vulnerable linguistic populations

Learning to read in a second language should not, in principle, differ from learning to read in a first language. In other words, the cognitive processes and rules governing reading do not change across languages, despite variations in orthographic transparency, granularity, and availability (Goswami, 2010; see Section 1.1.1). In any language, a successful reader must understand the relationship between spoken sounds and written symbols, be fast and accurate in identifying print, and be able to derive meaning from it. Consequently, the set of linguistic abilities involved in reading comprehension does not vary across languages: readers consistently rely on their phonological and syntactic processing skills, word recognition abilities, and the integration of textual meaning, inferencing, and background knowledge to ensure fluent and accurate comprehension (Grabe and Jiang, 2018). Crucially, once the reading mechanism and its correlates have been acquired, readers do not need to relearn the entire process when approaching a new language; rather, they adjust previously acquired rules to the new linguistic and orthographic system. As stated by Perfetti (2003), reading is characterised by a set of universal properties that are systematically found across all writing systems.

Research on bilingual children acquiring literacy in their second language has supported this hypothesis, showing, in some cases, superior reading performance in bilingual children compared to their monolingual peers. In their study, Bialystok and colleagues (2005) found that Spanish-English and Hebrew-English bilingual children acquiring literacy in both languages outperformed English monolinguals and Chinese-English bilinguals in English reading tasks. According to the authors, these results can be explained both by a general contribution of biliteracy to the understanding of the symbolic relationship between sounds and written language, and by a specific transfer of reading principles across languages – possible only when both languages share the same writing system (in this case, alphabetic; Hebrew children were exposed to the version of the script including vowel symbols).

However, a substantial body of literature has shown that this so-called bilingual advantage in reading acquisition cannot be generalised to all bilingual populations. A necessary condition for the emergence of such an advantage is that bilingual children acquire literacy in both of their languages – namely, that they are *biliterate*. Learning to read in two languages in parallel is the only condition under which reading strategies acquired in one language can be transferred to the other, as observed in the Spanish-English and Hebrew-English bilinguals described above. By contrast, children with a migration background rarely receive formal education in their family

language; rather, the community language is typically the only medium through which they develop literacy skills. This situation prevents this bilingual population from benefiting from the potential advantages deriving from dual literacy instruction.

In addition, as discussed in the previous paragraphs, bilingual children with a migration background often begin formal instruction with a linguistic disadvantage compared to their monolingual peers. This disadvantage has multiple origins: it stems from purely linguistic reasons (e.g., delayed consistent exposure to the community language, or limited proficiency in this language), but also from socioeconomic and cultural factors (e.g., low SES, poor HLE, limited competence in the family language as well). As already partially addressed in Paragraph 1.3.2.1, where the Italian situation was discussed, this often leads to more discontinuous academic trajectories for bilingual children with a migration background, highlighting difficulties that are visible even in the very first abilities taught at school – namely, reading, as we will see in the next paragraphs.

1.3.3.1. Decoding in vulnerable linguistic populations

Findings on decoding acquisition in bilingual children with a migration background have, to varying degrees, reported similar patterns compared to monolinguals.

The widest investigation on literacy acquisition paths in children acquiring literacy in a language different from their family language is surely that of August et al. (2009), who reported the results of *Report of the National Literacy Panel on Language-Minority Children and Youth*. The study consisted of a meta-analysis involving more than one hundred works and was aimed, among other goals, at investigating whether differences exist in the literacy acquisition trajectories between bilingual and monolingual children. The meta-analysis targeted exclusively studies in which children were learning to read in English, a language with an opaque orthography. The authors' findings suggest that the learning trajectories of bilingual children with a migration background closely resemble those of their monolingual peers with respect to word-level skills, such as decoding, whereas this is not the case for text-level skills, such as comprehension (see next paragraph). Apparently, adequate levels of decoding skills can be reached in a short amount of time even by children with a limited language competence.

Similarly encouraging results had emerged also from a study conducted by Lesaux and Siegel (2003), who tested migrant children who were acquiring literacy in English as their community language. Their sample was assessed in 2nd Grade on several decoding measures, including word

and nonword reading. Their analysis showed that not only did bilingual readers not differ from their monolingual peers in word reading, but they even outperformed them in nonword decoding by reading significantly more items in the same amount of time. As highlighted by the authors, even though bilingual children had displayed some difficulties in pre-reading skills tested at kindergarten, these did not prevent them from developing an adequate level of decoding within the same time span as their monolingual peers, or even better.

Such findings on an opaque orthography have been replicated in French as well. Specifically, Bellocchi and Bonifacci (2024) attempted to disentangle the impact of bilingualism and low socioeconomic status (SES) on reading outcomes in children learning to read in French. As discussed in Paragraphs 1.3.2.4 and 1.3.2.5, these two conditions often coexist in children with a migration background, and understanding the relative influence would be fundamental to adequately supporting children from both conditions. In their study, they assessed literacy skills (in terms of text, regular words, irregular words, and nonword reading) in bilingual and monolingual children with low or medium-high SES attending 3rd, 4th or 5th Grades in France. Results showed that the bilingual sample was slower in text reading and less accurate in irregular word decoding than the monolingual group. Conversely, low-SES children showed more marked difficulties only in regular word reading accuracy. These findings confirm that bilinguals' difficulties in reading are limited to lexical decoding strategies, while phoneme-grapheme conversion strategies are well-established even in this population and in an opaque orthography. The effect of low-SES on word reading, instead, could be associated with a reduced exposure to varied language input in these children's home environment, confirming the strong association between low SES and poor HLE (see Paragraph 1.3.2.5).

Further considerations on the impact of language exposure on bilingual's reading acquisition are provided by Bignon and colleagues (2025), who tested migrant newcomer children who were attending elementary schools in France but had not attended kindergarten there. Their results on children's word and nonword reading accuracy showed that newcomers underperformed both French monolinguals and bilingual children who had been exposed to French for a longer time, even though all groups were matched for length of attendance to primary school. As in previous studies, the discrepancy between more and less skilled French speakers was expected for word reading; as for the significant difference emerging also in nonword reading, the authors hypothesise that it may be due to the limited vocabulary of newcomer children, which prevents them from building a sufficient number of mental phonological representations (Ziegler et al., 2014).

Taken together, these findings on languages with an opaque orthography suggest that bilingual children with a migration background, provided they receive a certain threshold of community language input, achieve the same sublexical decoding levels than their monolingual peers within the same amount time of formal reading instruction. Conversely, these children may have difficulties exploiting the lexical reading strategy due to a limited (academic) vocabulary in their language of instruction, with potential consequences on their reading comprehension, as we will see in the following paragraph.

Comparable studies have been conducted also on languages with a transparent orthography.

In line with studies on opaque orthographies, Verhoeven (1990) investigated how Turkish-Dutch bilinguals and Dutch monolinguals learning to read in Dutch performed in word reading after five, ten, and twenty months of reading instruction. He found that, although both groups were influenced by stimulus length, familiarity, and syllabic complexity, the monolingual Dutch children achieved significantly higher scores in the task, at least until ten months of instruction.

The impact of bilingualism and SES on literacy outcomes has been investigated in a transparent orthography as well. Droop and Verhoeven (2003) compared word-reading performance of bilingual children with a migration background and Dutch monolinguals with high and low SES at the beginning and end of 3rd Grade, and at the end of 4th Grade. Similarly to the results obtained for French (Bellocchi and Bonifacci, 2024), bilingual children were found to perform comparably to high-SES monolinguals, except on orthographically complex stimuli. Additionally, bilinguals' improvement rate mirrored that of monolinguals. Conversely, low-SES monolinguals underperformed their high-SES peers. No difference in word-decoding accuracy between monolinguals and bilinguals reading in Dutch were reported also by Janssen and colleagues (2013).

The fact that bilingual children catch up with their monolingual peers in word reading only after longer reading instruction, does not necessarily entail that the two reading acquisition paths follow different developmental trajectories. To verify this hypothesis, Verhoeven (2000) tested bilingual and monolingual children reading in Dutch on word reading at three points (beginning, half, end) of 1st and 2nd Grade. Analyses yielded no significant interaction between group (bilinguals vs. monolinguals) and time, showing that the two groups proceeded and improved in word reading at the same pace, although bilinguals lagged behind monolinguals especially in more demanding orthographic conditions (e.g., words with consonantal clusters).

Differences between monolinguals and bilinguals seem to be more pronounced in reading speed, instead. In their longitudinal study involving monolingual German and bilingual children with a migration background and German as the language of instruction, Duzy et al. (2014) measured decoding speed from 1st to 3rd Grade. They found that bilingual children, as a group, performed more poorly than monolinguals on this component across all testing phases. Although both groups showed improvement over time, the skills of German monolinguals tended to grow at a faster rate. Moreover, while only 19% of the German monolingual children could be classified as poor decoders (i.e., scoring one percentile below 16 in the test norms), the proportion rose to 33% among bilingual children with a migration background and remained stable across years.

Decoding skills in bilingual children with a migration background have also been investigated in Italian across different primary school grades. As already mentioned in Paragraph 1.3.2.1, Murineddu and colleagues (2006) found significant differences between monolinguals and bilinguals with a migration background attending classes from 2nd to 8th Grade in word reading accuracy and speed but not in the same components of nonword reading.

Comparable findings emerged from a study conducted on various vulnerable populations attending Grades from 1 to 5 (Bonifacci and Tobia, 2016). The authors aimed to compare reading speed and accuracy in word, nonword, and text across children with learning disorders, poor comprehenders, late bilinguals (children exposed to Italian after age 4), early bilinguals, and a control group of typically developing monolinguals. In line with previous findings, no differences emerged for nonword-reading speed and accuracy, nor for word-reading accuracy, in early and late bilinguals compared to monolinguals, again due to the high predictability and transparency of Italian orthography. In word-reading speed, instead, monolinguals outperformed early bilinguals, who in turn outperformed late bilinguals; in text-reading accuracy, early bilinguals were comparable to monolinguals and better than late bilinguals, while in text-reading speed bilinguals in general were slower than monolinguals. Lexical reading strategies are consistently found to be the most affected in bilinguals, with more pronounced difficulties in individuals with reduced language competence. Clear evidence for this hypothesis was already provided by Bellocchi et al. (2016), who found that late bilinguals were less accurate than early bilinguals in stress assignment in infrequent positions (e.g., in the pre-penultimate syllable, such as *àlbero*).

Further evidence for the role of language exposure emerged from Persici and colleagues (2022), who administered word and nonword reading tasks to three groups of bilingual children with a migration background enrolled in the first, third and fifth grades of Italian schools. Their aim was

to examine whether the amount of exposure to Italian at home and mothers' proficiency in Italian could predict children's reading speed and accuracy, and whether differences in these components emerged between bilingual and monolingual children. While none of the predictor variables was found to correlate with reading accuracy, the authors observed that children who were more exposed to Italian at home and whose mothers had higher proficiency in Italian were faster at word reading in the third and fifth grades. Conversely, the same environmental factors were associated with slower times in nonword reading. According to the authors, this contrast might reflect the restricted benefits of a richer linguistic home environment, which may support literacy acquisition, but primarily for familiar words. Interestingly, no differences emerged between bilingual and monolingual children in either reading speed or accuracy across grades – a result attributed to the orthographic transparency of Italian, which allows emergent readers to reach high levels of fluency despite limited language proficiency.

Contrarily to previous studies in other languages (Bellocchi and Bonifacci 2024, Droop and Verhoeven 2003), no specific effects of SES and bilingual status was found for Italian readers (Bonifacci et al., 2020). However, this absence could be attributed to the fact that the task used in the Italian study did not include orthographically complex items, which were precisely those that yielded the most difficulties in bilingual children in previous studies.

Finally, older children's reading skills were examined by Melloni and colleagues (2022), who tested a group of nine-year-old Italian monolinguals and bilingual children with Italian as the community language on word and nonword reading tasks. Results revealed significant differences in word reading accuracy and marginally significant differences in word reading speed between the two groups, whereas no differences emerged for nonword reading. The authors interpreted these findings in light of the reduced vocabulary size typically observed in bilingual children with a migration background, which may hinder their ability to fully exploit the lexical reading route.

Despite mixed results – particularly evident for reading speed, which appears to be the most fragile decoding component in transparent orthographies (Serrano and Defior, 2008) – overall these findings point toward comparable acquisition trajectories and outcomes for decoding between bilingual children with a migration background and monolinguals, especially when sublexical decoding strategies are considered. Lexical reading, instead, appears to be more sensitive to language competence, leading bilinguals to underperform monolinguals especially in the textual dimension or in orthographically challenging contexts (consonant clusters,

infrequent word stress). In the next paragraph, we will see whether this gap has consequences for the other reading component, namely comprehension.

1.3.3.2. Reading comprehension in vulnerable linguistic populations

Since the ultimate goal of reading is to extract meaning from text, numerous studies have examined how learning to read in a language different from the family language influences reading comprehension. The strong interest in the relationship between children's proficiency in the community language (which is also the language of instruction) and reading comprehension is not surprising, given the central role that language knowledge plays in reading comprehension compared to, for instance, in decoding skills.

Many of the studies considered above have also investigated comprehension skills in bilinguals.

As mentioned in the previous paragraph, the executive summary by August et al. (2009) of the *Report of the National Literacy Panel on Language-Minority Children and Youth* already allows to draw a different picture for bilinguals' comprehension compared to their decoding. As stated by the authors, in fact, this vulnerable linguistic population appears to have more severe deficits in reading comprehension, presumably attributable not to poor decoding, but rather to limited oral language proficiency.

Two meta-analyses conducted on bilingual children with English or other languages as community and instruction language confirmed this hypothesis (Jeon and Yamashita, 2014; Melby-Lervåg and Lervåg, 2014). In the former study, the authors aimed to identify the correlates of reading comprehension in a second language. Potential reading-related correlates included decoding, vocabulary knowledge, and grammar knowledge in the language in which reading is acquired, plus family-language reading comprehension; metalinguistic correlates were phonological awareness, orthographic knowledge, morphological knowledge, and listening comprehension in the community language, plus working memory and metacognition. The analysis on 59 studies led to the conclusion that grammar knowledge ($r = .85$), vocabulary knowledge ($r = .79$), and decoding ($r = .56$) were the strongest correlates of reading comprehension for children acquiring literacy in their community language.

The second meta-analysis (Melby-Lervåg and Lervåg, 2014), instead, compared monolinguals and bilinguals on reading comprehension, language comprehension, phonological awareness, and decoding. Results confirmed that the gap in decoding and phonological awareness is small

(effect sizes: $d = -0.12$, $d = -0.08$, respectively) between the two populations, but increases for reading comprehension ($d = -0.62$) and oral language comprehension ($d = -1.12$). Moreover, low SES and home contexts in which exclusively the family language is used were found to increase the gap with monolinguals.

Supporting these findings, Kovelman et al. (2008) had already highlighted that reading comprehension was the only component in which both early and late bilinguals performed more poorly than monolinguals, with no effect of age of exposure.

More encouraging results come from studies on populations learning to read in English. Lesaux and Siegel (2003) showed that their bilingual second graders did not differ from their monolingual peers in reading comprehension. The authors interpret this result as a possible effect of the phonological training delivered in kindergarten, or of the fact that their two language subsamples did not differ with respect to SES. Similarly, no difference was found in this component by Lesaux and colleagues (2007). As in the previous study, this absence could be due to external factors, such as sample characteristics or education-related variables.

Findings from transparent orthographies are more in line with the results of the two meta-analyses. Verhoeven (1990), for instance, also assessed reading comprehension in his Dutch and Turkish-Dutch samples. Similarly to the findings obtained for word reading, monolingual children consistently outperformed bilinguals across all testing sessions, although both language groups showed comparable progress over time. Comparable results for Dutch bilingual and monolingual readers emerged also from Verhoeven (2000) and Droop and Verhoeven (2003).

Reading comprehension was also measured in the study by Duzy and colleagues (2014). The results from this component aligned with those from decoding speed: bilingual children obtained lower scores than monolinguals in both 1st and 3rd Grades, showed slower improvement rates, and 38% of them were classified as poor comprehenders, compared to 19% of the monolingual group.

Consistent findings were reported by Lervåg and Aukrust (2010), who showed that children with Urdu as family language and Norwegian as community language lagged behind their monolingual Norwegian peers in Norwegian reading comprehension tasks. This gap persisted longitudinally across grades and was accompanied by a slower growth. Both initial reading comprehension skills and their developmental trajectories were predicted by vocabulary size, which was significantly smaller in the bilingual sample.

As for Italian, Bonifacci and Tobia (2016) report a comparable performance between early and late bilinguals, highlighting that both groups lagged behind monolinguals in reading comprehension across all grades (1 to 5). Interestingly, this skill appears to be more affected by bilingualism, rather than by a low socioeconomic status (Bonifacci et al., 2020).

The underlying causes and predictive factors of bilinguals' reading competence will be examined in greater detail in Chapter 2. So far, despite some inconsistencies in bilinguals' reading outcomes – possibly due to the wide heterogeneity of this linguistic population – a general trend has emerged from the studies reviewed. Overall, bilingual children with a migration background display adequate decoding skills (with weaknesses limited to specific circumstances) but poorer comprehension performance, mostly attributable to their reduced language competence (CALP; Cummins, 1979a, 2008). Crucially, extensive formal instruction enables these children to improve their reading performance, but the literature does not agree on whether their rate of improvement matches that of monolinguals or remains slower. Even more importantly, this initial gap does not always appear to close completely, even after several years of formal education. Given the central role that reading plays not only in everyday life but also in academic success, it is unsurprising that research has shown that the persisting reading gap between monolinguals and bilinguals with a migration background – further compounded by the disadvantaged socioeconomic conditions typical of the latter – can have long-term consequences on bilinguals' professional trajectories.

This overall picture is further complicated by the fact that the weak reading performance displayed by bilingual children with a migration background often leads to the misdiagnosis of reading impairments in this population. Current assessment tools are typically standardised on monolingual populations and are therefore inadequate to capture the distinct acquisition and developmental trajectories of children who acquire literacy in a language different from their family language and who come from disadvantaged sociocultural backgrounds. The next section discusses the implications of this issue and the proposals that have been put forward to effectively identify reading impairments in bilingual populations.

1.3.4. Identification of reading deficits in bilingual populations with a migration background: issues and possible solutions

Diagnosing reading impairments in children whose language of instruction differs from their family language is particularly challenging, due to the apparent overlap between the reading

acquisition trajectories displayed by linguistically fragile bilingual populations and those observed in individuals with reading disabilities.

Consider, for instance, the most widespread reading impairment – developmental dyslexia (DD). As extensively documented, DD affects approximately 10% of school-aged children worldwide (Wagner et al., 2020) and, as defined by the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013), constitutes a specific learning disorder that impairs reading. Poor reading skills are, in fact, the hallmark of DD, which is characterized by slower or inadequate progress in reading acquisition despite adequate instruction. Importantly, dyslexia is independent of language-specific or general cognitive impairments. Although the precise aetiology of DD has yet to be fully established, research across different domains has identified neurological (Habib, 2000), visual (Valdois, 2022), and phonological (Snowling, 2001) deficits as possible concurrent causes. More recent literature converges on the view that multifactorial accounts are the most suitable to explain the origin of this disorder, particularly given the wide heterogeneity observed in its manifestation (Zoubrinetzky et al., 2014).

Reading outcomes in children with developmental dyslexia and in those with a fragile bilingual background can, to some extent, appear similar – at least superficially. As discussed earlier (see Section 1.3.3), bilingual children with a migration background often lag behind their monolingual peers in decoding and comprehension, although the findings are somewhat mixed. Most importantly, it remains unclear whether these children’s progress rates eventually align with those of their monolingual peers, as performance gaps have been observed even in later grades.

Comparable patterns have been reported in studies investigating dyslexic readers acquiring literacy in transparent orthographies. In Dutch, Verhoeven and Keuning (2018) found that children with dyslexia were particularly affected by word and nonword length in both reading accuracy and speed, and exhibited slower progress across grades. Similar results were obtained in Spanish by Davies and colleagues (2007), who reported that dyslexia exerted a greater impact on reading speed than on decoding accuracy. Persistent deficits in reading speed are, in fact, among the most consistent markers of dyslexia in transparent orthographies. Evidence from Italian (Barca et al., 2006; Tressoldi et al., 2001; Zoccolotti et al., 1999), German (Landerl and Thaler, 2006; Wimmer, 1996), and Spanish (Serrano and Defior, 2008; see Ziegler and Goswami, 2005, for a crosslinguistic review) consistently points to significant impairments and slower improvement rates in speed, while accuracy tends to remain within the normative range. This pattern is typically attributed to the highly consistent and predictable grapheme-phoneme conversion rules of transparent orthographies, which enable individuals with dyslexia to achieve

adequate accuracy despite slow and effortful reading. By contrast, accuracy deficits are more common in opaque orthographies, where grapheme-phoneme mappings are inherently less predictable (Reis et al., 2020; Ziegler et al., 2003).

In monolingual populations, dyslexia is typically diagnosed through standardised protocols assessing reading and phonological components, usually administered after three years of formal reading instruction (*Linea Guida per la Gestione dei Disturbi Specifici dell'Apprendimento*, 2021). However, applying the same assessment approach to linguistically fragile bilingual populations can be problematic and potentially misleading. As highlighted by Bedore and Peña (2008), existing assessment tools are normed on monolingual populations, which, as discussed above, follow different developmental trajectories. Testing bilingual children in their family language is often unfeasible, as these children are typically monoliterate in the community language (although being proven as effective; Erdos et al., 2014). Given the slower rate of progress observed in bilingual children, a 'wait-and-see' approach is sometimes adopted to allow additional time for the development of sufficient competence in the language of instruction. However, this strategy carries the risk of missing the critical window during which intervention is most effective. Consequently, the extensive and inappropriate use of monolingual-normed testing protocols may lead to overdiagnosis of reading impairments in bilingual populations, whereas postponing assessment in expectation of improvement may result in underdiagnosis – both scenarios potentially compromising children's academic progress (Bedore and Peña, 2008).

The risk of underdiagnosis of reading impairments in bilingual children has been widely documented in the literature. Deponio and colleagues (2000) conducted a large-scale survey in Scottish schools to investigate the proportion of bilingual pupils and how suspected cases of dyslexia in this population were identified and handled. The findings revealed that the proportion of bilingual pupils reported was markedly lower than that of monolingual students. Teachers were generally the first to express concern about suspected cases, typically after observing persistent difficulties in reading, spelling, and phonological or perceptual skills. Moreover, the study revealed a lack of consistency across assessment procedures: in some cases, the bilingual children's first language was assessed, while in others, heterogeneous – and sometimes informal – testing protocols were adopted. Overall, the authors highlighted a widespread uncertainty within the school system regarding how to identify potential reading difficulties in bilingual children, partly due to their unique developmental trajectories. They

therefore suggested that more emphasis should be placed on non-literacy-based measures, complemented by information on family language proficiency and sociolinguistic background.

Comparable findings were reported by Samson and Lesaux (2009), who conducted a longitudinal study examining the proportion of bilingual children with a migration background enrolled in special education services, the factors predicting their inclusion, and the literacy profiles of both monolingual and bilingual students. The results revealed that linguistically fragile bilingual children were underrepresented in special education services in kindergarten and first grade, but overrepresented by third grade, eventually exceeding the proportion of monolingual peers. As the authors noted, bilingual children with reading impairments tended to be identified later than their monolingual counterparts. Furthermore, teacher ratings of language and reading skills, overall reading proficiency, and bilingual status were significant predictors of subsequent placement in special education programmes. Analysis of literacy profiles showed that reading-impaired bilinguals performed more poorly than typically developing bilinguals, yet comparably to monolingual children with reading difficulties. Despite this similarity, bilingual students were still identified later and were ultimately overrepresented in special education. These findings confirm that, in the case of bilingual children from a migration background, ‘wait-and-see’ strategies are the most frequently adopted. Teachers often delay referral or intervention until students demonstrate sufficient proficiency in the language of instruction, partly due to a lack of confidence in distinguishing between learning disabilities and limited language competence. However, as stated by the *National Institute of Child Health and Human Development* (2000), these very children are those who are most at risk of failing to overcome their difficulties if timely identification and support are not provided. The authors therefore emphasize the pivotal role of early-grade teachers in recognizing children at risk and the need for targeted training to enable them to distinguish between reading difficulties rooted in learning disabilities and those related to incomplete language acquisition. In this regard, they propose the response-to-intervention framework as a valuable approach for early identification. According to this protocol, only children who fail to make progress despite receiving high-quality classroom instruction are referred for individualized literacy intervention, and, if progress remains insufficient, subsequently considered for special education support. As will be discussed in the empirical chapters of the present research, both monolingual and bilingual emergent readers can benefit from early interventions targeting pre-reading skills.

In recent years, several proposals have been advanced to improve the identification of reading impairments in bilingual children. Helland and colleagues (2023), for instance, examined

monolingual typically developing Norwegian children, monolingual children with dyslexia, and bilingual children with a migration background and Norwegian as their community language, in order to investigate differences and similarities in reading and spelling, language-specific skills (vocabulary, sentence comprehension) and domain-general abilities (e.g., short-term memory, rapid naming). The aim was to identify potential markers of dyslexia in bilingual populations. As expected, bilingual children's reading scores were comparable to those of the dyslexic group. However, while bilinguals performed better in sentence comprehension than in vocabulary, the opposite pattern emerged for dyslexic children. The two groups diverged more markedly in the domain-general measures, particularly in short-term memory, working memory, and rapid naming. Based on these findings, the authors identified three subgroups of bilingual children: one with performance levels similar to those of typically developing monolinguals, one similar to those of dyslexics, and one intermediate. They concluded that low literacy or language-specific outcomes cannot be considered valid indicators of dyslexia in bilingual children, as such patterns are typical of the bilingual population as a whole. Instead, early signs of reading impairment should be sought in domain-general abilities, which are less likely to be influenced by limited language proficiency, and therefore less prone to misinterpretation.

Bilingual and monolingual children's performance on reading, language-specific, and language-independent tasks was also investigated in Italian by Taha and colleagues (2022). Their study included monolingual and bilingual good readers, as well as monolingual and bilingual poor readers, who were tested across a range of tasks targeting these domains. Results revealed a clear effect of reading level, but not of language, on language-specific tasks (nonword repetition, sentence repetition, phonological awareness), while language-independent scores were comparable across the four groups. Phonological measures, in particular, had already been identified as reliable predictors for distinguishing between typically developing and dyslexic bilingual children in Italian (Vender et al., 2020; Vender and Melloni, 2021).

As this brief overview highlights, further research on the interaction between bilingualism and reading impairments remains necessary. To date, no standardized procedures are available for the accurate diagnosis of reading deficits in bilingual contexts. Consequently, bilingual children from disadvantaged backgrounds often face the dual risk of over- or under-diagnosis, as reflected in the inconsistent percentages of bilingual pupils in special education programmes reported across studies. The main source of misdiagnosis lies in the typically low proficiency these children display in the language of instruction, which makes it difficult to determine whether early reading difficulties stem from limited linguistic competence or from genuine

impairments. In response, schools often adopt *waiting strategies* – postponing diagnosis until sufficient language proficiency is achieved – yet this approach may delay essential interventions, reducing their effectiveness. Recent literature has thus shifted its focus away from exclusive reliance on reading and language-specific skills, which are not reliable indicators of dyslexia in bilinguals, toward metalinguistic or domain-general skills, which are typically impaired in dyslexia but remain unaffected by reduced language proficiency.

Such abilities are widely recognized as core predictors of reading development. Chapter 2 will provide an in-depth overview of the role these skills play in literacy acquisition, as well as how they can be assessed and effectively trained.

Before proceeding, the present chapter will conclude with a discussion of one of the most influential theoretical frameworks of language competence in bilingualism, which will help summarize and interpret the bilingual fragilities examined thus far.

1.3.5. A theoretical framework for bilingual outcomes in education

The findings that emerged from the studies reviewed in this chapter may be taken as evidence in favour of a “disadvantage of bilingualism”. As it is known, in fact, after the dramatic change in the consideration of bilingualism brought about by the work of Peal and Lambert (1962), research on the topic has largely, and sometimes inconclusively, debated the real effect of bilingualism on cognitive and linguistic domains. A consistent body of research has provided evidence in favour of a bilingual advantage in this respect (Barac and Bialystok, 2012; Bialystok, 1987, 2007, 2015; Bialystok et al., 2005; Cromdal, 1999), while other work has been more cautious, claiming that advantages are absent or limited to restricted circumstances (Baus et al., 2020; Desjardins et al., 2019; Paap et al., 2014, 2015; Sadat et al., 2012). More recent research has offered a more reconciling view, proposing a trade-off hypothesis according to which an enhancement in one specific domain (e.g., executive functions) structurally or biologically needs to be compensated by a cost in another domain (e.g., morphosyntactic processing) (Leivada et al., 2023; the hypothesis has been empirically supported in Festi and Vender, 2024). This might also apply to our specific case, in which the sometimes attested advantage in decoding is counterbalanced by a reduced language comprehension. Of course, this hypothesis would warrant further investigation, which goes beyond the scope of the present work.

However, the linguistic weaknesses displayed by bilingual children with a migration background is well attested, as are the consequences that this disadvantage has on specific reading components (text reading, reading comprehension). The present paragraph introduces a theoretical framework that, building on linguistic and sociocultural factors, will allow to clarify that the gap between bilinguals and monolinguals observed in the studies reviewed is not to be attributed to bilingualism *per se*, but rather to extralinguistic variables.

In his pioneering work, Cummins (1979b) proposed one of the most influential theoretical frameworks to explain the conflicting findings that had emerged from apparently comparable studies on bilingualism. Up to that point, research had typically examined the effects of dual language exposure (sometimes even interpreted as a source of ‘mental confusion’; Peal and Lambert, 1962), sociocultural factors, and educational settings in isolation rather than as interacting variables. Cummins distinguished, for example, between immersion programs, in which all students start with little or no knowledge of the language of instruction and receive gradual, supported exposure, and submersion programs, in which bilingual children are placed alongside monolingual peers and are expected to achieve rapid progress with minimal scaffolding. According to Cummins, the lack of a comprehensive model considering the interplay among these factors had led to the inconsistent findings surrounding bilingual outcomes.

To address this issue, he formulated two hypotheses to explain the diverse educational and linguistic outcomes of bilingualism: the Threshold Hypothesis and the Developmental Interdependence Hypothesis.

The Threshold Hypothesis was designed to account for the apparent inconsistencies in research showing that bilinguals’ linguistic and cognitive skills could be superior, equal, or inferior to those of monolinguals. Cummins (1979b) argued that such discrepancies stemmed from a lack of attention to variables such as socioeconomic status and the relative prestige of the two languages. In particular, studies often overlooked the impact that replacing a family language with a more prestigious community language could have on an individual’s linguistic development. Unlike children whose two languages are equally valued and institutionally supported – thus experiencing *additive bilingualism* – children with a migration background often live in contexts of *subtractive bilingualism*, where one of the languages dominates and the other is marginalised. As discussed earlier, this situation typically leads to incomplete development of both languages, especially the family language. According to the Threshold Hypothesis (Cummins, 1979b), the cognitive and linguistic benefits of bilingualism can only emerge once a certain minimum threshold of competence in both languages has been reached. Below this

lower threshold, children may experience negative effects of dual language exposure; reaching a higher threshold, by contrast, enables access to the potential advantages of bilingualism.

Closely related to this view, the Developmental Interdependence Hypothesis (Cummins, 1979b) posits that the level of competence a child can attain in the second language partly depends on the level of development already achieved in the first language at the time of intensive exposure to the second. A premature shift toward the new language often interrupts the full development of the first one, thereby undermining the foundation needed to make progress in the second.

Together, the two hypotheses conceptualize bilingualism not merely as a linguistic phenomenon, but rather as a multifaceted construct encompassing social, cognitive, and educational dimensions. This comprehensive framework remains particularly relevant for understanding the linguistic and literacy acquisition trajectories of bilingual children with a migration background, for whom bilingualism extends far beyond the simple alternation between two languages in daily life. Building on this perspective, the empirical studies conducted for the present dissertation aim to delineate a multidimensional profile of bilingual children with a migration background, taking into account linguistic, cognitive, socioeconomic, familial and literacy-related factors.

Chapter 2 – Early linguistic predictors of reading skills: role, screening, and intervention

2.1. What are reading predictors

Reading is a complex, multicomponent process. While the *Simple View of Reading* (Gough and Tunmer, 1986; Hoover and Gough, 1990) effectively explains how reading comprehension occurs – by considering it as the product of decoding and language comprehension – other factors of a heterogeneous nature must also be taken into account when investigating how all the single actions involved in reading are made possible.

A review of the various skills involved in the reading process is provided by Akarsu and colleagues (2024). In their work, the authors classify these abilities into six categories: organization of sensory input, visual perception and integration, motor functions, auditory-linguistic skills, self-regulation skills, and environmental factors.

Sensory integration allows for the organization of sensory input, which consists in the generation of perceptions, emotions, and behaviours, in addition to physical response. It is composed of three different but interconnected processes: *sensory registration* – the reception of sensory stimuli; *sensory modulation* – the brain's ability to maintain an adaptive range of performance in response to stimuli; and *sensory discrimination* – the differentiation and organization of the spatial and temporal aspects of external stimuli (Akarsu et al., 2024). In the reading process, the integration of these sensory components enables individuals, for instance, to focus on print, maintain an adequate posture, and associate symbols with the corresponding sounds (Skibbe et al., 2019).

This first component is closely connected with visual perception and integration, which allows for the recognition and distinction of letters and words, the learning of their spatial arrangement and directionality, and the grapheme-phoneme mapping (Yeatman and White, 2021). Motor functions, on the other hand, are necessary not only for maintaining an adequate body posture but also for ensuring correct and effective eye movements during reading (Rayner, 1998).

Self-regulation, which falls within the domain of executive functions, contributes to the modulation of thoughts, emotions, and behaviour, enabling individuals to adapt to their

environment. Studies have shown that self-regulation skills are positively associated with school readiness (Blair and Raver, 2015). More broadly, executive functions encompass attention, inhibition, working memory, and cognitive flexibility. Taken together, these components are essential for the successful completion of cognitively complex activities, including reading (Cartwright, 2012).

As previously discussed, environmental factors also play a crucial role in reading acquisition (see Paragraphs 1.3.2.4 and 1.3.2.5). These include the home literacy environment, socioeconomic status, cultural attitudes toward literacy, parental support, and child-parent interaction (Bello et al., 2024; Eisenwort et al., 2018; Ginsborg, 2006; Hoff, 2013; Luo et al., 2021; Novita and Kluczniok, 2022; Parks and Smeriglio, 1986; Pungello et al., 2009; Valcárcel Jiménez et al., 2024). Such environmental factors have been considered in our studies; specifically, in Study 1, we will examine how socioeconomic status can influence not only reading acquisition but also pre-reading skills.

Finally, the skills that Akarsu and colleagues (2024) define as auditory-linguistic skills include all language-related abilities that form the foundation of reading decoding and comprehension: vocabulary, phonological awareness, letter knowledge and listening comprehension. These skills are at the core of our investigation. In Study 1, we will see how preschool performance in these and other abilities predicts subsequent reading outcomes, comparing monolingual and bilingual children; in Study 2 and 3, the implications of training of one specific ability – phonological awareness – will be discussed.

All these heterogeneous abilities contribute equally to successful reading, and an impairment in any of them would likely lead to reading deficits or difficulties in reading acquisition of various kinds. However, providing a detailed analysis of how each of these skills relates to reading falls beyond the scope of the present work. The following sections will therefore analyse in detail the role of linguistic predictors of reading skills. Since the relationship between preschool predictors and later reading skills in monolingual and bilingual children acquiring literacy in Italian has been scarcely investigated (Casani, 2021), we will first review how previous studies have explored the predictor-reading relationship in English, in Italian monolingual preschoolers and beginning readers, and in older bilingual children acquiring literacy in Italian. We will then discuss whether investigating reading predictors can be an effective way to identify reading impairments in bilingual children. Finally, studies focusing on pre-reading skills training (phonological awareness) will be presented to illustrate that these abilities can be effectively supported even in linguistically fragile populations.

2.2. Linguistic predictors of reading skills in English

As is typically the case in much language-related research, most studies on linguistic predictors of reading have been conducted with English-speaking samples. However, extending research to other languages is essential, as different predictors have been shown to be more reliable in orthographically transparent languages versus those that are opaque. Nevertheless, selected studies on English will be analysed as a starting point for our examination of pre-reading skills. These studies will be classified into six broad categories of reading predictors: phonological, orthographic, and morphological awareness, vocabulary, lexical access, and oral skills.

2.2.1. Phonological awareness

The idea that phonological skills serve as a precursor to reading has been systematically investigated since the 1970s (Mattingly, 1972; see Adams, 1998, for a review). Phonological awareness can be defined as the ability to perceive and manipulate speech sounds (Stahl and Murray, 1994). These include not only phonemes but also larger phonological units such as onsets, rhymes, and syllables. Developing this ability is far from trivial: although spoken language is composed of distinct sounds, speakers do not perceive them as discrete units but rather as a continuous stream. Therefore, to speak and comprehend, individuals do not need to be explicitly aware of the sounds of language. Nevertheless, some degree of phonological awareness becomes necessary to understand the relationship between speech sounds and written symbols – that is, to learn to read.

As pointed out by Bryant and colleagues (1990), the reason why a certain level of phonological awareness is required before reading instruction is straightforward: in alphabetic languages, children must be aware of phonemes in order to learn the alphabet, as letters generally represent phonemes. However, more complex phonological awareness tasks are not immediately accessible; rather, they require familiarity with orthographic representations to develop fully. According to Perfetti and colleagues (1987), phonological awareness and reading stand in a reciprocal relationship: the former supports the initial stages of reading acquisition, while the latter enables the performance of more complex phonological operations. The relationship between phonological awareness and reading is further supported by evidence from dyslexic and illiterate individuals. As discussed in Section 1.3.4, the surface manifestations of dyslexia – namely, reading impairments – are consistently associated with phonological deficits (Snowling,

2001). Similarly, research has shown that illiterate individuals display poorer phonological skills than readers (Adrián et al., 1995).

The progressive acquisition of phonological awareness involves not only phonological skills but also the development of specific phonological components. In this regard, Stanovich (1992) hypothesized that sensitivity to phonological units develops along a continuum, with ‘shallow’, more salient units (such as rhymes and syllables) being more readily accessible, and ‘deep’, smaller units being acquired later on. This perspective was further elaborated by Adams (1998), who suggested that the various tasks used to measure phonological awareness correspond to increasingly complex and fine-grained phonological abilities. According to the author, the first level is represented by the ability to have an ear for words and to remember familiar rhymes. This is followed by the ability to identify rhyme and alliteration patterns in words, as in oddity tasks. The third level consists of identifying syllables and syllable-internal phonemes and their corresponding sounds, typically assessed through blending, segmentation, and isolation tasks. The fourth level entails full phoneme segmentation beyond the syllable level, as in tapping tasks. Finally, the fifth and most demanding ability involves phoneme addition, deletion, or substitution, resulting in the creation of a new (non)word.

Phoneme or syllable blending, deletion, segmentation, and substitution are among the most widely used tasks to assess phonological skills. These tasks directly measure, to varying degrees, a child’s ability to process and manipulate such units – a fundamental requirement for reading acquisition. Using these measures, the positive relationship between phonological skills and successful reading has been empirically confirmed by numerous studies, starting with Perfetti and colleagues (1987) and Torgesen and colleagues (1989), who found that higher accuracy in phoneme blending was associated with better reading abilities. These results have been consistently replicated over the years with various phoneme manipulation tasks (e.g., first- or final-phoneme deletion, tapping, blending, segmentation) and across both younger and older monolingual English-speaking children (Bryant et al., 1990; Clayton et al., 2020; Leather and Henry, 1994; Lonigan et al., 2000; Stahl and Murray, 1994; Storch and Whitehurst, 2002; Melby-Lervåg et al., 2012, for a meta-analysis). Collectively, these studies highlight the unique contribution of phoneme manipulation to concurrent and subsequent reading skills, especially concerning the decoding component (Demont and Gombert, 1996; Hogan et al., 2005; McBride-Chang et al., 1997, Powell and Atkinson, 2021). As will be discussed in Section 2.3, this relation has been proved valid also for transparent orthographies (Ergül et al., 2022; Pfof, 2015).

The relationship between rhyme identification and reading skills is possibly less straightforward. In Adams' (1998) hierarchy of phonological skills, this ability is placed among the most primitive ones, between the first and the second level. Indeed, children become familiar with rhyme units quite early, long before phonemes (Anthony et al., 2002). The predictive role of rhyme identification in reading development has been widely investigated, given its early accessibility in the phonological sensitivity continuum. However, research has produced mixed results regarding the unique contribution of this skill to reading acquisition. Lundberg et al. (1980) and Bradley and Bryant (1983, 1988) found a strong correlation between kindergarten rhyme sensitivity (rhyme production and odd-one-out tasks) and later reading skills, up to 4th Grade. According to Goswami and Bryant (1992), this correlation can be attributed to the large use of analogy as a strategy for initial word decoding. Specifically, the authors observe that if children are aware of rhymes, when they learn how to read a word like *beak*, they are facilitated in acquiring the correct spelling of an unknown word such as *peak*, since the two rhyme and the rhyming segments are constituted by the same graphemes. Despite these initial findings, subsequent research has not consistently replicated the results of Lundberg et al. (1980) and Bradley and Bryant (1983, 1988), showing that, when phoneme awareness is assessed together with rhyme awareness, the former always appears to have the greatest predictive power (Bryant et al., 1990; Duncan et al., 1997; Hulme et al., 1998, 2002; Melby-Lervåg, 2012; Muter et al., 1998; Nation and Hulme, 1997). Alternatively, rhyme sensitivity may come into play later on, when grapheme-phoneme conversion rules are already established: this is what emerged from the study by Wimmer and colleagues (1994), who found that, in children learning to read in German, kindergarten rhyme awareness had a limited predictive power on 1st Grade reading, but this power increased by the end of 2nd Grade. The authors suggest that initial reading can only exploit grapheme-phoneme conversion rules, and that only when these are learnt, rhyme sensitivity can contribute to building mental representations of written words through the connection of recurrent phoneme clusters in their written and oral form. However, it must be clarified that this study was conducted on a transparent orthography, whose initial acquisition may diverge from that of an opaque orthography in terms of pattern and strategies.

One further measure often used to investigate phonological competence is phonological working memory, a memory component specialized in the storage and processing of phonological information (Gathercole and Baddeley, 1993). Intuitively, all the tasks described above require the involvement of this component to be performed: in a phoneme blending task, for instance, all individual input phonemes must be temporarily stored in phonological short-term memory, before being blended into a whole word by the phonological working memory. One of the most

effective tasks employed to measure phonological memory is nonword repetition. This task requires participants to repeat strings of sounds forming non-existing words, designed according to the phonotactic rules of a given language. This apparently simple activity activates multiple phonological components, including phonological working memory, phonological processing, and speech perception and articulation (Vender et al., 2020). Additionally, it eliminates the direct influence of vocabulary knowledge, as it is based on novel, non-existent words.

As pointed out by Nation and Hulme (2011), relatively few studies have investigated the potential predictive relationship between nonword repetition and reading acquisition, while this ability has often been examined in dyslexic individuals, as a clear marker of reading impairments (Melby-Lervåg and Lervåg, 2012; Vender et al., 2020; Vender and Melloni, 2021). Considering phonological memory as a broader skill, findings on the relationship between this ability and reading development were obtained by Wagner and colleagues (1994, 1997), who investigated the developmental trajectory of this and other phonological processing skills and their mutual relationship with decoding growth. The first study was conducted using a longitudinal design on English-speaking children from kindergarten to 2nd Grade. The aim was verifying the causal influence between phonological processing components (analysis, synthesis, memory, naming) tested in kindergarten, and decoding, assessed in 1st Grade. Phonological memory, assessed through a sentence-repetition and a forward digit span task, was found to be significantly correlated with 1st Grade decoding when analysed in isolation. However, this effect disappeared when phonological memory was included in a structural equation model together with the other phonological processing variables. No causal relationship was found for decoding on phonological processing either. Additionally, phonological memory tested in kindergarten had a significant concurrent effect on letter naming, but letter naming in kindergarten did not exert the same effect on 1st Grade phonological memory. As further support for independence of phonological memory from reading acquisition, the authors observed that each phonological processing component displayed an independent growth rate, with phonological memory exhibiting the slowest among them. Comparable results were replicated in older children (Wagner et al., 1997).

When phonological memory is measured in terms of nonword repetition, however, different predictive patterns emerge. Gathercole and Baddeley (1993) found that nonword repetition assessed in kindergarten could predict reading outcomes at age 8. Specifically, nonword repetition appeared to correlate with a reading task that involved phonological recoding, namely one in which children had to complete a sentence by identifying the orthographic form of a word

represented in a picture. During phonological recoding, initial phonological segments need to be stored in phonological memory while subsequent graphemes are mapped onto the corresponding phonemes. Phonological storage and retrieval are likewise involved in nonword repetition, and this may explain the correlation between the two tasks.

Building on this finding, Nation and Hulme (2011) explored the reciprocal predictive relationship between nonword repetition and reading, both concurrently and longitudinally. They observed that no concurrent predictive pattern emerged between nonword repetition and reading in children aged 6, in either direction; however, the opposite occurred for 7-year-olds, for whom correlations were significant in both directions. Longitudinally, reading at 6 predicted nonword repetition at 7, whereas nonword repetition at 6 did not predict reading at 7.

According to the authors, this significant predictive relationship between reading and nonword repetition reflects a change in phonological processing associated with increased reading proficiency. They explain these results through the lexical restructuring hypothesis, according to which children's vocabulary growth leads to a shift from holistic phonological representations to a more fine-grained segmentation of phonological entries. Although the original version of this theory did not explicitly mention the role of literacy acquisition in lexical restructuring (Metsala and Walley, 1998), the authors hypothesise that acquiring orthographic forms of words clearly contributes to the specification of their phonological forms, enhanced by the phonological sensitivity required to learn grapheme-phoneme mappings. Increased sublexical skills, in turn, facilitate nonword repetition, which mainly relies on phonological processing. The association between vocabulary and phonological memory was further confirmed in longitudinal studies (Gathercole, 1995; Gathercole et al., 1992) showing comparable developmental trajectories between the two variables.

According to Martinez Perez and colleagues (2012), a fundamental aspect that had not been specifically addressed in previous research on the nonword repetition – reading relationship is which component of the phonological memory exerts the greatest influence on reading. In fact, traditional nonword repetition tasks, which typically consist of item varying in length and syllabic complexity, do not allow for the separation of item short-term memory (i.e., the ability to retain individual verbal information for a long time) and order short-term memory (i.e., the ability to recall lists of orally presented items in the correct sequence). By assessing these skills separately in kindergarteners, the authors found that only order short-term memory provided unique contribution to nonword reading at the end of 1st Grade.

Building on these previous, partially contrastive and incomplete findings, Cunningham and colleagues (2021) aimed to verify whether order short-term memory forms a separable construct from nonword repetition and, if so, whether the two skills predict reading longitudinally and vice versa. Digit span, phoneme repetition (for order short-term memory) and nonword repetition were assessed multiple times in English-speaking children starting from the beginning of 1st Grade. Potential mediation effects of phoneme awareness (phoneme isolation and deletion) were also examined. Reading was also tested at each time point through a word reading task and a letter knowledge task. Their results showed that order short-term memory, but not nonword repetition, directly predicted reading at initial stages, although this relationship weakened at later grades. Nonword repetition, instead, exhibited a predictive power on initial reading mediated by phoneme awareness. Looking at the opposite direction, letter knowledge predicted nonword repetition via phoneme awareness in the early grades, while word reading directly influenced nonword repetition in later grades.

Taken together, these findings suggest that the predictive relationship between nonword repetition and reading is not straightforward, but rather mediated either by vocabulary acquisition (Gathercole, 1995; Gathercole et al., 1992; Nation and Hulme, 2011) or by phonological awareness (Cunningham et al., 2021), and that only a specific component of phonological memory, namely order short-term memory, appears to be directly linked to reading outcomes (Martinez Perez et al., 2012). According to Cunningham and colleagues (2021), the interplay among phonological memory, phonological awareness and reading develops in two steps: first, phonological memory initially facilitates the storage of increasingly complex auditory stimuli, allowing for the development of increasingly fine-grained phonological representations; second, these representations support the development of decoding skills. The fact that the effect of phonological awareness on reading cannot be completely isolated, but that mediating effects exist (Cunningham et al., 2021; Wagner et al., 1994, 1997), is clearly a product of the multicomponent nature of the reading process. As we will see, comparable conclusions will be drawn also for the other predictors examined; this consideration played a central role in the development of Study 1 for the present dissertation (see Chapter 3).

The predictive link between phonological awareness and reading skills has been challenged by Castles and Coltheart (2004). According to the authors, previous studies could not completely rule out the possibility that the effect of a third variable might influence the relationship between the two skills. Specifically, they describe a number of requirements that studies investigating phonological awareness-reading skills relationship should fulfil, showing that very few of them

actually manage to do so. As for longitudinal studies, these criteria include (i) that phonological awareness be measured before children acquire any reading knowledge, including letter sound knowledge; (ii) that the third-variable problem be limited as much as possible by levelling out differences in common interfering variables such as age, language abilities, nonverbal intelligence, or working memory. Even though previous studies included in their analysis provided evidence in favour of blending and segmentation and phoneme awareness (in contrast to syllable and rhyme awareness) as the phonological operation and sensitivities most closely linked to successful reading acquisition, none of the studies examined could effectively rule out the interference of a potential third variable.

Considering then training studies, the authors further claim that, for a univocal connection between phonological training, phonological awareness, and reading outcomes to be established, (i) training protocols should focus exclusively on phonological awareness, leaving out any other reading-related skills such as sound-letter correspondence; (ii) the training benefits should also extend to reading, and not be limited to phonological awareness; (iii) the transfer should be reading-specific and not observed in other abilities, such as mathematical skills; (iv) children involved in the training must not have had previous literacy knowledge, otherwise the benefits observed could be attributable to a reinforcement of phonological skills built on previous reading competence. As highlighted for longitudinal research, the authors conclude that no study has managed to fulfil all methodological requirements. This, of course, does not directly entail that a link between phonological awareness and reading abilities is non-existing; rather, none of the studies was able to show that this relation is exclusive and not mediated by the effect of a third variable (e.g., previous reading knowledge, orthographic instruction included in the protocol, lack of transfer to reading skills, external variables not controlled for in the samples).

The observations proposed by Castles and Coltheart (2004) have been recently re-examined by Gioia and colleagues (2024). In their systematic review, the authors aimed to verify whether longitudinal or training studies carried out after Castles and Coltheart's analysis fulfilled the proposed requirements. Since their review yielded a negative answer, they conducted a large-scale longitudinal investigation on more than 810,000 French first graders, measuring the effect of phonological awareness, letter knowledge, and knowledge of the alphabetic principle (e.g., children's ability to identify the written form of the initial phoneme of words presented orally) on early 2nd Grade reading. They found that, when all predictors are considered in a regression model, only knowledge of the alphabetic principle emerges as significant predictor of later

reading. This finding has interesting implications for initial reading acquisition and phonological training, which, as claimed by the National Reading Panel (2000), appears to be more effective when orthographic representations are included. However, it must be borne in mind that these studies were conducted on opaque orthographies, for which explicit training on phonological awareness appears to be more effective (see Section 2.4); such considerations will be taken into account again in our training studies (Chapter 4 and 5).

2.2.2. Orthographic awareness

An ability closely related to phonological awareness in the reading acquisition process is orthographic knowledge, in particular letter knowledge. This refers simply to the ability to assign alphabetic letters their corresponding sounds or names. A substantial body of research has established the predictive role of this skill in later reading acquisition (Blaklock, 2004; Bruck et al., 1997; Clayton et al., 2020; Lonigan et al., 2000; McBride-Chang, 1999; Muter et al., 1998; Schatschneider et al., 2004). What these studies consistently agree on is the fact that not only does pre-reading letter knowledge provide unique contribution to initial reading outcomes, but it sometimes turns out to be the strongest predictor, explaining more individual variance in reading than phonological awareness or rapid naming (see below). This is precisely the finding obtained by Blaklock (2004), who showed that, although phonological awareness assessed at the beginning of 1st Grade (measured in terms of phoneme deletion) predicted initial reading, the significance of this relationship became null when letter knowledge was controlled. As discussed in the previous section, ensuring that children do not possess any orthographic knowledge was one of the requirements expressed by Castles and Coltheart (2004) to ensure that, when the link between phonological awareness and reading is tested, it is not mediated by a third variable. Further evidence of the central role that this competence plays in predicting reading is provided by the fact that letter knowledge was found to be indirectly related with reading comprehension as well, through a direct contribution to word reading (Catts et al., 2015).

According to Noel Foulin (2005), however, these consistent results can be challenged in two ways. First, most studies have been carried out on English-speaking samples, raising the possibility of language-specific effects; second, correlational analyses cannot fully explain why this relationship occurs. The first issue has been consistently challenged by several studies examining the predictive relationship between letter knowledge and reading in transparent orthographies (De La Calle et al., 2018; Leppänen et al., 2008; Näslund and Schneider, 1996;

Zarić et al., 2021; see Caravolas et al., 2013, and Landerl et al., 2022, for a cross-linguistic perspective). As in opaque orthographies, these studies demonstrated the unique contribution of early letter knowledge to later reading outcomes, which appears to be comparable, or even greater than, that of phonological awareness (Zarić et al., 2021). The potentially different role of reading predictors for transparent orthographies is addressed again in Section 2.3, dedicated to Italian studies.

As for the second, the author proposes that letter name knowledge and reading success are linked by an indirect relationship: letter knowledge enhances foundational literacy-related skills, such as phoneme-grapheme association and phonological sensitivity, which in turn underlie the acquisition of the alphabetic principle and reading skills.

This hypothesis has been recently empirically confirmed by Acha and colleagues (2023), who aimed to explore how the rate of letter acquisition modulates reading. To this end, they trained a sample of 30 children to learn the grapheme-phoneme mappings of artificial letters. Learning rate was measured by estimating the number of attempts needed to reach 80% accuracy in letter-sound mapping. After that, children were shown words constructed with these artificial letters. In the post-test, children were asked to read random words taken from the training items (word reading task) and to correctly discriminate words included in the training from phonological distractors (i.e., words that differed by one letter from the training items; word identification task). Results showed that children who were faster at acquiring letter-sound mapping were also more accurate in artificial word reading and in word identification. According to the authors, this finding adds to previous evidence showing that faster acquisition of letter sounds facilitates the application of this knowledge, leading to better reading fluency; additionally, solid letter knowledge allows for a more accurate identification of these units in words, enabling beginning readers to be faster and more accurate in word identification.

2.2.3. Morphological awareness

Morphological awareness refers to individuals' 'conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate that structure' (Carlisle, 1995, p. 194). Morphemes are defined as the smallest meaning-bearing sublexical components of a language. While the relationship between phonological awareness and reading is relatively straightforward – the former providing the foundation for the acquisition of grapheme-phoneme

correspondences and the latter enhancing phonological sensitivity – this may not be the case for morphological awareness and reading.

As noted by Deacon and Kirby (2004), relatively few studies have examined the role of morphological awareness in reading performance and its contribution to reading, independent of phonological awareness. As the authors argue, research investigating the link between morphological awareness and reading is essential to avoid treating this skill simply as ‘more phonological’, namely with a relationship with reading that is not independent from phonological awareness (Deacon and Kirby, 2004, p. 225). In morphologically rich languages, explicit identification of morphemes may serve as an intermediate mechanism between phoneme-grapheme conversion and the lexical route (Coltheart et al., 2001; see Section 1.1.1). This process not only facilitates the interpretation of novel words (e.g., *windowist* as ‘window-maker’) but also supports the correct spelling of irregular words (e.g., *react* and *read*, where the former consists of the prefix *re-* and the verb *act*, whereas the latter is a monomorphemic word; Deacon and Kirby, 2004).

As with phonological awareness, this ability has been assessed through a variety of tasks, including production (deriving an inflected form from a base), judgment (determining whether a word is morphologically derived from another), decomposition (extracting the base from a derived form), and analogy (applying a derivational process inferred from an example). Moreover, as discussed for phonological awareness, morphological awareness develops gradually, beginning with more salient units and operations (Kuo and Anderson, 2006). In his seminal ‘wug’ study, Berko (1958) demonstrated that preschool children are already able to apply inflectional processes to novel words – a finding that has been consistently replicated in subsequent studies on English (Carlisle, 1995). Awareness of derivational morphology, by contrast, has been shown to emerge later, typically around 3rd or 4th Grade, and to continue developing into later grades (Carlisle, 2000).

Previous research has demonstrated a positive correlation between morphological awareness and reading performance, although findings have been mixed regarding which reading components are most affected. The first study with this aim was conducted by Brittain (1970), who administered a modified version of Berko’s wug test (1958) to a sample of first- and second-grade children. The author found that higher accuracy in nonword inflection was associated with better performance across several reading measures, including word recognition and reading comprehension.

Possibly due to its later and slower development, or to its close association with reading comprehension, the predictive role of early morphological awareness on later reading outcomes has been less investigated in kindergarteners. Apel and colleagues (2013), for instance, aimed to investigate which morphological awareness tasks best predicted specific reading components in kindergarteners. The morphological awareness tasks selected included morphological derivation (completing a sentence by inserting a derived word from a given base) and compounding (creating novel words by combining affixes and providing a definition for the resulting word; e.g., re- plus -hit becomes *rehit*, which means ‘to hit again’). In kindergarteners, emergent reading was tested through standardised word and pseudoword reading tasks. Phonological awareness was also assessed – through word, syllable, and phoneme deletion tasks – to verify the unique contribution of morphological awareness to reading. Results showed that morphological awareness provided a significant unique contribution to concurrent reading, both for words and nonwords. However, when examining single-task contribution, only the morphological derivation task uniquely predicted nonword reading; no specific single predictor was found for word reading. These limited results may suggest a relatively small contribution of morphological awareness to reading decoding, especially in very young children; however, comprehension was not assessed in this sample, making a comparison between the two reading components unfeasible.

Most research on the link between morphological awareness and reading has therefore focused on beginning readers. In line with the study by Apel et al. (2013), Deacon and Kirby (2004) aimed to examine the unique contribution of morphological awareness beyond phonological awareness in a sample of English-speaking elementary school children from 2nd to 5th Grade. Reading was measured through single-word and nonword reading, as well as reading comprehension. Morphological awareness assessed in 2nd Grade uniquely predicted reading development beyond phonological awareness. The strongest contributions emerged for nonword reading and comprehension, suggesting, as anticipated above, a more substantial role of morphological awareness in comprehension than in decoding; the contribution to nonword reading, however, could not be fully explained within the authors’ framework.

The contribution of morphological awareness to reading comprehension was further supported by Kirby and colleagues (2012). In their longitudinal study, which followed children from 1st to 3rd Grade, they examined the contribution of morphological awareness (tested across all grades through a word analogy task) to reading (tested exclusively in 3rd Grade) beyond phonological awareness, and whether this contribution varied across reading stimuli (words, nonwords, and

text) and components (speed, accuracy, and comprehension). Overall, they found that the influence of morphological awareness on reading was greater when the former was measured in 3rd Grade, possibly due to children's growing focus on reading for meaning, which may increase their sensitivity to morphemic structure. Morphological awareness exerted an independent effect across all reading stimuli and components, but the effect was stronger for text-reading speed and comprehension.

A unique contribution of morphological awareness beyond phonological awareness to reading decoding was instead found for first graders assessed on word and nonword reading (Wolter et al., 2009). In this study, morphological awareness was tested through a derivation task similar to that used by Apel et al. (2013; see above). This is in contrast with the findings from Kirby and colleagues (2012), who did not find any predictive effect of first-grade morphological awareness on any third-grade reading components (word, nonword, and text reading speed, accuracy, and comprehension). This discrepancy could be due to the different design of the two studies (longitudinal vs. concurrent), but also to an evolution of children's reading strategies: whereas in early years they may exploit their implicit morphological competence to read larger portions of words (or nonwords) more accurately, once decoding is automatized they start to apply this knowledge to aid them in extracting meaning from written stimuli.

Findings in favour of the contribution of morphological awareness to reading comprehension were also reported by Cunningham and Carroll (2015). The authors tested fourth graders on nonword derivation, nonword reading, and reading comprehension. Morphological awareness scores did not predict nonword reading accuracy, but emerged as the only unique predictor of reading comprehension. Comparable results were obtained by Deacon and colleagues (2014) when exploring the longitudinal predictive power of third-grade morphological awareness on fourth-grade reading comprehension. Interestingly, their analysis allowed them to highlight that the effect of the former skill on the latter is not only direct, but also mediated through word reading outcomes. The unique contribution of morphological awareness to later reading was found also in younger readers (1st to 2nd Grade; Sparks and Metsala, 2023). When morphological awareness is found to be predictive of later-grade decoding, it is generally because reading tasks include morphologically complex words (Cunningham and Carroll, 2015; Levesque and Deacon, 2022).

As we will see for Italian, morphological awareness exerts a predictive role on reading in transparent orthographies as well, albeit with mixed results. Studies on German readers showed that morphological awareness was either predictive of concurrent spelling, rather than reading,

in 3rd and 4th Grades (Görge et al., 2021), or of none of these literacy outcomes in a comparable population, reporting a greater role of phonological awareness (Haase and Steinbrink, 2022). Results from Greek, instead, were more in line with those from English studies, showing that kindergarten morphological awareness predicted both word and nonword reading accuracy – suggesting an early morpheme-based reading strategy – and reading comprehension (Diamanti et al., 2017). Similar patterns were observed for Hebrew (Cohen-Mimran et al., 2023) and Norwegian (Diamanti et al., 2024). Finally, a cross-linguistic study conducted on French, English, and Greek early readers (Desrochers et al., 2018) revealed, consistent with previous studies, that morphological awareness in 2nd Grade was concurrently predictive of reading comprehension across all languages, while this relation for decoding held only for the languages with an opaque orthography. Such mixed findings can be explained by the extreme heterogeneity in study variables and design: according to a meta-analysis conducted by Lee and colleagues (2023), the predictive role of morphological awareness changes according to orthographic depth, yielding stronger relationship with decoding in orthographically opaque languages, and depending on the task through which the skill is assessed (for instance, derivation tasks show a greater connection with word reading compared to inflection tasks).

An additional aspect that deserves further investigation is the direction of the relationship between morphological awareness and reading. According to Kuo and Anderson (2006), existing studies concurrently support four potential relationships: (i) morphological awareness contributes to reading; (ii) reading contributes to morphological awareness; (iii) the two are reciprocally related; and (iv) both co-vary as a function of another mediating factor, namely phonological awareness.

In this regard, a study conducted by Deacon and colleagues (2013) verified the reciprocal correlation between second-grade morphological awareness (measured in terms of word analogy) and third-grade reading (word and nonword reading accuracy), as well as between the same skills in the opposite direction (second-grade reading and third-grade morphological awareness). Both relationships were found to be significant even when other relevant variables (vocabulary and phonological awareness) were controlled. These findings were also supported by Law and Ghesquière (2017), who measured exclusively the contribution of first-grade reading to second-grade morphological awareness, reporting a significant relationship. It appears, therefore, that morphological awareness also stands in a reciprocal relationship with reading, as already observed for phonological awareness. A certain degree of these skills is needed to acquire initial reading principles, but it is through reading that children become able to further

develop these skills and exploit them for more cognitively demanding tasks, such as comprehension of increasingly complex texts.

2.2.4. Vocabulary

As previously discussed, according to the Simple View of Reading (Gough and Tunmer, 1986; Hoover and Gough, 1990), reading comprehension is the product of decoding and language comprehension. One component that directly contributes to language comprehension is vocabulary. Vocabulary knowledge is typically defined as ‘lexical representations of the stored phonology or sound patterns of words within the lexicon, along with semantic representations of word meaning’ (Ouellette, 2006, p. 554). Given its close connection with language comprehension, it is not surprising that a substantial body of research has examined the relationship between oral vocabulary and reading. If the ultimate goal of reading is to derive meaning from written text, and if text consists of words in their written form, then the larger the number of lexical entries stored in an individual’s mental lexicon, the easier it will be to understand written language once grapheme-phoneme correspondences have been established. At the same time, exposure to written stimuli allows emergent readers to acquire new words: as argued for other predictors of reading, vocabulary and reading also stand in a reciprocal relationship (Ricketts et al., 2007).

In terms of breadth and depth of lexical entries stored in an individual’s mental lexicon (Ouellette, 2006), vocabulary is typically measured using productive or receptive tasks – that is, tests in which participants are asked either to name a given object or to select the target picture corresponding to a spoken word.

Over the years, numerous researchers have investigated the relationship between vocabulary knowledge and both concurrent and later reading performance across different age groups, employing both cross-sectional and longitudinal designs. Overall, studies have consistently reported a significant relationship between vocabulary and reading comprehension. Focusing on pre-reading vocabulary and later reading, Muter and colleagues (2004) found that preschool vocabulary predicted later reading comprehension but not reading accuracy. This was confirmed by Duff and colleagues (2015), who found that infant vocabulary (i.e., measured before the age of two) accounted for only 11% of the variance in reading accuracy but 18% in reading comprehension. Comparable conclusions were reached by Sénéchal and colleagues (2007), who reanalysed previous studies (Sénéchal and LeFevre, 2002) on the predictive role of

kindergarten vocabulary in early reading comprehension. Interestingly, they observed that preschool vocabulary predicted later reading comprehension, but only in the higher grades, indicating a greater role of phonological awareness and decoding in earlier stages. This finding supports the hypothesis that children's orthographic and phonological competences must be sufficiently developed before lexical knowledge can exert its predictive influence. Further evidence comes from Bleses and colleagues (2016), who demonstrated that infant vocabulary could partially explain variance in reading skills even ten years after the initial assessment.

The effect of vocabulary on decoding, however, appears to be quite limited. Ouellette (2006) examined how receptive and expressive vocabulary breadth and depth predicted decoding, visual word recognition, and reading comprehension in more skilled readers. He found that only receptive vocabulary breadth accounted for variance in decoding, while both receptive and expressive vocabulary breadth predicted visual word recognition (measured through irregular word reading), and receptive vocabulary breadth and depth predicted reading comprehension. Similarly, Ricketts and colleagues (2007) found predictive relationships between vocabulary and irregular word reading and comprehension, but not between vocabulary and decoding accuracy, regular word reading, or text accuracy. The predictive role of receptive vocabulary for irregular word reading may be explained by the fact that a larger vocabulary facilitates the faster and more accurate recognition of words that cannot be read through straightforward grapheme-phoneme conversion. Overall, these findings confirm that vocabulary knowledge makes a stronger contribution to reading comprehension, particularly among more advanced readers.

2.2.5. Lexical access

To ensure adequate comprehension, word reading must not only be accurate and meaningful but also fluent – that is, readers should be able to identify printed words and access their meaning rapidly. A skill that has been consistently found to correlate with this ability is rapid automatized naming (RAN), defined as ‘the ability to name, as quickly as possible, visually presented familiar symbols such as digits, letters, colors, and objects’ (Georgiou et al., 2013, p. 218). Given its multicomponent nature, the contribution of RAN to reading has been widely debated: while some studies have emphasised its connection with phonological processing, others have argued for an independent role, as RAN has been shown to predict reading beyond phonological awareness (Denckla and Cutting, 1999).

The first scholar to investigate this relationship was Denckla (1972), who identified a severe colour-naming deficit in children with dyslexia. Since then, extensive research has provided both longitudinal and concurrent evidence for the predictive relationship between RAN and reading. Kirby and colleagues (2003), for instance, tested a sample of English preschoolers on rapid naming to assess whether this ability predicted later word, nonword and text reading comprehension beyond phonological awareness. They found not only an independent contribution of RAN, but also a greater predictive role of this skill in later grades compared to earlier ones. Moreover, slower RAN performance in kindergarten was significantly correlated with poorer later reading across all grades. Similar findings were reported by two meta-analyses: Araújo and colleagues (2015) showed that RAN predicted all reading measures (word, nonword, text, and comprehension), with stronger effects for word and text reading; McWeeny and colleagues (2021) further confirmed the unique predictive contribution of preschool RAN, particularly for word reading.

Despite the robust empirical link between RAN and reading, the underlying mechanism of this relationship has remained unclear. Georgiou and colleagues (2013) sought to clarify this issue by manipulating RAN task features such as seriality (stimuli presented serially vs. discretely), size (number of items and repetitions), and naming (requirement to name vs. respond to stimuli), and then examining the predictive relationship with word and nonword reading fluency. Their results revealed that only serial, name-specific RAN tasks predicted reading fluency, suggesting that RAN relates to reading because both involve the processing of serially ordered stimuli and the retrieval of specific verbal labels.

2.2.6. Oral skills

As previously discussed, reading is closely connected to oral language, as print is merely the written representation of oral speech. Therefore, reading comprehension cannot occur without an adequate background of oral skills. Among these, listening comprehension and narrative skills have been largely proven to be effective predictors of reading outcomes.

In Section 2.2.4, we have seen that vocabulary plays a fundamental role in reading comprehension, and of course also in listening comprehension. However, listening comprehension is not only the ability to attribute meaning to spoken words, but rather ‘one’s abilities to understand what one’s hears, [...] such as understanding a story told at the dinner table or building a mental model while watching a cartoon on television’ (Hogan et al., 2014, p.

202). To do so, individuals need not only to possess an adequate vocabulary, but also inferencing abilities and background knowledge of what they are hearing. As a consequence, listening comprehension can be assessed through different modalities, according to the aspect that the assessment aims to capture: picture-matching tasks focus more on vocabulary and grammar knowledge (e.g., tasks asking ‘point to the picture of the girl who is wearing a hat’), while story listening with comprehension questions can explore the role of inferencing and background knowledge in greater detail (Hogan et al., 2014).

Studies that have explored the relationship between listening comprehension and reading skills have consistently found a predictive effect of the former on the latter. Catts and colleagues (2005), for instance, tested a sample of English-speaking children longitudinally across all elementary grades. Results from listening comprehension and reading tasks showed that the former always uniquely contributed to variance in reading comprehension, but its contribution changed over the years: it was smaller in the first grades, leaving a greater role to decoding, and increased in later years. These findings are consistent with those discussed in the previous section on vocabulary, which also became a more significant predictor in more expert readers (see Section 2.2.4). Such a differential predictive role of phonological/decoding skills and listening comprehension skills has been consistently replicated in several longitudinal studies, both with preschoolers and beginning readers (Kendeou et al., 2009; NICHD Early Child Care Research Network, 2005; Storch and Whitehurst, 2002). This view has been more recently challenged by Lervåg and colleagues (2018), who found that listening comprehension was predictive of reading comprehension even in early grades and maintained its unique contribution across years. However, their study was carried out on a Norwegian-speaking sample, a language whose orthography is more transparent than English; as we will see in the next section, the predictive role of many components analysed so far can vary according to orthographic transparency.

The other oral language component frequently analysed in relation to reading is narrative skills. This is defined as ‘the ability to construct an original story and to retell a previously heard story’ (Roth et al., 1996, p. 258). The motivation behind the link between this oral skill and literacy lies in the structural similarities shared by the two abilities. Indeed, children naturally transition from a communicative to a narrative use of language throughout their linguistic development, and the connected texts they begin to deal with during reading instruction typically have a narrative structure. In addition, both oral and written narratives share a concise style, make use of richer and rarer vocabulary – often to convey unfamiliar or abstract concepts – and require cognitive

effort to abstract from reality (Roth et al., 1996). Despite these shared traits with written stimuli, narrative skills have been less investigated than other reading predictors, such as phonological awareness and vocabulary. When explored, however, narrative abilities are usually assessed using telling tasks, in which children are asked to tell a story based on a series of pictures, or retelling tasks, in which they are required to recall the events of a story they have just heard.

Among the studies that have focused on the predictive role of narrative skills, that by Reese and colleagues (2010) investigated it both in a sample of children who had already received one year of reading instruction and in one who had received two. Narrative skills were measured in terms of memory and quality of the retelling, while reading was evaluated in terms of fluency. Similarly to listening comprehension and vocabulary, retelling scores uniquely predicted reading in more skilled readers, but not in those who had received reading instruction for only one year.

However, these results can be challenged from two opposite perspectives. In a longitudinal study conducted by Piasta and colleagues (2018), narrative skills and emergent literacy (including vocabulary, letter knowledge, and phonological awareness, measured through rhymes detection and production, word and syllable blending, and sentence and syllable segmentation) were assessed in preschoolers, who were then retested in word reading after two years of instruction. Results showed that narrative skills and emergent literacy were weakly correlated, and that when these were introduced into the predictive model, narrative abilities could not account for individual variance in reading. In contrast, a more recent nine-year longitudinal study by Babayiğit and colleagues (2021) did show a significant unique contribution of preschool narrative skills across grades, although limited to reading comprehension. Children involved in this study were tested on reading at 10 and 14 years of age: this might provide further evidence in favour of the greater role of oral language skills in reading comprehension at later grades.

This section serves as an introduction to the main linguistic predictors of reading skills. Since most research on this topic is English-based, studies focused almost exclusively on English samples have been considered so far. This has allowed us to identify the most relevant reading predictors, to understand why they play this role, determine which reading component they most strongly influence, and establish at which reading stage their predictive effect becomes significant. All these aspects are summarised in Table 1.

Reading predictor	Assessment measures	Most influenced reading component	Reading proficiency level needed for the predictive effect	Main studies
Phonological awareness	Phoneme/syllable manipulation, rhyme detection, nonword repetition	Decoding	Emergent reading skills	Cunningham et al., 2021; Lundberg et al., 1980; Mattingly, 1972; Perfetti et al., 1987
Orthographic knowledge	Letter name/sound knowledge	Decoding	Emergent reading skills	Acha et al., 2023; Blaiklock, 2004; Noel Foulin, 2005
Morphological awareness	Morphological production, judgment, decomposition, analogy	Decoding and comprehension (mixed results)	Advanced reading skills	Brittain, 1970; Cunningham and Carroll, 2015; Deacon et al., 2013
Vocabulary	Receptive/expressive vocabulary, rapid automatized naming	Comprehension	Advanced reading skills	Muter et al., 2004; Ouellette, 2006; Ricketts et al., 2007
Lexical access	Rapid Automatized Naming	Decoding and comprehension	Emergent and advanced reading skills	Denckla, 1977; Georgiou et al., 2013; Kirby et al., 2003;

Oral skills	Listening comprehension, narrative abilities	Comprehension	Advanced reading skills	Babayiğit et al., 2021; Catts et al., 2015; Lervåg et al., 2018; Piasta et al., 2018

Table 1. Details on the role of linguistic predictors of reading skills in English.

As can be seen from this schematic summary, different language skills may overlap in predicting components of subsequent reading outcomes. This has consequential implications for the early predictive screening of potential reading difficulties: if several pre-reading skills jointly contribute to predicting a specific reading component, doubts may arise as to which language skills should be included in assessment protocols. Moreover, results from previous research have sometimes failed to identify unique contribution of each single language skill, highlighting a high degree of co-variation among these abilities. Study 1 of the present dissertation specifically addresses this issue: our approach argues in favour of a comprehensive, multicomponent view of the linguistic predictors of reading skills. We will show that comprehensive patterns of performance in preschool language tasks can effectively predict subsequent reading outcomes.

Before moving on to our experimental studies, research on reading predictors in Italian will be analysed and discussed. As already mentioned, very few studies have explored this relationship in Italian compared to English. However, research on transparent orthographies is crucial, as the predictive role of pre-reading skills has been shown to vary according to the orthographic transparency (Share, 2008). To our knowledge, only one study has explored the relationship between linguistic predictors and reading skills in preschool bilingual children acquiring literacy in Italian (Casani, 2021). Therefore, studies focusing on preschool monolinguals and preschool and older bilinguals will also be considered.

2.3. Linguistic predictors of reading skills in Italian

2.3.1. The Simple View of Reading in a transparent orthography

Before examining previous studies on reading predictors in Italian, it is important to clarify why the predictive role of language skills may differ in a transparent orthography with respect to an opaque orthography.

According to Hoover and Gough (1990), reading comprehension is the product of decoding and language comprehension. Consequently, the more advanced these two components are, the easier and more effective the understanding of written language will be. Studies on English have shown that, in beginning readers, the outcome of this interaction largely depends on the decoding component. This is quite intuitive, as in the early years children must first establish a stable phoneme-grapheme mapping, which then allows them to transition to more automatized reading (Florit and Cain, 2011). This proportion is reversed in more skilled readers: once decoding becomes automatic and reading for meaning becomes essential, vocabulary and oral language skills emerge as the strongest predictors (Catts et al., 2005; Ouellette, 2006; Reese et al., 2010).

However, studies on Italian have challenged this perspective. According to Florit and Cain (2011), the differing weights of decoding and language comprehension in reading comprehension are linked to the distinct reading acquisition trajectories observed in learners of opaque versus transparent orthographies. As previously discussed, children learning to read in an opaque orthography require more time than their peers in a transparent orthography to achieve comparable levels of accuracy (Seymour et al., 2003). The faster automatization observed in transparent orthographies may therefore anticipate the contribution of language comprehension, even in younger readers. To test this hypothesis, Florit and Cain (2011) conducted a meta-analysis that included studies examining the roles of decoding and language comprehension (measured in terms of narrative comprehension with multiple-choice questions, or picture-matching task to assess comprehension at sentence- or word-level) in reading comprehension across both orthographic systems. The results confirmed a greater and earlier influence of language comprehension compared to decoding on reading comprehension in transparent orthographies. In fact, whereas the influence of language comprehension on reading comprehension was minimal in English beginning readers and increased over time, this relation was observed to be much stronger for beginning readers of transparent orthographies. However, it must be clarified that, when decoding was measured in terms of reading accuracy, it did not

exert significant predictive power on reading comprehension; instead, if speed was considered, the relationship with reading comprehension was comparable to that of language comprehension. These findings are supportive of two views on the acquisition trajectories of transparent orthographies: first, the predictable correspondence between phonemes and graphemes allows for a rapid automatization of the acquisition of such correspondence, yielding to early high levels of accuracy and more cognitive resources allocated for language comprehension; second, that reading speed appears to be more sensitive to progressive improvement in reading, marking it as the component more sensitive to reading deficits in transparent orthographies. These findings have also been replicated experimentally by Tobia and Bonifacci (2015), who tested Italian students from Grades 1 to 5 on reading speed and accuracy, as well as language and reading comprehension. Separate models for each grade consistently revealed a stronger predictive role of language comprehension across all levels. Similar conclusions were reached more recently by Florit and colleagues (2022), who found a moderate relationship between language comprehension and reading comprehension in first graders, while only weak or non-significant associations emerged between reading fluency or accuracy and comprehension. Interestingly, language comprehension also proved to be the most valid predictor of reading comprehension in bilingual children learning to read in Italian as their community language, alongside a smaller contribution from reading accuracy (Bonifacci and Tobia, 2017b).

We can now examine whether the distinct roles played by decoding and language comprehension in a transparent orthography also affect the predictive power of pre-reading skills.

2.3.2. Linguistic predictors of reading skills in monolingual Italian preschoolers and beginning readers

Research on linguistic predictors of reading skills in monolingual Italian preschoolers is extremely limited. Orsolini and colleagues (2006) investigated whether lexical reading – that is, the quick and accurate identification of words as whole units, in this case elicited by words with atypical stress assignment – in second-grade children was associated with kindergarten performance in vocabulary knowledge, letter knowledge and phonological awareness (syllables and phonemes identification, nonword repetition). They found that children who continued to perform poorly in lexical reading by the end of Grade 2 were also those who had obtained the

lowest scores in all preschool language tasks. Although the authors did not support these findings with a correlation analysis – thus preventing any direct inference of predictive relationships – the correspondence between preschool language tasks and later reading performance can be taken as preliminary evidence of a connection between the two abilities.

A predictive relationship between preschool performance and emergent reading was instead the focus of research conducted by Pinto and colleagues (2016, 2017). In their first study, the authors found that preschool domain-specific skills (syllable and phoneme blending and segmentation, RAN, and vocabulary) predicted first-grade reading (speed, accuracy, and comprehension) more effectively than domain-general skills (e.g., working memory, oculomotor coordination). More specifically, all reading components were predicted by phonological awareness tasks. In their second study, emergent reading skills – measured through phonological awareness (rhyme detection), orthographic knowledge (letter-sound correspondence), and narrative ability (story retelling) – were assessed in preschoolers to verify their predictive role in first-grade word reading accuracy. Results revealed a predictive power of emergent reading skills as a unitary construct, with a greater contribution of orthographic knowledge.

Studies in which reading predictors were tested at the onset of formal reading instruction yielded similar findings. For instance, Tobia and Marzocchi (2014) found that phonological awareness and RAN significantly predicted reading speed in beginning readers, while vocabulary contributed to reading only in more proficient readers. In a comparable longitudinal study, Mascheretti and colleagues (2024) reported that phonological awareness (rhyme detection, initial sound recognition, syllable and phoneme blending) in first graders predicted word and nonword accuracy and speed up to 5th Grade.

Rapid automatized naming was further explored in a study by Di Filippo and colleagues (2005), who found a predictive role of this skill in concurrent reading speed and accuracy in children from Grades 1 to 6.

Only one recent study has focused exclusively on narrative skills as predictors of reading (Vettori et al., 2025). The authors examined a sample of third- and fourth-grade students, who were tested on narrative skills through an invented story task and, one year later, on text reading speed and accuracy. Narrative skills were found to predict reading performance, but only for accuracy.

Similarly, Vernice and Pagliarini (2018) were the only authors to examine the predictive power of morphological awareness for concurrent speed, accuracy, and comprehension in word,

nonword, and text reading. Their study, involving students from Grades 1 to 5, showed that accuracy in morphological awareness tasks predicted reading speed and accuracy across all reading measures for beginning readers, whereas this effect disappeared in more skilled readers, who instead showed a contribution of morphological awareness to reading comprehension. These findings support the idea that morpheme-based reading strategies may serve as an intermediate route between grapheme-phoneme conversion and lexical reading: the ability to identify morphemes can enhance word recognition at early stages, while, once word identification becomes automatic, this skill may contribute to reading for meaning.

This overview of Italian studies on the relationship between reading predictors and reading skills allows us to draw some preliminary conclusions about this relationship in a transparent orthography and about the current state of research in this area. First, research has mainly focused on language comprehension and phonological awareness as predictors of reading. The former has consistently emerged as reliable predictor of reading comprehension, while the latter has been associated with decoding components. This is unsurprising, given the well-established reciprocal relationship between phonological awareness and decoding on the one hand (see Section 2.2.1), and the central role of oral language comprehension in understanding written text on the other. The main difference compared with studies in English is the stronger contribution of language comprehension to reading comprehension – even in beginning readers. This has been attributed to the transparent orthography of Italian, which allows for faster automatization of print identification and, as a consequence, frees cognitive resources for language comprehension even in the early grades (Florit and Cain, 2011).

A second observation concerns the lack of studies examining other linguistic predictors beyond phonological awareness and language comprehension. RAN, vocabulary, morphological awareness, and narrative skills deserve further exploration as potential predictors in a transparent orthography.

Finally, very few studies have focused on preschoolers – a population that remains understudied in Italian research. Yet, if predictive trajectories between preschool performance and later reading could be more consistently established, early screening protocols could be designed for the timely identification of children at risk for reading difficulties. This is precisely the aim of Study 1 (Chapter 3), which will analyse a variety of reading predictors in kindergarten children, examining the predictive relationships between these and emergent reading skills.

2.3.3. Linguistic predictors of reading skills in bilingual advanced readers

Studies on the relationship between reading predictors and literacy in bilingual children with a migration background learning to read in Italian are also very limited. However, as emerged from Chapter 1, this population typically displays different reading acquisition trajectories compared to their monolingual peers, and cross-linguistic investigation of such trajectories is needed to prevent the risk of misdiagnosis of reading impairments in these children.

The most comprehensive investigation to date is that of Bellocchi and colleagues (2017), who examined whether reading performance (accuracy, speed, and comprehension) in monolingual and bilingual children learning to read in Italian was differentially predicted by phonological awareness, letter knowledge, nonword repetition, morphosyntactic comprehension, vocabulary, and rapid automatized naming. Participants were tested in 1st Grade on reading predictors and in 2nd Grade on reading outcomes. According to their findings, while reading speed was equally predicted in both language groups by RAN (along with phonological awareness and letter knowledge for monolinguals and a marginal contribution of vocabulary for bilinguals), reading accuracy was predicted by letter knowledge, phonological awareness, and vocabulary for monolinguals, and by nonword repetition for bilinguals. As for comprehension, monolingual performance was predicted by letter knowledge and vocabulary, whereas for bilinguals it was predicted by morphosyntactic comprehension. The results for reading speed confirmed those reported in studies with monolingual populations (Di Filippo et al., 2005; Tobia and Marzocchi, 2014), reinforcing the established link between rapid naming of serial stimuli and reading processes, even in transparent orthographies (Georgiou et al., 2013). Conversely, the authors attributed the different predictive patterns for reading accuracy to the pre-reading skills that children independently develop before school entry. That phonological awareness and letter knowledge predicted reading accuracy in monolinguals is unsurprising, as the crucial role of these skills in early decoding has been consistently demonstrated across different languages, including Italian (Orsolini et al., 2006; Pinto et al., 2016; Mascheretti et al., 2024). However, since children were first tested at the beginning of 1st Grade, their orthographic knowledge could only rely on input from the home literacy environment – often limited in bilinguals with a migration background (Eisenwort et al., 2018; Luo et al., 2021; Novita and Kluczniok, 2022; Valcárcel Jiménez, 2024; see Paragraph 1.3.2.5). This limited exposure may, in turn, have affected the development of phonological awareness, which is known to be mutually influenced by print exposure (Perfetti et al., 1987). The same reasoning applies to vocabulary, which played a significant role in monolinguals' reading accuracy and comprehension, but only a marginal role

in bilinguals. The unique contribution of morphosyntactic comprehension to bilinguals' reading comprehension can be interpreted in light of the importance that this skill has in bilinguals' language acquisition. Of course, this skill plays a crucial role in monolinguals' language development as well, but, as remarked by the authors, it typically reaches a high level in the first years of primary school, allowing for other skills (such as vocabulary) to establish a predictive relationship with reading. Bilinguals' vocabulary knowledge, instead, may be too limited at school onset, giving rise to the opposite predictive pattern.

Partially in contrast with these findings, Bonifacci and colleagues (2024) found that vocabulary and morphosyntactic comprehension were significant predictors of concurrent reading accuracy in bilingual children acquiring literacy in Italian. The vocabulary effect – absent in Bellocchi et al. (2017) – may be explained by participants' age: while Bellocchi et al. examined beginning readers, Bonifacci et al. studied children in 3rd, 4th, and 5th Grade. Although bilingual individuals tend to have smaller vocabularies than monolinguals throughout life (Bialystok and Luk, 2012), the children in this later study may have benefitted from several years of schooling and literacy exposure, which likely expanded their vocabulary and, consequently, improved their reading accuracy.

The effect of the age variable is partially contradicted by Persici and colleagues (2025), who explored the concurrent predictive power of vocabulary on word and nonword reading speed and accuracy in bilingual and monolingual children attending 1st, 3rd, and 5th Grades in Italian schools. In contrast with Bellocchi et al. (2017), where 1st Grade vocabulary only marginally affected 2nd Grade reading speed in bilingual children, this more recent study found a significant predictive role of vocabulary on bilingual first graders' word and nonword reading accuracy and speed, third graders' word reading accuracy, and fifth graders' word reading speed. The discrepancy observed for beginning readers (i.e., second graders in Bellocchi et al. (2017) study and first graders in Persici et al. (2025) study) could be explained by a number of factors: (i) in the first study the relationship was longitudinal, whereas in the second concurrent; (ii) in the first study, reading speed and accuracy were analysed as latent variables by including observed measures from word, nonword, and text, while in the second outcomes from word and nonword speed and accuracy were analysed independently; (iii) the first study included a set of predicting variables (phonological awareness, nonword repetition, RAN, letter knowledge, vocabulary, morphosyntactic comprehension), while in the second only receptive vocabulary was assessed. Hypothetically, one or more of these methodological differences might have affected the predictive link between beginning readers' vocabulary and reading skills.

The role of vocabulary as a predictor of reading in Italian thus clearly warrants further investigation.

A further study explored the potential predictive role of morphological awareness on concurrent reading outcomes in bilingual children. Vernice and Pagliarini (2018) administered morphological comprehension and production tasks, along with vocabulary and reading (speed, accuracy, and comprehension) to monolingual and bilingual students from Grades 1 to 5. Morphological awareness emerged as a predictor of nonword reading speed and text reading accuracy in bilinguals, while vocabulary predicted text comprehension. The authors interpreted these results as evidence for morpheme-based processing in reading, with vocabulary knowledge contributing more strongly to comprehension.

To our knowledge, the only study investigating reading predictors in bilingual preschoolers learning to read in Italian is Casani's (2021). The work primarily focused on the predictive role of phonological skills assessed in kindergarten on subsequent reading outcomes. The author found that specific phonological awareness tasks (syllable segmentation, minimal pairs recognition) predicted reading speed for sublexical components of existing words, while others (syllable blending) predicted reading accuracy for the same stimuli. However, because bilingualism was included in the analyses only as a random effect, this study does not provide information on differential predictive patterns for bilinguals and monolinguals.

In conclusion, as shown for Italian monolinguals and in English studies, different linguistic pre-reading skills concurrently contribute to predicting later reading outcomes, but the predictive patterns for monolinguals and bilinguals share many similarities (Muter and Diethelm, 2001). However, the effects of phonological awareness and language comprehension appear consistent among bilingual learners as well, albeit with some group-specific differences compared to their monolingual peers.

Understanding the effectiveness of specific language skills as reading predictors in bilingual children is key to developing more targeted screening protocols for this population. As discussed in Section 1.3.3, bilingual children with a migration background sometimes follow reading acquisition trajectories that differ from those of their monolingual peers, resembling those of children with dyslexia. This is largely due to incomplete mastery of the language of instruction at school entry (Flege et al., 1999; Gathercole, 2002; Harley, 1992; Jia, 2003), which generally improves over time (Bello et al., 2023; Goldberg et al., 2008; Guion, 2003; MacLeod et al., 2009; Paradis, 2007). Nevertheless, this linguistic gap may cause bilinguals to lag behind their

monolingual peers in reading performance, potentially compromising their academic success (Vernice et al., 2019). As previously noted, assessing reading skills using monolingual-normed tests or adopting a ‘wait-and-see’ approach are not ideal solutions (Deponio et al., 2000; Samson and Lesaux, 2009). Conversely, testing linguistic predictors of reading skills has proven effective in distinguishing typically developing bilinguals with low language proficiency from those with reading impairments (Helland et al., 2023; Taha et al., 2022; Vender et al., 2020; Vender and Melloni, 2021). One open question, however, is whether these same predictors can enable the early identification of children at risk for reading difficulties – even before formal schooling begins. As discussed throughout this chapter, all pre-reading skills are, to some extent, dependent on reading development; nonetheless, basic levels of phonological awareness and rapid naming are necessary for initial decoding, while oral language knowledge (vocabulary, comprehension, narrative skills) supports reading comprehension. Poor performance in these areas may therefore signal children at risk for early reading difficulties. Further details and an empirical examination of this hypothesis are presented in Chapter 3.

Children with linguistic and reading vulnerabilities should not only be identified early but also receive prompt support. The final section of this chapter will review studies on the effectiveness of didactic interventions administered to preschoolers and beginning readers, and discuss their implications for reading acquisition.

2.4. Didactic interventions on phonological awareness

An extensive body of research has explored the potential effects of phonological training on emergent reading skills. The reason behind this widespread interest lies, of course, in the close relationship consistently found between competence in phonological skills and success in learning to read. Although the influence of phonological awareness, and consequently of decoding skills, has been shown to play a more marginal role in reading comprehension in more transparent orthographies – where language comprehension has greater predictive power (Aro, 2006; Florit and Cain, 2011) – a certain degree of phonological knowledge is still necessary to understand the basic alphabetic principle, namely that letters represent speech sounds.

As stated by Lundberg et al. (1988), when a skill is found to play such a crucial role, the question naturally arises as to whether it can be supported through training. In the context of the present work, phonological training represents a complementary tool for developing comprehensive protocols for the early screening and support of linguistically vulnerable children. Before

presenting our findings concerning the effectiveness of didactic interventions on phonological awareness in monolingual and bilingual preschoolers (Study 2, Chapter 4) and beginning readers (Study 3, Chapter 5), previous studies focusing on the effects of phonological training will be discussed. Since very few studies have examined training effects in bilingual samples, findings from research on monolingual preschoolers and beginning readers across different languages, as well as studies on at-risk populations, will also be analysed. Subsequently, empirically supported recommendations and best practices for designing phonological interventions will be addressed.

2.4.1. Phonological training for preschool children

The landmark study in this field is commonly considered to be that of Bradley and Bryant (1983), who were the first to demonstrate both the longitudinal predictive role of phonological skills on subsequent reading and the positive effects of phonological training on literacy acquisition. As pointed out by Lundberg and colleagues (1988), however, the Bradley and Bryant (1983) study could not rule out the possibility that reading skills may have interfered with the outcome of the phonological training. The children examined were six years old and had already begun formal reading instruction when the study commenced.

To eliminate this confound, Lundberg and colleagues (1988) conducted a comparable study involving six-year-old Danish children who, in accordance with national policies, had not yet been exposed to reading instruction. Children were first tested on phonological skills (sentence segmentation, syllable blending and segmentation, phoneme deletion, blending and segmentation) during their final year of kindergarten. After five months of daily training sessions targeting progressively less salient phonological units, children were re-tested on the same tasks and, once enrolled in Grade 1, on word reading. The first post-test confirmed the positive effect of training on phonological skills, especially for phoneme manipulation tasks. Word reading after seven months in Grade 1, however, showed only marginally significant differences between the two groups.

Lundberg et al.'s study (1988) therefore provided crucial evidence that phonological skills can be effectively trained before literacy acquisition. Their results, however, were partially criticised by Kozminsky and Kozminsky (1995), who argued that the gains observed in the sample might also be due to the age at which participants were tested – six years, an age at which the phonological system is already relatively mature. To verify whether phonological training could also be

effective in younger children, Kozminsky and Kozminsky (1995) implemented the same protocol used by Lundberg et al. (1988) with five-year-old Hebrew kindergarteners over an eight-month period. Unlike previous studies, their aim was to investigate the impact of kindergarten phonological awareness training on subsequent reading comprehension (Grade 1 and Grade 3), rather than on phonological skills themselves. Their results revealed significant differences in reading comprehension scores for the intervention group at both assessment points. These findings added further evidence that phonological skills can be effectively trained in young children with no prior reading instruction, and that such interventions can have long-term effects.

These results have been replicated in numerous studies and across different languages. Schneider and colleagues (1997), for instance, investigated the effectiveness of phonological training in children acquiring literacy in a transparent orthography (German). The Lundberg et al. (1988) program was adapted to the specific characteristics of German. A group of 205 kindergarteners received training over seven months, after which post-test data on phonological skills were collected; reading outcomes (word reading and comprehension) were assessed in Grade 1 and Grade 2. As in previous studies, the authors found generally better phonological skills in the intervention group, particularly in tasks assessing phoneme manipulation. Long-term effects were evident in Grade 1 but disappeared in Grade 2, possibly due to the generalised effects of formal reading instruction. Comparable results were reported by Kjeldsen et al. (2003) with 108 Finnish kindergarteners using only 60% of the Lundberg et al. (1988) program. The validity of the protocol was also demonstrated in a large-scale sample including more than 2000 children (Lundberg et al., 2012).

Across the studies reviewed so far, while the effects of phonological training on phonological skills – especially those involving manipulation of less salient units – were consistently observed, this was not always the case for effects on subsequent reading skills. In Lundberg et al. (1988), for example, the effect on word reading was only marginal; in Schneider et al. (1997), benefits extended to reading skills but only in Grade 1. Kozminsky and Kozminsky (1995), on the other hand, found long-term effects on reading comprehension up to Grade 3, and similar results were obtained for the children in Kjeldsen et al. (2003), who showed training effects on word reading up to Grade 2.

More recent studies have also yielded mixed results. Pfohl et al. (2019) found a clear immediate effect of phonological training on phoneme-level skills, but this effect disappeared by Grade 1, with marginal benefits for word reading and comprehension limited to children who had

performed poorly in kindergarten. Wolff and Gustafsson (2022) observed generalized effects on reading skills three years after a phonological intervention; however, gains were again greater for at-risk children. Comparable conclusions were reached by Kartal et al. (2016): their Turkish kindergarten sample showed immediate benefits in phonological awareness, but these were not maintained at the eight-month follow-up.

Meta-analyses conducted at different time points (Bus and Van IJzendoorn, 1999; Ehri et al., 2001; Suggate, 2016) suggest that benefits on reading skills tend to be greater for children learning to read in English. According to the authors (Ehri et al., 2001), this effect may be attributed to orthographic transparency and the mechanisms involved in learning to read. As discussed above, English has an opaque orthography, and for children acquiring reading in this language, the automatization of grapheme-phoneme conversion takes longer (Seymour et al., 2003). Therefore, explicit training focusing on phonemic units and their mapping onto graphemes may be particularly beneficial for children learning to read in an opaque language.

The fact that several of the studies mentioned above (Ehri et al., 2001; Pfof et al., 2019; Suggate, 2016; Wolff and Gustafsson, 2022) – all involving typically developing children – found that the greatest benefits of phonological training emerged for those who had exhibited poorer phonological skills in kindergarten suggests that such intervention programs may effectively strengthen these abilities even in children at risk for developing reading difficulties. The following paragraph provides an overview of studies that have specifically focused on phonological training in vulnerable populations.

2.4.2. Phonological training for at-risk populations

The first study addressing the potential training benefits for a vulnerable population was that of Brady and colleagues (1994)². The aim of their work was to verify the feasibility of implementing a phonological training program in inner-city kindergarten classes (English-speaking children), a sample that would rule out the possibility that children entered the intervention with advanced phonological skills or basic reading knowledge. Children were pre- and post-tested on rhyme generation, phoneme segmentation, and deletion. The intervention program lasted 18 weeks and, as in previously described studies, included activities focusing on progressively less salient units and more demanding operations (rhymes and syllables, phoneme isolation, internal

² See also Blachman et al. (1994) for comparable findings on low-income English-speaking kindergarteners.

representation of the syllable structure). Results revealed not only significant improvements in phonological awareness tasks for the intervention group, but also a higher likelihood of promotion to Grade 1 and better word and nonword reading scores.

Low-income children attending schools in New Zealand were the focus of the study conducted by Gillon and colleagues (2007). Despite being monolingual English speakers, these children came from extremely disadvantaged urban areas and displayed poor semantic and syntactic skills in their oral language. In addition to verifying the effectiveness of phonological awareness training, the authors aimed to examine a point not addressed in previous research, namely, whether children from disadvantaged backgrounds would require a period of language-focused training prior to phonological awareness training. To this end, they administered a 6-weeks language intervention program followed by a phonological awareness intervention with the same duration to one subset of the sample, and the same interventions in reverse order to the remaining subset. The language intervention targeted the comprehension and production of specific linguistic concepts, such as 'above vs. below', 'some vs. many', and comprehension of complex sentences including conjunctions (if, because, either/or). Phonological training focused exclusively on phoneme manipulation (identification, segmentation, blending, phoneme-grapheme mapping). Results showed that both groups progressed comparably on phonological awareness tasks, suggesting that the language level of low-income children, although lower than that of their monolingual peers, is nonetheless sufficient for achieving significant gains in phonological awareness.

Findings on the effects of phonological training on reading skills also appear mixed for vulnerable populations. As mentioned above, children in the Brady et al. (1994) intervention performed better than controls on word and nonword reading. Conversely, Nancollis and colleagues (2005) did not replicate these findings: their experimental group of socioeconomically disadvantaged children, who received training focused on onset-rime and syllable awareness, did not show advantages in reading two years later. According to the authors, this may be due to the fact that their intervention targeted larger and more salient units, which are less directly connected to the acquisition of the alphabetic principle. Similar findings for limited-scope interventions were reported by McIntosh et al. (2007), who tested and trained preschool children from disadvantaged backgrounds exclusively on phoneme isolation and rhyme awareness. The training was effective, but potential benefits for later reading were not examined.

Significant benefits for phonological skills (rhyme detection, phoneme blending and segmentation) were also found in a comparable sample by Muñoz and colleagues (2018), who

tested low-income children acquiring literacy in a transparent orthography (Spanish). These children were trained daily through short sessions over a six-month period. As in McIntosh et al. (2007), this program did not assess the effect of phonological training on subsequent reading outcomes.

As extensively shown in Section 1.3.3, bilingual children with a migration background also represent a population at risk of developing reading difficulties. Although less consistently, research has examined the effectiveness of didactic interventions targeting phonological awareness in this population. Stuart (1999) was the first to implement phonological training in preschool classes, including a high percentage of migrant children learning to read in the community language. As noted by the author, previous studies targeting vulnerable populations had deliberately excluded bilingual children (Blachman et al., 1994; Brady et al., 1994). At pre-test, children were assessed on phoneme identification and segmentation, phonics knowledge (letter-sound recognition and recall), and word and nonword reading. The twelve-week intervention was delivered to whole classes by trained teachers, while control classes engaged in shared reading activities. No further details, however, are provided on the intervention activities. At immediate post-test, experimental children showed significant gains in phoneme segmentation but not in phoneme identification, possibly because their pre-test performance in the latter skill was already relatively high. Benefits were also observed for all phonics knowledge measures and for reading, and reading gains were maintained one year after the intervention (end of Grade 1).

A subgroup of children was re-assessed on phonological and reading skills at the end of Grade 2 in a follow-up study (Stuart, 2004). Results indicated that gains for the experimental group were retained in phoneme segmentation, letter-sound recall, and nonword reading, but not in word reading, where experimental and control children performed similarly. These findings indicate that interventions targeting phonological awareness can enhance sublexical skills, whereas performance in real-word reading appears more affected by traditional formal reading instruction.

A significant limitation of this study is the absence of an explicit comparison between bilingual and monolingual children. Although the author specifies that most participants were bilingual (86%, 112 out of 122 children), the language variable is not considered in the analyses. While the gains in phonological and reading skills demonstrate that these abilities can be effectively trained in bilingual children, a statistical comparison with monolinguals would have offered a

clearer understanding of potential differences in gains and developmental trajectories between the groups.

This methodological limitation recurs in much of the literature on phonological training in bilingual children. Patscheke and colleagues (2016), for instance, trained only preschoolers from migrant families learning to read in German. Pre- and post-tests included syllable segmentation, rhyme detection and production, phoneme recognition, and blending. Training was provided in three weekly 20-minute sessions over 14 weeks, targeting the abilities assessed at pre-test, presented in order of increasing difficulty. Meanwhile, two additional groups participated either in musical training or sports activities. Children in the phonological training group showed greater improvement in tasks involving large units (syllable blending and rhyme tasks), but so did children involved in the musical training, challenging the effectiveness of the program. Gains were limited to these skills, as all groups showed similar improvement on the remaining tasks.

Potential benefits for subsequent reading skills were also examined in migrant children acquiring literacy in a transparent orthography (Engel de Abreu et al., 2020). The authors aimed to determine whether children trained on phonological awareness in Luxembourgish during kindergarten would show additional gains in phonological and reading skills in German, given that kindergarten instruction in Luxembourg typically takes place in the former language, while primary school instruction takes place in the latter. The testing protocol was extensive and included measures of syllable segmentation, rhyme identification, onset-rime blending, onset identification, phoneme manipulation, blending, segmentation and letter knowledge. Intervention activities were presented as playful and engaging games involving multimodal resources (flashcards, songs, ‘parrot-talk’ activities). The program lasted 20 hours over 12 weeks, with the first two weeks dedicated to syllable and rhyme tasks and weeks 3-12 to phoneme awareness (identification, blending, segmentation) and phoneme-letter mapping. Children also participated in shared reading sessions designed to foster print and book awareness. The control group engaged in standard kindergarten activities.

The immediate post-test included the same tasks as the pre-test, whereas the delayed post-test (nine months later, five months into Grade 1) included phonological measures, as well as word and nonword reading, and a word-picture matching comprehension task in German. Gains in both large and small unit sizes were observed at the immediate post-test for the experimental group, and these were maintained at the delayed post-test. Benefits were also noted for letter knowledge, although this effect disappeared after nine months – likely due to explicit instruction received by the entire cohort. Regarding potential transfer effects, the experimental group

showed significantly higher scores on phonological awareness in German; however, this effect did not extend to word and nonword reading. Similar findings were reported by Bodé and Content (2011), who observed transfer effects between Luxembourgish and German for phonological skills but not for letter knowledge. Interestingly, experimental children displayed higher word comprehension scores. According to the authors, this limited transfer may be attributed to the role of phonological awareness in German, which appears to be more closely linked to reading comprehension than to decoding. This finding had emerged from a systematic review on the relationship between pre-reading phonological awareness and early literacy acquisition in German contexts conducted by Pfost (2015). As expected, the correlation between phonological awareness and decoding was lower than that observed for English studies, confirming that the transparency of the German orthographic system allows for an effective acquisition of decoding, independently from individual differences in phonological skills (see also Zugarramundi et al., 2022). The less expected association between phonological awareness and reading comprehension, instead, is explained as a result of the comprehension tests administered to beginning readers: as proposed by the author, at early stages of reading acquisition, reading comprehension tests strongly rely on children's reading skills, and if these are poor, comprehension cannot be effective. Clearly differentiating between the two skills (reading decoding and reading comprehension) in beginning readers is therefore not always straightforward.

A comparison between monolingual and bilingual Spanish-speaking children was conducted by Herrera and colleagues (2011). Their testing protocol included rhyme and phoneme identification as well as syllable tapping. The training program also targeted these skills, presented in order of increasing difficulty and decreasing salience. Phonological skills were assessed immediately after the first round of training, after the second round (each of eight weeks), and three months later. Phonological awareness scores were significantly higher for children in the training group across all post-tests, all tasks, and both language groups (monolinguals and bilinguals with a migration background).

The overall findings from this review clearly demonstrate that phonological awareness can be enhanced even in preschool children from disadvantaged backgrounds, both monolingual (Blachman et al., 1994; Brady et al., 1994; Gillon et al., 2007; McIntosh et al., 2007; Muñoz et al., 2018; Nancollis et al., 2005) and bilingual (Bodé and Content, 2011; Engel de Abreu et al., 2020; Herrera et al., 2011; Patscheke et al., 2016; Stuart, 1999, 2004). Despite the heterogeneity of

assessment methods, training programs, and intervention durations across studies, all specific phonological skills consistently emerged as enhanced by training.

Less consistent results were obtained, however, for transfer effects on subsequent reading skills, which – as in monolingual typically developing children – are not always observed. Among the studies examined on at-risk populations, only Brady et al. (1994) and Stuart (1999, 2004) found positive transfer effects on word or nonword reading in the early grades. As suggested for monolingual preschoolers, it is possible that such interventions are more beneficial for children learning to read in an opaque orthography, where the inconsistent mapping between phonemes and graphemes may become more accessible with greater phonological competence (Ehri et al., 2001). Notably, the studies reporting reading gains were precisely those carried out with English-speaking monolingual and bilingual children; this is the only shared characteristic between the Brady et al. (1994) and Stuart (1999, 2004) studies, which differed in both intervention duration (18 vs. 12 weeks) and the phonological units and operations assessed (see above). In contrast, Nancollis et al. (2005) also examined English preschoolers, but an effect on reading skills may have been prevented by the limited scope of their assessment and intervention (onset-rime and syllable only).

Evidence for the effectiveness of didactic interventions has also emerged in studies on transparent orthographies (Engel de Abreu et al., 2020; Herrera et al., 2011; Kartal et al., 2016; Kjeldsen et al., 1997; Muñoz et al., 2018; Patscheke et al., 2016; Pfof et al., 2019; Schneider et al., 1997). The following paragraph provides an overview of comparable studies conducted with Italian preschoolers.

2.4.3. Phonological training for Italian preschoolers

Phonological training studies focusing on Italian preschoolers are limited, compared to those involving English-speaking children, and somewhat more recent. Most research on Italian children has focused on typically developing monolingual preschoolers, although some studies have delivered phonological training programs also to language-impaired, bilingual, or first-grade children.

Preliminary evidence on the effectiveness of an original phonological training program for Italian preschoolers was provided by Zanchi and colleagues (2012). Their study involved 47 children enrolled in the final year of kindergarten. The components targeted through training were

phoneme and syllable identification, segmentation, and blending. The training did not strictly follow a progressive design, as initial meetings were already dedicated to non-salient units (syllable and phoneme blending and segmentation), while rhyme identification was introduced only later, toward the end of the program. The intervention lasted ten hours, distributed across weekly meetings (whose duration is not specified). A control group took part in standard curricular activities.

A comparison of pre- and post-test means showed that the intervention was effective across all phonological measures. These findings suggest that even relatively short interventions can enhance phonological skills in typically developing preschoolers; however, a follow-up assessment on reading skills would have clarified whether phonological competence transfers to subsequent reading in Italian – an aspect that has emerged as problematic in previous literature on other languages.

An interesting aspect of Italian studies on phonological training concerns the heterogeneity of the methods adopted. The study mentioned above, for instance, used a traditional school-based design consisting of playful classroom activities. Goffredo and colleagues (2016), instead, developed a Microsoft Kinect™-based application to boost children's phonological skills through highly interactive, movement-based games. The rationale behind this design is that young children's learning is facilitated by motion-based systems, as they allow for a connection between motor skills and more abstract concepts (e.g., manipulation of sublexical units; Gardner, 1983). During the activities, children completed rhyme identification, initial and final syllable recognition, and syllable blending tasks; to select answers, they moved their bodies, and the movement was mirrored by an avatar in the videogame. The intervention consisted of five weekly 20-minute sessions. Participants were a small group of Italian monolingual preschoolers randomly assigned to either the videogame intervention or a control group. The assessed abilities matched those trained in the experimental group.

An improvement in all phonological skills was observed for the experimental group, an effect not exhibited by the control group; however, the authors only provided the delta scores between pre- and post-tests, without reporting statistical analyses confirming the significance of this improvement. As noted by the authors, this was a pilot study designed to assess the potential effectiveness of an innovative tool for enhancing pre-reading skills. Children showed full familiarity with this technology-based design, supporting the use of similar tools in future studies involving larger samples.

A different intervention design was proposed by Majorano and colleagues (2022). Unlike other studies, their program – called *Talk* – included activities carried out both at school and at home, with the aim of strengthening family-school collaboration. As discussed in Paragraph 1.3.2.4, families' attitudes toward literacy acquisition play a crucial role in providing children with adequate pre-reading skills (Eisenwort et al., 2018; Valcárcel Jiménez et al., 2024). The intervention, specifically designed by the authors for the purpose of the study, (12 weeks in the final year of kindergarten) included syllable blending and segmentation activities, and phoneme identification tasks. Parents were instructed on the activities during dedicated meetings with teachers. The same skills were assessed at pre- and post-test. Although limited to syllable manipulation, the group receiving the *Talk* intervention showed gains in phonological awareness, suggesting that family involvement in this type of program can be beneficial and warrants further investigation.

A further training proposal is that of Majorano and colleagues (2023). Differently from previous studies, the authors tested the effectiveness of an original training program based exclusively on syllable manipulation. This idea builds on the premise that syllables are phonological units that are easily accessed by children and that some teachers begin formal reading instruction precisely from these units. If children were to start school with improved awareness of syllables, this could facilitate and accelerate reading acquisition. To test this hypothesis, the authors involved a group of preschoolers in a 12-week program of computer-based training focusing on increasingly complex activities on syllable identification, blending, segmentation, and word reading. These skills were also assessed at pre- and post-test. The experimental group showed significant improvements across all phonological measures, which extended to word reading, providing preliminary evidence of potential transfer effects also for Italian.

Consistent with previous studies, greater benefits were observed for children with lower language competence (Ehri et al., 2001; Kartal et al., 2016; Kjeldsen et al., 1997; Pfost et al., 2019; Schneider et al., 1997; Suggate, 2016; Wolff and Gustafsson, 2022; see section above). Measured at pre-test using receptive vocabulary. In line with previous studies, the implementation of more traditional protocols has also led to gains both in typically developing children (Giovagnoli et al., 2015; Trambagioli et al., 2015) and in linguistically impaired or at-risk children (Terribili et al., 2011; Savelli et al., 2011). Training programs were found to be effective also for first graders (Cividati et al., 2014). Unfortunately, to our knowledge, no studies have examined the concurrent or long-term effects of phonological training on reading skills in typically developing Italian children.

Only one study has examined phonological training in bilingual preschoolers with a migration background acquiring literacy in Italian. In this work, Casani (2021) proposed a didactic intervention to monolingual and bilingual children at two time points: during the final year of kindergarten and in 1st Grade. The first intervention focused exclusively on rhymes and syllables (identification, minimal pairs, blending, segmentation). In the second part, phoneme-level tasks (blending, segmentation, spoonerisms) were introduced, while some sessions remained dedicated to larger units. The first phase lasted 20 hours, and the second 11 hours. Before the training and at the end of kindergarten, children were tested on the same abilities trained, plus nonword repetition, which was not part of the intervention. Reading skills (words, nonwords, texts, and comprehension) were assessed at the end of the program to verify potential transfer effects.

At the end of the first training, the whole experimental group showed significant gains in syllable blending, word minimal pair recognition, rhyme detection, initial syllable recognition, and nonword repetition. Language group differences emerged for initial syllable recognition and rhyme detection, with bilingual children showing larger effect sizes. At the end of the second training, experimental children were faster in word and nonword reading than the control group.

Taken together, these preliminary findings (Casani, 2021) indicate that extensive training can benefit children entering school with lower language skills. This appears particularly true for simpler phonological operations, which are often unaffected by interventions in typical populations (Lundberg et al., 1988). Furthermore, experimental children – irrespective of language group – were able to transfer their enhanced phonological skills to sublexical reading, as shown by their faster reading times at the second post-test. The long duration of the intervention (31 hours overall) may also have contributed to these gains, in line with other studies on bilinguals (Gunn et al., 2000). Benefits in reading skills may also be attributed to the immediate assessment following the intervention, as discussed in the next paragraph. The results reported by Casani (2021) are further interpreted and discussed in the intervention studies of the present dissertation (Chapters 4 and 5).

2.4.4. Phonological training for beginning readers

As previously discussed in Section 2.2.1, phonological and reading skills stand in a reciprocal relationship (Perfetti et al., 1987). This consideration underlies the studies reviewed in the present section: if reading acquisition depends on children's initial phonological skills, then

training the latter should facilitate the acquisition of the alphabetic principle. This positive effect has been reported in the literature, although not consistently (Bus and Van IJzendoorn, 1999; Ehri et al., 2001; Suggate, 2016). Building on this reciprocal relationship, research has also explored whether initial reading acquisition can be further supported by phonological training administered in the early grades.

Preliminary evidence supporting this hypothesis was provided by Cunningham (1990), who examined the effects of the same phonological training programs on both kindergarten and first-grade children. Unlike previous studies, the author compared two types of interventions: one, following a more traditional approach, focused exclusively on basic phoneme operations (blending, segmentation), and did not provide children with specific explanation on the rationale or the motivation behind these activities. This version of the intervention was called by the authors 'Skill and drill'. The other version (*Metalevel*) additionally included moments of active reflection on the usefulness of these operations for everyday reading activities. For example, children were guided to consider how segmenting a word into individual sounds could help decode unfamiliar words. Both interventions involved playful activities with concrete representations of sounds and interactive games, and neither made explicit reference to orthographic representations. Kindergarten and first-grade children were randomly assigned to one of the two intervention programs; a third group participated in oral comprehension activities as a control condition.

The study aimed to evaluate potential differences in the effectiveness of the two interventions on phonological skills (phoneme deletion, identification, oddity) and reading (letter-sound knowledge, word recognition, reading comprehension), comparing both against the control group and against each other. Results showed that all four experimental groups outperformed the controls across all phonological and reading measures at both grade levels. Gains in phonological skills were comparable across the four experimental groups. Interestingly, however, the Metalevel first-grade group showed significantly greater improvement in reading skills than the Skill and drill group, a difference not observed in kindergarten.

The author's conclusions are twofold: first, phonological skills do not appear to depend strictly on reading experience; otherwise, differences between kindergarteners and first graders would have emerged. Second, first graders appear to be more sensitive to active reflection on sublexical manipulation, which leads to greater gains in reading. This difference may be attributed to the more substantial engagement of first graders in reading activities, where strategies learned during the intervention can be immediately applied. Kindergarten children, by contrast, seem to

benefit from any type of phonological training, possibly due to their still limited exposure to reading. The effectiveness of active reflection on phoneme-based manipulation has also been supported by later studies (Lie, 1991; Defior and Tudela, 1994; Uhry and Shepherd, 1993).

Additional evidence for the positive effects of phonological training on concurrent early reading skills comes from Reading and Van Deuren (2007). In their study, a subgroup of English monolingual first graders received phonological training in both kindergarten and early 1st Grade, whereas another subgroup received training only at the beginning of 1st Grade. Pre- and post-tests included letter knowledge, phoneme segmentation, and nonword and text reading. The intervention, delivered throughout the school year, focused on progressively demanding skills with frequent monitoring. Children who had received kindergarten training initially outperformed their peers in phoneme segmentation, but by the end of 1st Grade, the two groups achieved comparable results across all measures. According to the authors, this pattern suggests that children can still benefit from phonological training while they are developing early reading skills.

A more detailed investigation of which beginning readers benefit most from first-grade phonological intervention is provided by Poskiparta et al. (1999). Their study examined Finnish monolingual first graders identified as at risk for reading difficulties due to extremely poor phonological awareness and cognitive delays at school entry. These children were compared with peers with near-average cognitive levels but similarly poor phonological skills. Both samples were divided into intervention and control groups. The intervention involved progressive sublexical activities (from rhymes to phonemes). Pre- and post-tests assessed syllable deletion and phoneme isolation, as well as phoneme blending, deletion, and word recognition. At the post-test, children with near-average cognitive levels improved regardless of the intervention, and the experimental subgroup with cognitive delays matched these gains, showing the largest improvements overall. The control subgroup with cognitive delays, instead, showed no comparable progress. These findings, consistent with several other studies (Blachman et al., 1994; Bodé and Content, 2011; Brady et al., 1994; Ehri et al., 2001; Engel de Abreu et al., 2020; Gillon et al., 2007; Herrera et al., 2011; McIntosh et al., 2007; Muñoz et al., 2018; Nancollis et al., 2005; Patscheke et al., 2016; Pfost et al., 2019; Stuart, 1999, 2004; Suggate, 2016; Wolff and Gustafsson, 2022), indicate that phonological training can be especially beneficial for children with linguistic or cognitive vulnerabilities, both before and during the acquisition of reading.

Similarly, Gillon et al. (2019) investigated phonological awareness support in beginning readers from disadvantaged urban areas of New Zealand, whose development had been affected by the 2011 Christchurch earthquake. After assessment on phoneme identification, segmentation,

blending, and nonword reading, children received a ten-week training focused on phoneme-level skills and letter-sound correspondence, delivered in four weekly 30-minute sessions using themes drawn from children's literature. Control children followed the regular curriculum. Post-test results showed improvements in all phonological measures for the experimental group, with gains extending to nonword decoding. As the authors note, this enhanced skill may be beneficial for novel word decoding, which relies on similar mechanisms (grapheme-phoneme conversion; Coltheart et al., 2001).

Phonological training has also been examined in bilingual first graders learning to read in the community language. A recent meta-analysis by Ludwig et al. (2019) evaluated the effectiveness of literacy intervention programs for children learning to read in English as an early L2. Although neither type of intervention (e.g., phonological, vocabulary, orthographic) nor grade of administration (kindergarten, first, second) acted as significant moderator, overall effect sizes were large across reading components, suggesting that literacy training is effective for bilingual learners as well (see Section 2.4.2).

This conclusion is supported by studies such as Gunn et al. (2000) and Konerding et al. (2020). Gunn and colleagues implemented a two-year intervention aimed at enhancing phonological and reading skills in bilingual and monolingual early-grade students from disadvantaged socioeconomic contexts in the U.S. Children in the experimental group showed significantly better nonword reading after 4-5 months, with improvements extending to word reading and comprehension after 15-16 months. Gains were comparable for Hispanic and non-Hispanic students. The authors note that generalized benefits emerged only after two years, suggesting that longer interventions may be more effective for at-risk children.

Different results emerged in the study by Konerding et al. (2020), where an eight-week computer-based intervention was delivered to second-grade children with a migration background learning to read in German. The program targeted phonological skills (identification, deletion, substitution), word and nonword decoding, and reading comprehension, and included auditory training, grapheme-phoneme mappings, and word reading. Gains were observed only for phoneme deletion and substitution, but these were not maintained at follow-up; no training effects were observed in reading. The authors attribute these findings to the limited role of phonological awareness in German reading development, due to the high predictability of grapheme-phoneme correspondence in the language, which enables children to acquire decoding skills rapidly, even with low phonological skills. They also suggest, as in Gunn et al. (2000), that a longer intervention might have been more beneficial for bilingual children.

Despite some mixed findings, the studies reviewed in this section confirm that phonological training can be effective, even in beginning readers, with more consistent gains in concurrent reading skills than in studies that administer training in kindergarten with later follow-ups. Interventions delivered at the start of literacy instruction appear especially beneficial for at-risk readers, including low-income, language-impaired, and bilingual children with a migration background.

At the same time, substantial heterogeneity in intervention methods can be observed, including duration and scheduling, administrators (teachers, researchers, practitioners), grouping formats (small groups, whole classes), and, critically, the specific skills assessed and targeted. In the final part of this section, we examine reviews that outline best practices for designing phonological interventions.

2.4.5. Guidelines for designing phonological training programs

The methodological differences outlined above make comparisons across phonological training studies particularly challenging. Nevertheless, (systematic) reviews conducted over the years have presented a series of guidelines to maximize the effectiveness of didactic interventions (Bonifacci and Tobia, 2017a; National Institute for Literacy, 2008; National Reading Panel, 2000; Pullen and Justice, 2003; Schuele and Boudreau, 2008). The most relevant features are summarised in the present section.

The first point concerns what should be targeted in a phonological intervention. As empirically demonstrated by Cunningham (1990), phonological awareness should not be enhanced *per se*, but rather as a means to boost reading skills. To this end, phoneme segmentation and blending are the key skills most closely related to reading success. However, for children – especially preschoolers – to become able to manipulate such small units, training should always begin with more salient units, such as rhymes or whole words, and then gradually move toward syllables and phonemes. This is in line with the phonological continuum proposed by Stanovich (1992; see Section 2.2.1). At the same time, operations should progress from simpler to more cognitively demanding ones (e.g., from identification to blending, and finally to substitution; Adams, 1998).

Another recommended aspect concerns the inclusion of orthographic representations. According to the National Reading Panel (2000), employing letters in phonological training strengthens the connection between spoken and written representations of sounds, facilitating

the transfer from phonological awareness to reading skills. As previously discussed, however, this aspect can be problematic, as participants' previous knowledge of letter-sound correspondence or its inclusion in training programs can act as a third variable and confound the effect of a pure phonological training (Castles and Coltheart, 2004; see Section 2.2.1).

The modalities through which phonological awareness is trained are as important as the skills themselves. Especially for younger children, tasks or instructions presented in an overly abstract way may lead to confusion or demotivation. Whenever possible, tangible representations of the target units or operations should be provided (Brady et al., 1994; Lundberg et al., 1988). Additionally, as discussed in Section 2.4.3, motion-based learning systems should be promoted for young children, as they facilitate the association between motor skills and the understanding of the purpose of physical actions (Gardner, 1983). Research from other educational fields has shown that active, movement-based activities can be particularly beneficial for young learners (e.g., scientific concepts: Dođru and Şeker, 2012; geometry: Kaur, 2020; foreign language vocabulary: Toumpaniari et al., 2015).

Systematic reviews also converge on the need for training to be intentional, rather than incidental: results are more robust when instructions are explicit and targeted. Schuele and Boudreau (2008) further provide useful guidelines regarding trainers' attitudes during activities. Besides carefully planning a gradual progression from simpler to more complex units and operations, administrators should repeatedly demonstrate all underlying processes, enabling children to reason autonomously (think-aloud strategy). Moreover, they should remember that training differs from testing: during intervention activities, the focus should be on the process leading to the answer rather than on response correctness. Scaffolding should always adapt to children's answers – both correct and incorrect – to maximize learning.

One aspect that does not appear to play a specific role is the identity of the administrator. As emerged from the comparison of studies, phonological training is effective regardless of whether it is administered by teachers, researchers, or practitioners, provided they are well trained (National Reading Panel, 2000).

Final recommendations concern timing and target populations. Regarding duration, interventions between 5 and 18 hours have been associated with larger effect sizes, while longer programs are not necessarily linked to greater improvements (but see the cases discussed above for bilingual children; Gunn et al., 2000; Konderding et al., 2020). The intervention studies reviewed typically distributed activities over 7 to 12 weeks, with 3-5 sessions per week, each lasting 15-30

minutes. The ideal timing for intervention onset is between kindergarten and the early primary school years, as extensively shown in the previous paragraphs. This is particularly relevant for at-risk children, as delays in intervention may cause them to fall irreparably behind their typically developing peers. In this regard, phonological training appears especially beneficial for disadvantaged or at-risk children.

Taken together, the studies reviewed in this section support the conclusion that, despite considerable methodological heterogeneity, didactic interventions targeting phonological skills are effective in enhancing these skills and, to a more limited extent, initial reading skills. As noted above, benefits are particularly evident for children with or at risk for reading or language impairments. This is especially relevant for the present dissertation, which, following Casani (2021), will examine the effectiveness of phonological training in monolingual and bilingual preschoolers and beginning readers with a migration background – a population still understudied in the Italian context (Chapters 4 and 5).

Chapter 3 – Study 1: Predicting emerging reading skills: a longitudinal study on monolingual and bilingual preschool children acquiring literacy in Italian

3.1. Introduction

3.1.1. Linguistic profile of bilingual children with a migration background

In a world where migration phenomena are increasing, and an ever-growing number of children acquire literacy exclusively in a language different from that spoken in their families, studying the learning trajectories of these children is crucial for supporting their academic success.

According to data published by the Italian *Ministero dell'Istruzione e del Merito*, the percentage of students from migrant families attending Italian schools was 11.2% in 2022/23. This represents a rather high proportion, which is even higher in kindergartens and primary schools (12.5% and 13.3%, respectively).

As discussed in more detail in Chapter 1, most of these children are predominantly exposed to their family language during the first years of life, followed by a sudden shift toward the community language upon entering school. Moreover, they are often enrolled in submersion programs (Cummins, 1979b) where the use of their family language – typically a minority language without official recognition – is neither considered nor encouraged. Consequently, these children begin formal education at a disadvantage compared to their monolingual peers, as they do not match the language proficiency level of classmates who are native and monolingual speakers of the language of instruction. The Italian situation does not represent an exception to this picture: as reported in Paragraph 1.3.2.1, bilingual children with a migration background lag behind their peers in specific reading tasks, such as word reading and comprehension (Bonifacci and Tobia, 2016; Cordin et al., 2021; Cordin and Vender, 2022; Melloni et al., 2022; Murineddu et al., 2006).

The linguistic development of bilingual children with a migration background (BCMB) has been widely studied, but findings are mixed regarding their proficiency in the community language. On the one hand, bilingual children's vocabulary in the community language has sometimes been found to be larger than in the family language (Bello et al., 2023), and no differences in vowel

pronunciation have been observed compared to monolinguals (Guion, 2003; MacLeod et al., 2009). On the other hand, several studies have reported a persistent linguistic gap between bilingual and monolingual populations (Flege, 1999; Gathercole, 2002; Harley, 1992). A more optimistic view has also been proposed, suggesting that bilinguals simply require the same amount of exposure as monolinguals – albeit over a longer period – to eventually catch up (Jia, 2003; Goldberg, 2008; Paradis, 2007).

These mixed results can be interpreted within the theoretical framework proposed by Cummins (1979b). In his review of studies addressing the so-called bilingual advantage or disadvantage, he argued that the development of the two languages is mutually dependent. Specifically, the Threshold Hypothesis posits that the cognitive and (meta)linguistic advantages sometimes observed in bilinguals become visible only when a high threshold of language competence is achieved. Below that threshold, bilingualism may result in linguistic disadvantage instead. The Developmental Interdependence Hypothesis, on the other hand, holds that the level of proficiency a child attains in the second language partly depends on the level already achieved in the first language at the time when extensive exposure to the second language begins.

With respect to the first hypothesis, BCMB typically do not reach high competence in both of their languages (see above). For example, their vocabulary in the family language often remains limited to everyday conversational contexts, while that in the community language benefits from school instruction (Bialystok et al., 2010; Cummins, 1979a, 2008). As for the second hypothesis, the linguistic competence of BCMB may not be as rich as that expected of monolingual children, partly due to extra-linguistic factors.

Indeed, the linguistic development of BCMB is also strongly influenced by socioeconomic (SES) and migrant status. As already addressed in Paragraphs 1.3.2.4 and 1.3.2.5, low-income contexts can negatively affect a child's psychological well-being, and less educated parents may be less aware of child development processes, resulting in overall poorer parent-child interactions (Ginsborg, 2006; Parks and Smeriglio, 1986). Furthermore, migrant and low-SES families often provide less stimulating home literacy environments – a factor commonly measured by the number of books available at home and the time spent reading or engaging in literacy-related activities together. All these factors have been shown to play a crucial role in bilingual children's language development (Bello et al., 2024; Eisenwort et al., 2018; Luo et al., 2021; Novita and Kluczniok, 2022; Valcárcel Jiménez et al., 2024).

3.1.2. Reading assessment in bilingual children with a migration background

The acquisition of the basic principles of reading strongly depends on previously acquired language knowledge. As already discussed, according to the Simple View of Reading, reading comprehension is the product of decoding (i.e., the ability to convert print symbols into spoken sounds quickly and accurately) and language comprehension (i.e., the ability to derive meaning from spoken sounds) (Gough and Tunmer, 1986; Hoover and Gough, 1990). Difficulties in either of these components can lead to reading impairments. Developmental dyslexia, for instance, is typically characterised by poor decoding skills (American Psychiatric Association, 2013).

Given this close relationship, it is not surprising that BCMB often display initial difficulties in reading acquisition similar to those observed in dyslexic children; these difficulties emerge in specific areas of decoding, but most importantly in comprehension (Duzy et al., 2014; Lervåg and Aukurst, 2010; Melloni et al., 2022; Persici et al., 2022; Verhoeven, 1990; see Paragraphs 1.3.3.1 and 1.3.3.2). Consequently, diagnosing reading impairments in the BCMB population is particularly challenging. Previous studies have shown that reading assessment methods used with these children are highly heterogeneous, leading to both over- and under-representation of bilinguals in special education programs (Deponio et al., 2000; Samson and Leseaux, 2009; see Section 1.3.4). These studies report that teachers tend either to assess these students using tests normed on monolingual populations or to adopt a ‘wait-and-see’ approach, expecting natural language improvement over time. However, research has shown that both approaches entail risks of misdiagnosis – either over- or under-identifying reading impairments in BCMB.

A possible way to tackle this issue would be to assess linguistic reading predictors, in addition to reading skills themselves (Bedore and Peña, 2008). As discussed in Section 2.1, reading predictors are a set of skills whose development underlies that of literacy (Akarsu et al., 2024). These range from sensory, visual, and motor functions to auditory-linguistic skills, executive functions, and environmental factors. For the present work, we will focus on linguistic skills and, to some extent, on environmental factors.

In Chapter 2, we have seen that the various components of reading (decoding speed and accuracy, language comprehension, and reading comprehension) are predicted by several pre-reading skills, both concurrently and longitudinally, and across opaque and transparent orthographies. Reading decoding, for instance, is typically predicted by phonological awareness, i.e. the conscious identification and manipulation of language sounds (Adams, 1998; Leather and Henry, 1994; Lonigan et al., 2000; Mattingly, 1972; Melby-Lervåg et al., 2012; Perfetti et al.,

1987; Stahl and Murray, 1994; Storch and Whitehurst, 2002; Torgesen et al., 1989, for English; Mascheretti et al., 2024; Orsolini et al., 2006; Pinto et al., 2016, 2017, for Italian). The relationship between phonological awareness and decoding is explained by the fact that, in alphabetic languages, print symbols represent phonemes – language sounds. A basic understanding that spoken language is composed of discrete sounds is therefore fundamental to acquiring grapheme-phoneme conversion rules (Bryant et al., 1990). Consequently, print awareness – the ability to assign names or sounds to written letters – has also been found to be a reliable predictor of decoding (Bruck et al., 1997; Lonigan et al., 2000; McBride-Chang, 1999; Muter et al., 1998). Another important predictor is rapid automatized naming (RAN), which consists in the rapid naming of serial objects, letters, or colours. RAN has been found to predict both decoding and comprehension crosslinguistically (Araújo et al., 2015; Denckla, 1972; Denckla and Cutting, 1999; Georgiou et al., 2013; Kirby et al., 2003; McWeeny et al., 2021 for English; Di Filippo et al., 2005; Pinto, et al., 2016; Tobia and Marzocchi, 2014 for Italian). The predictive relationship is attributed to the shared processing of serial visual stimuli involved in both reading and RAN (Georgiou et al., 2013). To a more limited extent, morphological awareness has also been found to predict reading decoding (Brittain, 1970; Deacon and Kirby, 2004; Kirby et al., 2012; for English; Vernice and Pagliarini, 2018 for Italian).

Turning to reading comprehension, this skill has been shown to be more reliably predicted by decoding in opaque orthographies – particularly at early stages – and by language comprehension in transparent ones (Florit and Cain, 2011). Despite these discrepancies, oral language skills overall make a substantial contribution to reading comprehension. These include vocabulary, oral language comprehension, and narrative skills (Babayiğit et al., 2021; Bleses et al., 2016; Catts et al., 2005; Duff et al., 2015; Muter et al., 2004; Ouellette, 2006; Piasta et al., 2018; Reese et al., 2010; Ricketts et al., 2007; Sénéchal et al., 2007, for English; Orsolini et al., 2006; Pinto et al., 2016, 2017; Vettori et al., 2025, for Italian). Among metalinguistic skills, morphological awareness has occasionally been found to predict reading comprehension, especially in more advanced readers (Deacon and Kirby, 2012 for English; Vernice and Pagliarini, 2018 for Italian). If the ultimate goal of reading is to derive meaning from text, and if text is the written representation of oral language, it is unsurprising that stronger oral skills play a key role in reading comprehension.

Research on reading predictors in bilingual children acquiring literacy in Italian is limited but consistent. Studies on skilled readers have shown that predictors in this population may follow different patterns from those observed in monolinguals, while remaining reliable. So far,

nonword repetition, vocabulary, morphosyntactic comprehension, and morphological awareness have been found to predict reading accuracy (Bellocchi et al., 2017; Bonifacci et al., 2024; Vernice and Pagliarini, 2018); RAN, vocabulary, and morphological awareness predict reading speed (Bellocchi et al., 2017; Persici et al., 2025; Vernice and Pagliarini, 2018); while reading comprehension is predicted by morphosyntactic comprehension and vocabulary (Bellocchi et al., 2017; Vernice and Pagliarini, 2018).

Beyond their predictive value, pre-reading skills have also proven effective in distinguishing typically developing bilingual children from those with developmental dyslexia. Specifically, Vender and colleagues (2020) compared bilingual and monolingual children with or without dyslexia in a nonword repetition task. They found that only dyslexic children struggled with this phonological measure, while no differences emerged between the two typically developing groups. These findings were further supported by another study introducing additional phonological measures (rhyme detection, spoonerism; Vender and Melloni, 2021). Similar conclusions were reached in a study on morphological awareness in the same population, where bilingualism did not represent a disadvantage, whereas dyslexia did (Vender et al., 2021).

Nevertheless, all these studies were conducted on advanced readers or on children already diagnosed with dyslexia. Given the vulnerabilities shown by BCMB and the risk of misdiagnosis, identifying the most at-risk children before formal instruction begins would be crucial. To our knowledge, only one study has examined reading predictors in bilingual and monolingual Italian preschoolers. Casani (2021) found that bilinguals and monolinguals differed in kindergarten performance on most phonological awareness measures, vocabulary, and RAN. Moreover, his findings confirmed the longitudinal predictive power of early phonological skills for later literacy (see Section 2.3.3).

A final consideration concerns socioeconomic and family context in the BCMB population. When assessing reading or pre-reading skills in these children, this factor should always be taken into account (Deponio et al., 2000). Attempting to disentangle the effects of migrant bilingual status with those of low SES, Bonifacci and colleagues (2020) found that BCMB and monolingual children with equally low or higher SES performed similarly in reading fluency, though the bilingual group showed lower scores in reading and oral comprehension.

3.2. The study

A longitudinal investigation of the developmental trajectory and correlation of early reading predictors and later reading skills would thus allow to clarify whether these predictors can effectively and timely identify bilingual children with a migration background at risk to develop reading impairments.

Previous studies have shown that different predictors can contribute to explaining variance in the same reading component, and vice versa. This is not surprising given the multicomponent nature of reading (Akarsu et al., 2024). Isolating the individual contribution of different pre-reading skills can be challenging, as language tasks are clearly intercorrelated. Since so little is known about pre-reading skills in bilingual preschoolers acquiring literacy in Italian as their community language, a comprehensive analysis of reading predictors might help shed light on this issue.

3.2.1. Research questions

Building on these premises, we formulated the following research questions:

- (RQ1) How do monolingual and bilingual preschoolers with a migration background perform on reading predictors (including phonological, orthographic, and morphological awareness, vocabulary, lexical access, and oral language skills) in Italian?
- (RQ2) Can preschool performance in linguistic pre-reading skills predict emergent reading outcomes in bilingual and monolingual preschool children acquiring literacy in Italian?
- (RQ3) How do environmental factors such as SES and language exposure contribute to the development of pre-reading skills in bilingual children with a migration background?

To address these questions, we designed a longitudinal study in which a sample of monolingual and bilingual children was tested on pre-reading skills in kindergarten and on reading measures in 1st and 2nd Grade.

Another key aspect of our study concerns the innovative assessment method used to collect reading data. As described in Section 1.2, the finger-tracking web application *ReadLet* (Taxitari et al., 2020) was implemented to gather fine-grained data on reading decoding and comprehension. This was the first time a sample of first graders was assessed with this tool, and an original protocol – including words, nonwords in isolation, and narrative texts with comprehension

questions – was developed specifically for this purpose. The present study also offered an opportunity to collect detailed decoding and comprehension data for the target population by performing analyses at the word level and controlling for parameters often not sufficiently evaluated in standardised tests (see Paragraph 3.4.2.1). Given the novelty of the finger-tracking protocol for first graders, the results obtained from *ReadLet* were compared with those from the standardized tests of the *DDE-2* (Sartori et al., 2016).

3.2.2. Predictions

RQ1 will be addressed by comparing monolinguals and bilinguals' kindergarten performance through a series of t-tests. Based on previous results (Casani, 2021), we expect bilingual children to underperform monolinguals across language skills.

The answer to RQ2 will be obtained through a cluster analysis. This analysis has allowed us to group participants according to similarities in their kindergarten task performance and to use the resulting groups to predict subsequent reading outcomes via linear regressions. To our knowledge, no study has employed this kind of statistical approach to examine reading predictors, although cluster analysis has proven effective in identifying profiles of poor and good readers (Konold et al., 2003). However, our decision to implement this analysis was motivated by the fact that it allowed us to rule out multicollinearity issues often arising when dealing with tasks measuring strongly interconnected abilities (e.g., different tasks tapping language abilities, as in our case; Farrar and Glauber, 1967; Lavery et al., 2019). As will be confirmed by our data, scores from tasks as those we adopted typically display significant correlation values, and including all of them in a single regression model would entail the risk of obtaining false significance due precisely to such existing correlation. In addition, the variables included in the experimental tasks were not directly manipulated, as tasks were administered in their original form and only total scores were considered for the analyses, rather than performance on specific items (e.g., answers to inferential vs. textual questions in the Listening Comprehension task; see Paragraph 3.4.1.1 below). For this reason, our data were not suitable for fine-grained correlational analyses between specific subcomponents. Finally, our study was conducted on a relatively small sample (74 children) and included a high number of measures (see Section 3.4.1), two concurrent conditions that are not advisable for correlational approaches (Knofczynski and Mundfrom, 2008; Norouzian and Plonsky, 2018).

Given the absence of comparable studies, formulating precise predictions at this stage is challenging. However, if the link between preschool predictors and later reading is valid, we would expect preschoolers with weaker profiles – both bilinguals and monolinguals – to display poorer reading performance in 1st and 2nd Grade, and conversely, those with stronger pre-reading skills to perform better. The exploratory nature of cluster analysis allows for a data-driven approach that does not strictly rely on predefined categories.

Finally, data for RQ3 were derived from the *Q-BEx* questionnaire (De Cat et al., 2023), which was completed by parents of bilingual children. A cluster analysis was applied to these data as well, allowing us to group children according to similarities in SES and language exposure. This grouping was included in a linear regression to examine the relationship between external factors and kindergarten performance on language tasks. We expect that children from more disadvantaged family environments will also display greater difficulties.

3.3. Participants

3.3.1. Groups

The sample for the present study comprised 79 children aged between 5.2 and 6.3 years ($M = 5.84$, $SD = 0.30$) at the start of the study, all of them attending the third and final year of Italian kindergarten (*Scuola dell'infanzia*). Specifically, participants were recruited from kindergartens located in the Veneto region, in northern Italy, an area with a higher concentration of migrant children compared to the rest of the country (15.2% vs. 11.2% according to the report published in August 2024 by the *Ministero dell'Istruzione e del Merito*; see Paragraph 1.3.2.1). More precisely, children were enrolled in three kindergartens (“Mons. G. Ciccarelli”, a private kindergarten, and “Federico Garofoli”, and “Giovanni XXIII”, public kindergartens) situated in a medium-sized town not far from Verona, San Giovanni Lupatoto. Its location and the presence of many important factories on the territory is attractive for migrant families, whose percentage in the town is higher than the national mean (11.2% vs. 9.2%; ISTAT database accessed in November 2025).

Among our participants, 44 were monolingual Italian speakers (henceforth, MONO group) and 35 were bilingual children with heterogeneous languages as family languages and Italian as community language (BI group). All bilingual participants were born and raised in Italy and came from families with a migration background. Three of them had only one parent who was a native speaker of a language other than Italian.

The family languages spoken by the children in the BI group were very heterogeneous, as typical of the migrant population living in this area, and included Romanian (13), Arabic (8), Albanian (3), Sri Lankan (3), Moldovan (2), Serbo-Croatian (2), Chinese (1), Ghanaian (1), and Spanish (1). The family language of one bilingual participant could not be identified, as neither the child nor the teachers were able to provide this information; additionally, the parents were not available to fill in the questionnaire (see below). However, this participant was excluded from the sample for unavailability to participate in all testing sessions (see Section 3.3.3).

3.3.2. Recruitment

Participants were recruited through a collaboration with the non-profit organization *Canalescuola*. *Canalescuola*, one of the partners of the PNRR scholarship that funded the present doctoral research, is a non-profit entity operating in northern Italy offering innovative training courses for teachers, educators, parents, and students on a variety of school-related subjects. Upon obtaining their schools' consent, all third-year children were involved in the recruitment, and the parents of 79 of them gave their consent for their children's participation in the study.

To ensure a voluntary and informed participation, all parents received a consent form together with an information sheet including all relevant details of the study. The document explained the duration of the study, the non-invasive and playful nature of the tests, and the possibility to withdraw their consent at any time; pseudonimisation of all collected data was also guaranteed. The experimental protocol of the present study and of Studies 2 and 3 have been approved by the Human Research Ethics Committee of the University of Verona (request ID number 08.R1/2023).

3.3.3. Inclusion criteria

To be included in the sample, participants had to meet the following criteria: (i) having Italian as the only language or Italian as community language and another language as family language; (ii) having attended the first two years and being enrolled in the third year of an Italian kindergarten; (iii) not having received a formal reading or writing instruction; (iv) not being diagnosed with cognitive or linguistic impairments. As a further measure, to ensure equal cognitive capacities

across participants, the *Raven's Coloured Progressive Matrices* (Raven et al., 1998) was administered to the sample.

Of the 79 children in our sample, three bilingual children were excluded because they had moved away either during the final year of kindergarten or right before 1st Grade onset (one of these three children was the participant with an unidentified family language). Two additional bilinguals were excluded because they were unable to complete at least 70% of the tasks included in the experimental protocol, due to an extremely poor proficiency in Italian, possibly due to undiagnosed language impairments. Among the remaining BI participants, we could not obtain language exposure measures from two children, as the parents were not available to fill in the questionnaire; however, these participants were retained in the sample.

Data analysis was then performed on a sample of 74 children, namely, 44 Italian monolinguals and 30 bilinguals. The division between monolinguals and bilinguals was established based on the family history of the children included in the sample; specifically, children with a migration background were assigned to the BI group. A degree of engagement with the family language was ensured and confirmed for all participants belonging to this group through the administration of the *Q-BEx* questionnaire to the parents (De Cat et al., 2023; see below).

3.4. Study design

The aim of the present study was to verify the potential correlation between patterns of performance in early linguistic predictors of reading skills and later literacy abilities. To do so, we designed a three-year longitudinal study with three assessment points.

At T0, our sample was tested on linguistic reading predictors. Given the reduced amount of previous research on this topic, especially regarding preschool children and BCMB with Italian as the community language, we decided to examine a range of language skills, focusing on those that had emerged as reliable predictors in other languages or in older populations (see Sections 2.2.1-2.2.6). Therefore, the predictors selected were the following: oral skills (Narrative Abilities and Listening Comprehension), phonological awareness (Nonword Repetition, Phoneme Blending, Rhyme Detection), orthographic knowledge (Letter Knowledge), vocabulary (Receptive and Productive Vocabulary), lexical access (Rapid Automatized Naming), and Morphological Awareness (Nonword Inflection and Derivation).

At T1 children were attending the first year of primary school (age $M = 6.92$, $SD = 0.29$). This phase was aimed at testing participants' reading abilities, with the ultimate goal of verifying the presence of a correlation between early predictors and later literacy skills.

Another reading assessment was proposed again at T2, towards the end of children's 2nd Grade (age $M = 7.72$, $SD = 0.29$), following the same purpose.

3.4.1. T0: assessment of linguistic reading predictors

3.4.1.1. Materials

Narrative abilities and listening comprehension

The TOR 3-8 test (Test per la valutazione della comprensione orale; Levorato and Roch, 2007) was administered to assess Listening Comprehension. In the task, children were asked to listen to a story, read aloud by the experimenter, and to answer ten comprehension questions (five textual and five inferential questions) by pointing to the pictures that represented the correct answers.

The MAIN test (Multilingual Assessment Instrument for Narratives; Gagarina et al., 2019) was used to measure Narrative Abilities. After hearing a story, participants were asked to retell it at their best, without prompts. Points were assigned to every structural event correctly recalled and to psychological terms employed in the narration; plus, ten comprehension questions were asked at the end of the retelling.

Phonological awareness

Phonological awareness was assessed via three measures: Nonword Repetition, Rhyme Detection, and Phoneme Blending.

The Nonword Repetition task was adopted from a protocol developed by Vender and colleagues (2020). Participants were asked to repeat 40 pseudowords after hearing them from the experimenter. Stimuli length ranged from 2 to 5 syllables and varied in syllabic complexity (CV, CVC, CCV, CVV, CCVC and CVVC syllables were employed). Complete stimuli for this and the other non-standardised tasks can be found in Appendix A.

Rhyme Detection was assessed via a protocol developed by Vender and Melloni (2021). Children had to point to the image corresponding to the target rhyming word, avoiding phonological and semantic distractors.

The Phoneme Blending task was developed for the purpose of the present study. After hearing a word segmented into phonemes, participants had to blend it in a whole word. Stimuli were high-frequency words composed of two or three syllables and with different syllabic complexity (CV, CCV, CVC).

Orthographic knowledge

Children's orthographic knowledge was measured through the Letter Knowledge task (Task 1) of the *DDE-2* battery (*Batteria per la valutazione della Dislessia e Disortografia Evolutiva – 2*, Sartori et al., 2016). Children had to name out loud letters from the Italian alphabet, appearing one at a time on a tablet.

Vocabulary

Receptive Vocabulary was assessed using the *Peabody Picture Vocabulary Test – Revised (PPVT-R)*, Dunn and Dunn, 2000) in the Italian adaptation by Stella and colleagues (2000). After being presented with four pictures at a time, children had to point to the one corresponding to a target word.

The *TFL* test (*Test Fono-Lessicale*; Vicari et al., 2007) was used to measure expressive vocabulary. In this task, participants were presented with a series of pictures and asked to name the object or action depicted out loud.

Lexical access

Lexical access was investigated via a Rapid Automatized Naming (RAN) task, adopted from Vender and Delfitto (2024). Four objects (frog, house, apple, sun, finger) were repeated in a 50-item matrix, displayed on a sheet of paper. Children were asked to name all the objects, as fast and accurately as possible.

Morphological Awareness

This ability was assessed via a nonword inflection and derivation task developed by Vender and colleagues (2017) and Melloni and Vender (2022). The task consisted of a nonword pluralization task and an evaluative morphology task. In the former, children were prompted to generate the

plural form of pseudowords modeled after the four pluralization classes of Italian; in the latter, nonwords had to undergo derivation processes by attaching diminutive, augmentative, and pejorative suffixes.

Nonverbal Intelligence

To assess Nonverbal Intelligence, we administered the *Raven’s Coloured Progressive Matrices* (Raven et al., 1998). Children were presented with 36 incomplete patterns. For each, they had to select the correct piece from six options to complete the sequence.

Bilinguals’ linguistic history and socioeconomic context

To obtain quantitative data on language exposure and proficiency, together with information concerning the socioeconomic status of bilingual families, the *Q-BEx* questionnaire (De Cat et al., 2023) was administered to the parents of bilingual children. The following modules were selected: Background information and Risk factors (compulsory), Language exposure and use, Language Proficiency, Richness of linguistic experience. Main caregiver(s)’ higher education in the family or community language was considered as a measure of socioeconomic status. Details on the questions can be found in Table 1.

The questionnaire was administered in person by the experimenter during individual meetings with the parents, which took place at children’s schools and lasted approximately 30 minutes. This phase was carried out when children were enrolled in 2nd Grade.

Section	Questions
Background information and Risk factors	Number of languages spoken or understood
	Personal information
	Number of siblings and birth order
	Kindergarten or school attendance
	Periods of absence from school
	Family composition
	Age of first word/sentence

	Concerns about language development
	Amount of family/community language use and exposure during interactions at home
	Amount of family/community language use and exposure during interactions at school
	Amount of family/community language use and exposure during interactions in the local community
Language exposure and use	Amount of family/community language use and exposure during interactions on holiday
	Major changes in the child's life
	Age and place of first exposure to each language
	Amount of overheard speech at home in each language
	Speaking and listening proficiency in each language
Language proficiency	Reading and writing proficiency in each language
	Proficiency compared to other bilingual children
	Frequency of reading, writing, doing homework in each language
	Frequency of language lessons at or outside school
Richness of linguistic experience	Frequency of technology-related activities in each language
	Frequency of interactions with peers in each language
	Frequency of participation in organised activities outside school in each language

Main caregiver(s)' highest education level in the community/family language
Number of people frequently interacting with the child in each language
Number of people frequently interacting with the child in each language who are proficient in that language

Table 1. Questions included in the Q-BEx questionnaire.

3.4.1.2. Procedure

All the children took part in three testing sessions, which lasted approximately half an hour each. In the first session, tasks tapping Nonverbal Intelligence, Listening Comprehension, Rapid Automatized Naming, Nonword Repetition, Letter Knowledge, and Productive Vocabulary were administered. The second session focused on Narrative Abilities, Phoneme Blending and Morphological Awareness; the Rhyme Detection and the Receptive Vocabulary tasks were left for the final session. The order of administration was kept identical across participants. Sessions were spaced approximately one week apart to minimize fatigue, especially in view of the young age of our participants. All the sessions took place in a quiet room in the kindergartens (“Ciccarelli”, “Garofoli” and “Giovanni XXIII”). The administration for the children attending the “Ciccarelli” kindergarten was conducted by the author of this dissertation, while two Linguistics Master’s students were responsible for the remaining participants. Before data collection, these assistants received specific training to ensure consistent administration procedures. To reduce performance anxiety and create a comfortable testing environment, experimenters always made sure to put children at ease, allowing for informal conversation and playful interaction with the experimenter. All tests were introduced as playful games.

A variety of modalities were employed for task administration: specifically, the Nonverbal Intelligence, the Letter Knowledge, the Receptive and Productive Vocabulary, the Morphological Awareness, and the Rhyme Detection tasks were administered using a tablet; the Rapid Automatized Naming task on paper; the Nonword Repetition and the Phoneme Blending tasks orally; finally, the Listening Comprehension and Narrative Abilities tasks were presented using a combination of oral and visual (tablet-based) formats. Each task, with the exception of those testing Letter Knowledge, Listening Comprehension, and Narrative Abilities, was preceded by

practice items. For every test, answers were manually annotated by the experimenters; 1 point was awarded to correct answers, 0 otherwise. For the Rapid Automatized Naming task, time (in seconds) was recorded.

3.4.2. T1: first test on reading skills

3.4.2.1. Materials

DDE-2

Tests 2 and 3 of the *DDE-2* battery were selected to assess decoding skills via standardized measures. Test 2 consisted of 112 Words to be read in isolation, selected according to a crossed manipulation of imageability (high vs. low) and frequency (high vs. low); test 3 included 48 Nonwords, created following Italian phonotactic rules.

Overall reading times and errors for Words and Nonwords were manually recorded.

Since the test is not standardised for 1st Grade children, only raw scores (mean reading times in seconds for single stimuli, total errors for Word and Nonword lists) were used for analyses.

ReadLet

An original protocol was designed for the purpose of the present study on the finger-tracking application *ReadLet* (Taxitari et al., 2020). The protocol was specifically designed for 1st Grade children, a population whose reading profile had not been investigated with this technology so far.

The testing protocol included Words and Nonwords to be read in isolation and two short narrative Texts followed by comprehension questions. Complete materials can be found in Appendix B.

Unlike the *DDE-2* protocol, whose criteria for word selection are semantic- and frequency-based, we decided to rule out the potential effect of these variables, which might not have a substantial impact on first graders' reading, by including exclusively frequent words. In contrast, as explained below, we selected our words to be read in isolation based on length, syllabic complexity, and morphological derivation. Since this was the first time that first graders were tested with a finger-tracking protocol, no detailed analysis was carried out on the specific effects of these variables on decoding; however, future studies should address this matter by verifying whether length and morphological derivation (as shown by Marzi et al., 2023 and Mazzarino and

Marzi, 2023, on more skilled readers) and syllabic complexity affect beginning readers' decoding.

As for Nonwords, a problematic aspect evidenced in the *DDE-2* is the presence of syllables or endings that are unlicensed in Italian (e.g., *vranoma*, in which the syllable *vra-* is never attested in initial position in Italian, and *cogiu*, where the final *-u* is a very anomalous ending, restricted to a few function words), as well as the overrepresentation of syllables that are rarely found in the position in which they appear in the protocol (e.g., *gnoba*, *gnaro*, *gnufo*, where the initial *gn-* is extremely rare in Italian and is more frequently attested in internal word position). Moreover, since the selection criteria for word stimuli in the *DDE-2* were exclusively semantic- and frequency-based, drawing a direct comparison between word and nonword reading strategies would be problematic.

In our *ReadLet* protocol, instead, we applied the same orthographic and morphological criteria for the selection of Words and the creation of Nonwords, which, notably, strictly adhered to the phonotactic rules of Italian. Comparing reading speed and accuracy outcomes between Words and Nonwords from our protocol would enable, for instance, verification of whether beginning readers of Italian rely on the lexical route even in the initial stages of their reading acquisition, excluding potential confounding effects caused by the orthographic properties of the stimuli. This aspect will be marginally taken into account in Study 2; however, future research should provide further evidence for this hypothesis, benefiting from the fine-grained data quality provided by the finger-tracking methodology.

Children were first exposed to Words in isolation, which comprised 30 frequent nouns drawn from the *Nuovo vocabolario di base della lingua italiana* (De Mauro, 2016). As mentioned above, words were manipulated according to length (from two to four syllables, e.g. *vita*, *domenica*), syllabic complexity (open and closed syllables, syllables with a complex onset and with consonant doubling, e.g. *semaforo*, *pulcino*, *gradino*, *cavallo*) and morphological complexity (monomorphemic and suffixed words, e.g. *semaforo*, *musicista*).

Children were instructed to read the Words as fast and accurately as possible while finger-pointing them. Tracking times were recorded automatically by the application, while errors were manually annotated by the experimenter.

The same procedure was followed for the Nonword lists, administered immediately after the Word reading task. Nonwords were created following the phonotactic rules of Italian and the

same syllabic (e.g., *nuse*, *parno*, *spobo*, *maffi*), length (e.g., *zalo*, *selaftime*) and morphological (e.g., *banteco*, *bantemento*) criteria described above.

The final part of the *ReadLet* protocol involved reading two short Texts followed by three comprehension questions each. In terms of both length and topics, the stories were inspired by the intermediate and final 1st Grade assessment tests from the *Prove MT* (Cornoldi & Colpo, 1998). The first story of our protocol, *Il coniglietto* ('The bunny'), focused on the Easter bunny, a traditional character familiar to young children. The second, *Il riccio* ('The hedgehog'), depicted an interaction between a little boy and an animal – an often-recurring theme in children's literature. Building on the material from the *Prove MT* protocol, however, we attempted to improve a few problematic aspects that, in our opinion, emerged from their stories.

First, both of their first-grade targeted stories (*La storia di Babbo Natale* and *Il bruco e i gerani*) have a very weak narrative structure, especially concerning the ending, which is essentially absent in both cases; the narration feels interrupted rather than intentionally concluded, and this may negatively affect children's engagement while reading. Considering the importance of enjoyment in child-directed experimental procedures, we aimed to elaborate short (fewer than 80 words) but fully developed stories, including a brief introductory contextual overview, a central narration focusing on the main character's actions, and a conclusion. An example is reported in Table 2; complete materials can be found in Appendix B.

Another crucial issue concerns the language adopted in the *Prove MT*. In fact, the vocabulary, syntactic choices, and contextual references included in the protocol's stories often seem infrequent or outdated. In *La storia di Babbo Natale*, for instance, the presents that Santa Claus delivers (miniature train, fire truck, toy kitchen, puppets) clearly reflect a past vision of this celebration, and some low-frequency words could be difficult for beginning readers to decode (e.g., *burattini*, 'puppets'). Similar considerations apply to *Il bruco e i gerani*, in which the protagonist (who is given a very outdated name, *Gigi*), finds a little caterpillar among his mother's *gerani*, a highly specific and infrequent flower name ('geranium' in English). The same short story also contains an infelicitous syntactic formulation, namely *Prepara un aeroplanino di carta e vi spinge sopra il bruco* ('He makes a paper plane and pushes the caterpillar on it'), where the pronoun *vi* is used as a locative pronoun – an unusual choice, typical of poetic and archaic register, compared to the much more frequent (and functionally equivalent) *ci*.

To avoid these issues, which could have an undesirable negative impact on children's reading, we decided to include only contemporary, frequent words, while keeping the syntactic structures of the stories as simple as possible.

Story	Translation	Narrative structure
<i>Un coniglietto vuole regalare le uova di Pasqua a tutti i bambini.</i>	A little bunny wants to give Easter eggs to all the children.	Introduction
<i>Per fare una sorpresa, cerca un posto dove nasconderle. Durante la notte trova un bel prato e decide di mettere le uova di cioccolato in mezzo ai fiori.</i> <i>Il mattino dopo, sul prato si vedono tante uova colorate. Tutti i bambini corrono verso il prato per raccogliere le uova.</i>	To make it a surprise, he looks for a place to hide them. During the night, he finds a beautiful meadow and decides to put the chocolate eggs among the flowers. The next morning, the meadow is full of colourful eggs. All the children run toward the meadow to collect them.	Central narration
<i>Il coniglietto sorride, felice di aver fatto una bella sorpresa ai bambini.</i>	The little bunny smiles, happy to have given the children such a lovely surprise.	Conclusion

Table 2. Content and narrative structure of one of the stories included in the ReadLet protocol, Il coniglietto.

To ensure these aspects, as well as readability and comparability, the texts were analysed using the *READ-IT* platform (Dell’Orletta et al., 2011), an online tool for assessing lexical, syntactic, and global textual complexity. Table 3 presents the main parameters considered for the evaluation.

	Words (tokens)	Periods	<i>GULPEASE</i> index	Words belonging to the <i>VdB</i>
<i>Il coniglietto</i>	73	6	63,5	87,2%
<i>Il riccio</i>	72	6	66,4	92,3%

Table 3. Parameters included in the textual complexity evaluation of the short narrative texts included in the ReadLet protocol.

The number of words and sentences was kept as low as possible, using the *Prove MT* as a reference (66 words and 6 sentences for *La storia di Babbo Natale*; 75 words and 13 sentences for *Il bruco e i gerani*). The *GULPEASE* index, developed by Lucisano and Piemontese (1988), is a numerical scale used to objectively define a text’s readability. Its calculation considers the number of sentences, letters, and words in a text, and yields a value between 0 and 100, where 0 corresponds to very low readability and 100 to very high readability. Our stories obtained *GULPEASE* values slightly higher than 60, which in principle should indicate a level of complexity easily accessible to middle school children but difficult for elementary school children. However, we retained the two texts in the protocol for two main reasons: first, because *La storia di Babbo Natale*, which is intended for administration in the middle of 1st Grade, also obtained a comparable value when uploaded on the *READ-IT* platform; second, because length, lexical, syntactic and global parameters all fell within acceptable ranges, as displayed visually in the platform section *Proiezione della leggibilità sul testo* (‘On-text readability projection’; see Figures 1 and 2, where green colour indicates low levels of complexity).

SID	frase	base	less.	sint.	glob.
1.	Un coniglietto vuole regalare le uova di Pasqua a tutti i bambini.				
2.	Per fare una sorpresa, cerca un posto dove nasconderle.				
3.	Durante la notte trova un bel prato e decide di mettere le uova di cioccolato in mezzo ai fiori.				
4.	Il mattino dopo, sul prato si vedono tante uova colorate.				
5.	Tutti i bambini corrono verso il prato per raccogliere le uova.				
6.	Il coniglietto sorride, felice di aver fatto una bella sorpresa ai bambini.				

Figure 1. Visual indications for length, lexical, syntactic and global complexity for the story *Il coniglietto*.

SID	frase	base	less.	sint.	glob.
1.	Per tornare a casa da scuola, Luca passa sempre vicino a un parco.				
2.	Un giorno, trova un piccolo riccio tutto solo.				
3.	"Povero riccio, sicuramente si è perso".				
4.	Luca prende il riccio con attenzione e lo porta a casa.				
5.	Alcuni giorni dopo, Luca va a fare una gita nel bosco e decide di liberare il riccio.				
6.	Piano piano, posa il riccio sulle foglie del bosco, felice di aver aiutato il suo piccolo amico.				

Figure 2. Visual indications for length, lexical, syntactic and global complexity for the story *Il riccio*.

The analysis conducted with the *READ-IT* platform also allowed for the calculation of the proportion of words contained in the *Vocabolario di base* (De Mauro, 1997) out of the total number of words in the text. As shown in Table 3, the percentages for our stories were considerably high, and, most importantly, comparable to those from the *Prove MT* (87.2% for *La storia di Babbo Natale*, and 83.6% for *Il bruco e i gerani*). This ensured high lexical accessibility of the narrative texts.

At the end of each story, children answered three comprehension questions displayed one at a time on the tablet. Each question was accompanied by three multiple-choice options: a correct answer, a distractor based on a detail present in the text but unrelated to the question, and a distractor semantically related to the question but not mentioned in the text. The order of the answers was always randomized across participants. Questions were exclusively textual, meaning that the answers could be directly inferred from information contained in the text, as the short length and the extreme simplicity of the narrative structure did not allow for the formulation of appropriate inferential questions. Example questions, taken from the story *Il coniglietto*, are reported in Table 4.

Both response times and answers were automatically recorded by the application.

To sum up, since this was the first administration of the present protocol to first graders, the following parameters were considered as measures of decoding and comprehension: (i) reading accuracy for Words, Nonwords, and Texts, measured in terms of decoding mistakes (e.g., omissions, substitutions, inversions) and manually annotated by the experimenter; (ii) reading times for Words, Nonwords, and Texts, measured in seconds required to finger-track single words (reading times equal to zero or higher than 20 seconds were excluded from the analysis) and automatically recorded by the application. Reading times were automatically collected at the sentence, word, syllable, and letter levels by the application, but only those corresponding to whole words were considered for the present analysis; (iii) comprehension accuracy, measured in terms of correct answers provided to the questions found at the end of each short text.

Questions	Answers	Translation
<i>Chi trova le uova?</i>	<i>*I bambini</i> <i>Il coniglietto</i> <i>Le galline</i>	Who finds the eggs? *The children The little bunny The hens
<i>Quando nasconde le uova il coniglietto?</i>	<i>*Di notte</i> <i>Di mattina</i> <i>Di pomeriggio</i>	When does the little bunny hide the eggs? *During the night During the morning During the afternoon
<i>Perché il coniglietto mette le uova in mezzo ai fiori?</i>	<i>*Per nasconderle</i> <i>Perché sembrano fiori</i> <i>Per proteggerle</i>	Why does the little bunny put the eggs among the flowers? *To hide them Because they look like flowers To protect them

Table 4. Answers and multiple-choice questions from the story *Il coniglietto*, together with English translation. Asterisks mark correct answers.

3.4.2.2. Procedure

The first test on reading skills took place when children were enrolled in 1st Grade and had received a minimum of eight months of formal reading instruction. All tests were administered in a single session, which lasted approximately 30 minutes and took place in a quiet room of participants' schools.

3.4.3. T2: second test on reading skills

3.4.3.1. Materials

ReadLet

The same Word and Nonword lists used during the first reading assessment were retained for this second testing session.

To prevent ceiling effects, however, new narrative Texts were selected for the second part of the protocol (see Appendix C). These stories were developed by the research team of the *ComPhys Lab* in the context of the *ReadLet* project (Marzi et al., 2020) and were specifically designed for more expert readers. Each Text was composed of two short episodes, and each episode was followed by two comprehension questions.

3.4.3.2. Procedure

Literacy skills were reassessed in the second half of 2nd Grade, to evaluate the long-term predictive validity of linguistic measures tested in at T0. The same testing procedure as in T1 was adopted: children completed the *DDE-2* Word and Nonword reading tasks (Sartori et al., 2016), followed by the *ReadLet* protocol. All tests were administered in a single 30-minute session.

3.5. Results

3.5.1. Monolingual and bilingual performance on preschool linguistic predictors of reading skills

Performance of monolingual (MONO) and bilingual (BI) participants was compared on all tasks administered at T0. Analysis was performed via a series of t-tests, using the R built-in function *t.test* (R Core Team, 2023). Results are reported in Table 5.

	MONO		BI		<i>t</i>	<i>df</i>	<i>p</i>	Cohen's <i>d</i>	95% <i>CI</i>
	MEAN	SD	MEAN	SD					
AGE	69.82	3.69	70.43	3.39	-0.74	65.78	0.46	-0.17	[-0.64, 0.29]
NVI ₍₃₆₎	21.02	5.68	18.30	6.49	1.86	56.77	0.07	0.45	[-0.02, 0.92]
NWR ₍₄₀₎	25.07	4.95	19.47	6.03	4.21	54.11	<.001***	1.03	[0.54, 1.52]
LK ₍₂₁₎	14.07	6.60	9.00	6.14	3.38	65.33	<.01**	0.79	[0.30, 1.27]
PB ₍₁₂₎	3.02	3.94	1.10	2.54	2.55	71.82	<.05*	0.56	[0.08, 1.03]
RD ₍₁₀₎	6.41	2.62	4.40	2.48	3.34	64.54	<.05*	0.78	[0.30, 1.26]
LC ₍₁₀₎	6.57	2.24	4.57	2.54	3.48	57.16	<.001***	0.84	[0.36, 1.33]
NA	20.00	3.80	14.93	5.07	4.65	50.44	<.001***	1.16	[0.66, 1.66]
RV ₍₁₇₅₎	85.07	18.06	56.60	17.75	6.73	63.17	<.001***	1.59	[1.05, 2.11]
PV ₍₄₅₎	32.90	4.46	25.50	6.25	5.59	48.74	<.001***	1.41	[0.89, 1.92]
RAN	64.50	19.86	78.20	18.96	-2.99	64.33	<.05*	-0.70	[-1.18, -0.22]
MA ₍₃₀₎	15.04	5.45	9.37	4.91	4.66	66.52	<.001***	1.08	[0.58, 1.57]

Table 5. Descriptive statistics (*M*, *SD*) for monolingual and bilingual age and accuracy in Nonverbal Intelligence (NVI), Nonword Repetition (NWR), Letter Knowledge (LK), Phoneme Blending (PB), Rhyme Detection (RD), Listening Comprehension (LC), Narrative Abilities (NA), Receptive Vocabulary (RV), Productive Vocabulary (PV), Morphological Awareness (MA), and seconds for Rapid Automatized Naming (RAN), together with Cohen's *d* effect size. When appropriate, maximum possible score for each task is reported within parentheses in the first column.

Overall, t-tests evidenced that monolingual children outperformed their bilingual peers in all tasks, with the sole exception of Nonverbal Intelligence, $t(74) = 1.86, p > .05$.

Table 6 below reports correlations among reading predictors for the whole sample. As expected, significant correlations emerged among all linguistic reading predictors tested at T0, with very few exceptions.

	NVI	NWR	LK	PB	RD	LC	NA	RV	PV	RAN	MA		
NVI	1.000												
NWR	.248*	1.000											
LK	.387***	.288*	1.000										
PB	.225	.404***	.502***	1.000									
RD	.323**	.422***	.248*	.328**	1.000								
LC	.290*	.333**	.397***	.150	.257*	1.000							
NA	.444***	.377***	.526***	.293*	.276*	.508***	1.000						
RV	.412***	.497***	.494***	.427***	.552***	.365**	.541***	1.000					
PV	.258*	.457***	.442***	.241*	.502***	.517***	.578***	.805***	1.000				
RAN	–	.448***	–.268*	–	.587***	.375***	–.295*	–.191	–	.589***	.493***	–.374**	1.000
MA	.288*	.514***	.372**	.383***	.600***	.350**	.433***	.533***	.559***	–	.362**	–	1.000

Table 6. Correlations among predictor measures: Nonverbal Intelligence (NVI), Nonword Repetition (NWR), Letter Knowledge (LK), Phoneme Blending (PB), Rhyme Detection (RD), Listening Comprehension (LC), Narrative Abilities (NA), Receptive Vocabulary (RV), Productive Vocabulary (PV), Rapid Automatized Naming (RAN), Morphological Awareness (MA). * $p < .05$, ** $p < .01$, *** $p < .001$

3.5.2. Cluster analysis: patterns of performance in linguistic predictors of reading skills

Given our aim of determining how potential score patterns in early linguistic reading predictors influence later reading skills in monolingual and bilingual learners, a hierarchical agglomerative cluster analysis was conducted on R using the `hclust` package (R Core Team, 2023). Hierarchical clustering is a multivariate statistical technique that allows for grouping data points based on similarity or distance measures, minimizing the distance among points within clusters, and maximizing that between clusters (Akarsu et al., 2024; Crowther et al., 2021; Staples and Bieber, 2015). In our case, participants assigned to a given cluster should display comparable scores across all measures, which in turn should be different from those of participants belonging to other clusters. After computing a distance matrix on scaled data (distance measure: Euclidean distance; linkage method: Ward's method), a dendrogram of the clustering outcome was obtained via the `fviz_dend` function, revealing the relationship between cases (participants).

For the present analysis, the distance matrix was computed including data from all predictor measures tested at T0 (Nonverbal Intelligence, Nonword Repetition, Phoneme Blending, Rhyme Detection, Listening Comprehension, Narrative Abilities, Receptive Vocabulary, Productive Vocabulary, Rapid Automatized Naming and Morphological Awareness), and without applying an *a priori* distinction between MONO and BI participants. Figure 3 represents the dendrogram resulted from the hierarchical clustering applied on predictor measures.

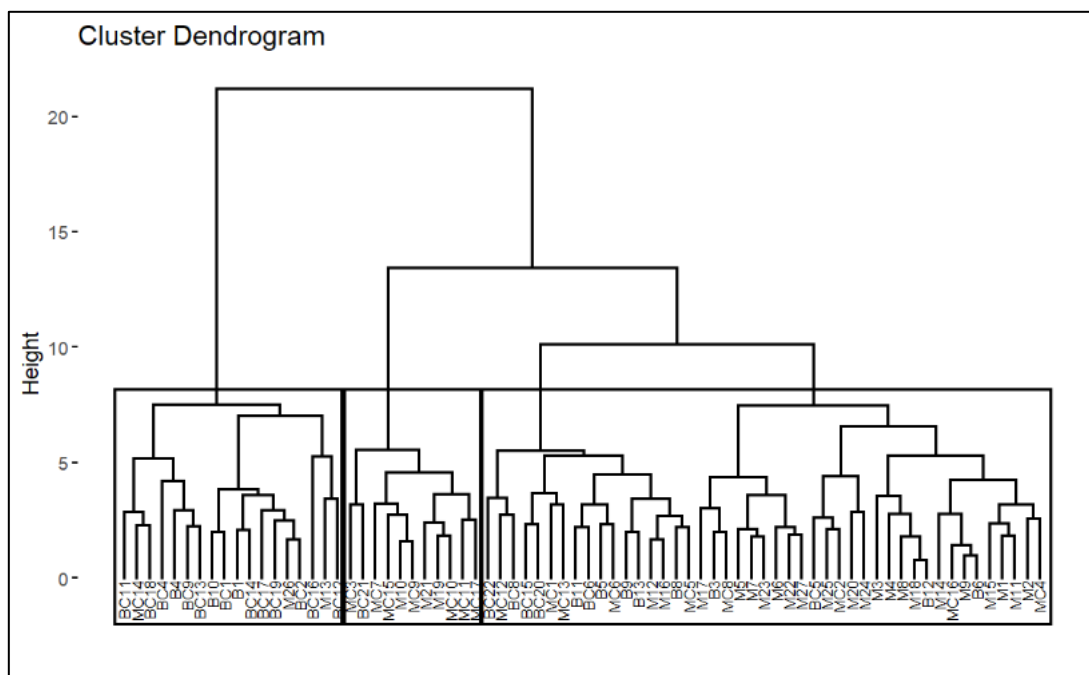


Figure 3. Dendrogram representing clustering of participants' performance on reading predictors, measured at T0.

As can be seen in Figure 3, in agglomerative hierarchical clustering each observed case (here, participants) is initially considered to be a cluster on its own (x axis). What the algorithm does is then to start grouping single observations according to similarity measures (e.g., participants MC14 and BC18, in the leftmost side of the x axis). This procedure is recursively repeated for all observations, leading to the creation of progressively larger clusters and, eventually, to a single cluster including all observations (top of y axis) (Staples and Biber, 2015). The height at which observations are joined (y axis) is indicative of the similarity of the merged elements: the lower it is, the more related are the observations to each other (e.g., participants M18 and B12 in the rightmost side of the x axis).

As a result, division into clusters can be determined by 'cutting' the dendrogram tree at comparable heights (see Figure 3). In this specific case, the decision to limit the division to only three clusters was mainly motivated by the small sample size. After obtaining the cluster division via the *cutree* function of the R stats package (R Core Team, 2023), a scatterplot visualizing participants' distribution into clusters was obtained using the *fviz_cluster* function (factoextra package, R Core Team, 2023). The blue cluster shown in Figure 4 will be referred to as Cluster 1 (C1) from now on; the green cluster as Cluster 2 (C2); and the yellow cluster as Cluster 3 (C3).

Analyses proceeded by observing participants distribution across the three Clusters, and then by conducting a series of one-way ANOVAs to verify how each Cluster performed in every task administered at T0. Statistical comparison between clusters also served to provide internal validity to the tripartition of our initial sample.

3.5.2.1. Participants distribution into clusters and performance for each task

Cluster analysis grouped our participants as follows:

- Cluster 1: 11 participants (10 MONO, 1 BI)
- Cluster 2: 45 participants (31 MONO, 14 BI)
- Cluster 3: 18 participants (3 MONO, 15 BI)

Next, we wanted to explore the main effect of Cluster on each task administered at T0. Assumptions of normality and homoscedasticity for distribution were verified via Shapiro-Wilk (*shapiro.test* function on R) test for normality and Levene's test (*leveneTest* function on R) for homoscedasticity. When these assumptions were not met ($p\text{-value} < .05$), Kruskal-Wallis test (*kruskal.test* function on R) was used to compare raw score means between clusters; otherwise, ANOVAs were employed (*aov* function on R; R Core Team, 2023). Results and descriptive statistics (mean, sd) are reported in Table 7. F values refer to results from ANOVAs (Nonverbal Intelligence, Narrative Abilities, Receptive Vocabulary, Morphological Awareness), while χ^2 values to results from Kruskal-Wallis test (Nonword Repetition, Letter Knowledge, Phoneme Blending, Rhyme Detection, Listening Comprehension, Productive Vocabulary, Rapid Automatized Naming). Significant between-cluster differences emerged for all abilities assessed at T0.

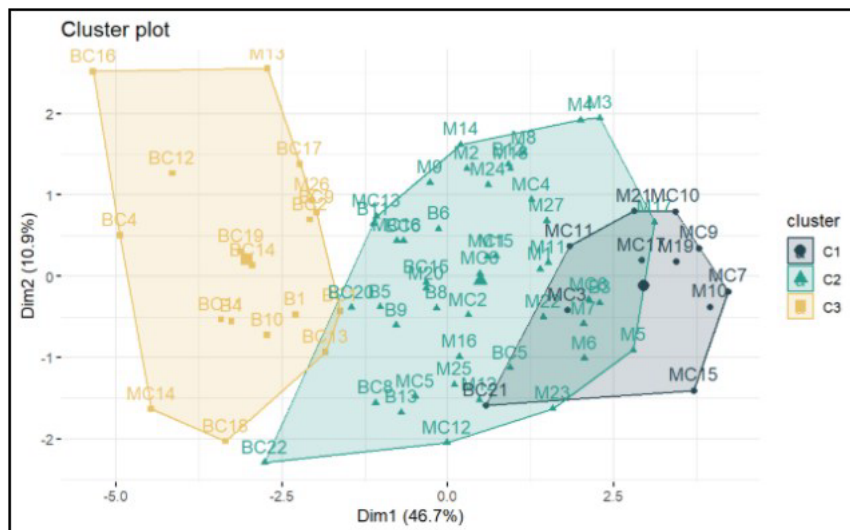


Figure 4. Participants distribution across Clusters.

Measure	C1		C2		C3		$F(2, 71)/\chi^2$	η^2/ϵ^2
	Mean acc.	SD	Mean acc.	SD	Mean acc.	SD		
NVI (36)	25.36	4.36	20.53	5.32	15.05	5.61	$F = 13.85^{***}$	$\eta^2 = .28$
NWR (40)	28.82	5.15	22.60	5.22	19.61	6.03	$\chi^2 = 14.68^{***}$	$\epsilon^2 = .18$

LK (21)	20.00	1.09	13.09	5.78	4.44	3.03	$\chi^2 = 38.65^{***}$	$\varepsilon^2 = .52$
PB (12)	9.36	2.91	1.15	1.82	0.61	1.33	$\chi^2 = 33.06^{***}$	$\varepsilon^2 = .44$
RD (10)	8.36	1.75	5.84	2.52	3.28	1.74	$\chi^2 = 26.95^{***}$	$\varepsilon^2 = .35$
LC (10)	6.73	2.45	6.22	2.10	4.00	2.93	$\chi^2 = 9.04^*$	$\varepsilon^2 = .10$
NA	20.54	4.86	19.38	3.32	12.78	5.16	$F = 19.54^{***}$	$\eta^2 = .35$
RV (175)	96.10	12.22	78.93	17.41	46.22	12.00	$F = 41.77^{***}$	$\eta^2 = .54$
PV (45)	33.36	4.48	31.93	4.53	22.72	6.04	$\chi^2 = 27.49^{***}$	$\varepsilon^2 = .36$
RAN	55.45	7.47	64.98	14.00	91.67	23.81	$\chi^2 = 28.26^{***}$	$\varepsilon^2 = .37$
MA (30)	17.77	4.05	13.93	4.99	6.72	4.25	$F = 22.42^{***}$	$\eta^2 = .39$

Table 7. Descriptive statistics (mean accuracy and standard deviations) and results from ANOVAs and Kruskal-Wallis performed on raw scores of single tasks administered at T0 with Cluster as main effect. When appropriate, maximum possible score for each task is reported within parentheses in the first column.

Since a significant main effect of Cluster on performance was found for all measures, Tukey HDS (for normally distributed values) and Pairwise Wilcoxon (for Kruskal-Wallis outputs) tests were conducted for post-hoc analyses on single tasks, to verify significant differences among Clusters. Results are summarized in Figure 5-7 and Table 8.

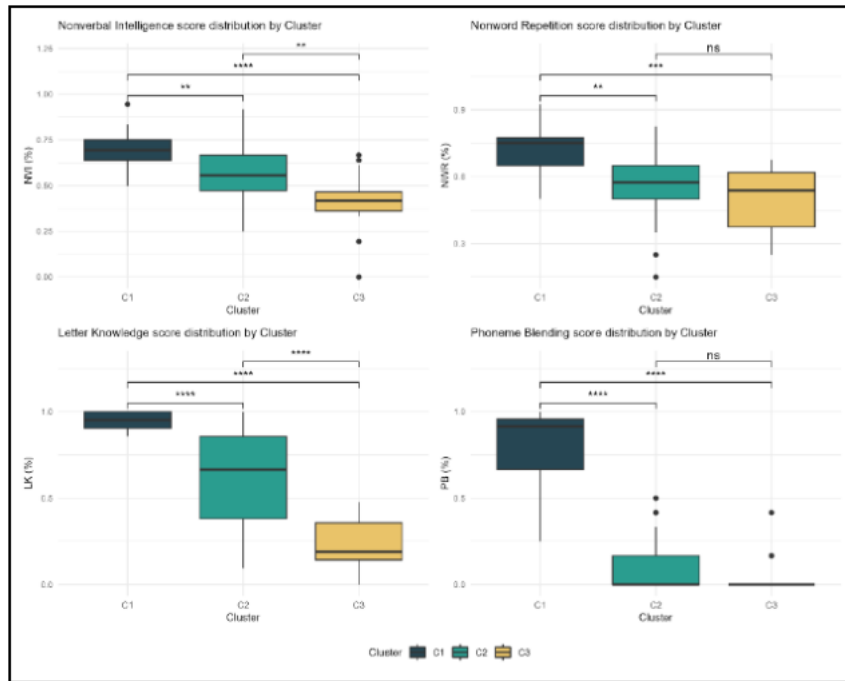


Figure 5. Between-cluster contrasts for Nonverbal Intelligence, Nonword Repetition, Letter Knowledge and Phoneme Blending.

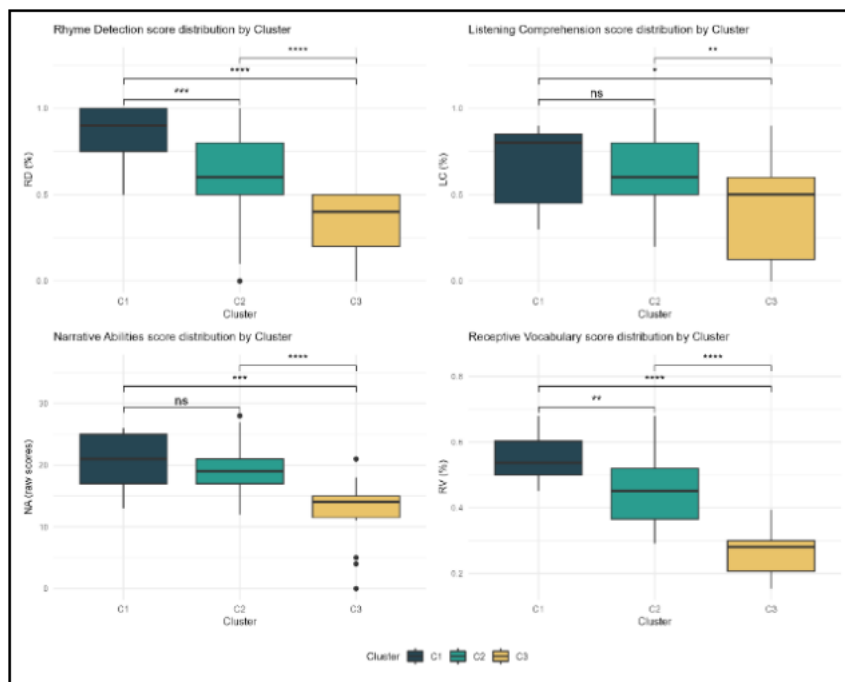


Figure 6. Between-cluster contrasts for Rhyme Detection, Listening Comprehension, Narrative Abilities and Receptive Vocabulary.

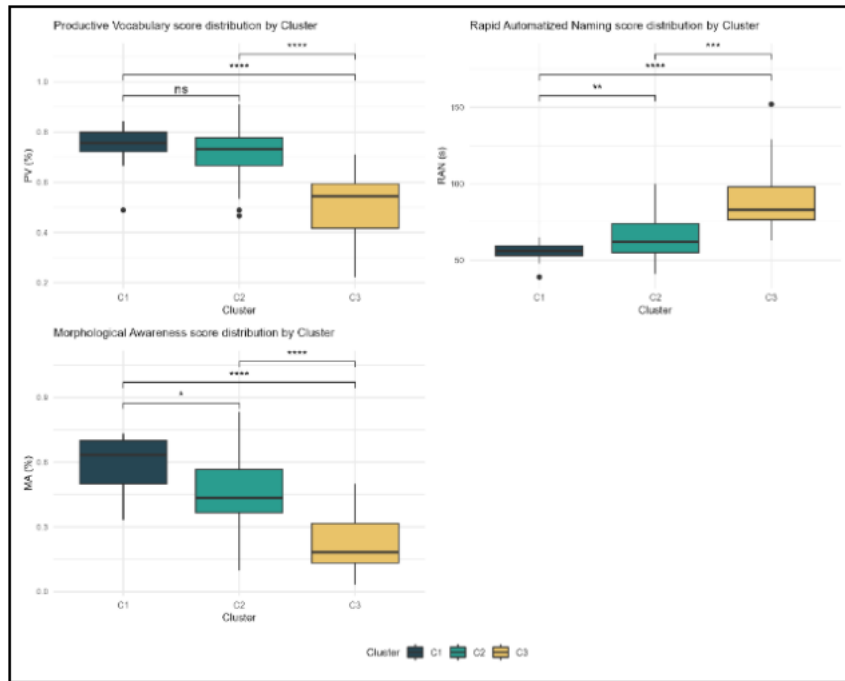


Figure 7. Between-cluster contrasts for Productive Vocabulary, Rapid Automatized Naming and Morphological Awareness.

	(I) cluster	(J) cluster	Mean difference (I-J)	p
NVI	C1	C2	4.83	<.05*
		C3	10.31	<.001***
	C2	C3	5.48	<.01**
NWR	C1	C2	3.02	<.01**
		C3	3.80	<.001***
	C2	C3	1.57	>.05
LK	C1	C2	3.38	<.01**
		C3	6.08	<.001***
	C2	C3	4.26	<.001***
PB	C1	C2	5.28	<.001***
		C3	5.34	<.001***
	C2	C3	0.96	>.05

RD	C1	C2	2.77	<.01**
		C3	5.06	<.001***
	C2	C3	3.61	<.001***
LC	C1	C2	0.80	>.05
		C3	2.62	<.05*
	C2	C3	2.62	<.05*
NA	C1	C2	1.17	>.05
		C3	7.77	<.001***
	C2	C3	6.60	<.001***
RV	C1	C2	17.16	<.01**
		C3	49.87	<.001***
	C2	C3	32.71	<.001***
PV	C1	C2	1.07	>.05
		C3	4.39	<.001***
	C2	C3	4.73	<.001***
RAN	C1	C2	-1.93	<.05*
		C3	-4.87	<.001***
	C2	C3	-4.35	<.001***
MA	C1	C2	3.79	<.05*
		C3	11.00	<.001***
	C2	C3	7.21	<.001***

Table 8. Post-hoc comparison between Clusters for single tasks administered at T0.

Significant differences were consistently found between Cluster 1 and 3, across all measures. Cluster 1 and 2 did not differ significantly in Listening Comprehension, Narrative Abilities, and Productive Vocabulary ($p > .05$); Cluster 2 and 3 obtained comparable performance in Nonword Repetition and Phoneme Blending ($p > .05$). The considerable number of significant differences

between the groups obtained provided internal validity to the division of the sample into three Clusters.

By observing cluster distribution in plots contained in Figure 5-7, we could identify a clear pattern of performance for all Clusters: in fact, Cluster 1 always displayed the highest scores, consistently followed by Cluster 2, and then by Cluster 3, despite not all contrasts resulted significant. As a consequence, and for practical reasons, Cluster 1 will be henceforth renamed as HC (high-performing Cluster), Cluster 2 as IC (intermediate-performing Cluster) and Cluster 3 as LC (low-performing Cluster).

As partially anticipated by the significant correlations found among the reading predictors assessed at T0, the strong link among these skills was also confirmed by the patterns emerged from the cluster analysis. In fact, all these tasks represent different approaches to measuring underlying language abilities, and the fact that our participants displayed consistently high, intermediate, or low scores across all tasks is not surprising. Presumably, this is also the reason why determining the unique contribution of these skills to reading is not always feasible and sometimes leads to inconsistent results (see Section 2.2.)

An interesting result instead emerged from the observation of participants' distribution across Clusters. Whereas most of the monolingual children fell into the Intermediate Cluster (31 out of 44), with a substantial percentage also in the High Cluster (10), and very few in the Low Cluster (3), the situation appeared reversed for the bilingual group, which was equally split between the IC and the LC. As already observed from the t-test results (see Table 5), bilingual preschoolers therefore appear to underperform their monolingual peers in pre-reading skills.

One final preliminary point concerns between-cluster performance on each task. Figure 4 clearly shows that the LC is more markedly separated from the remaining clusters, and this is statistically confirmed by ANOVA results, which reported comparable outcomes between this Cluster and the IC only for Nonword Repetition and Phoneme Blending. If preschool performance can predict initial literacy, then we would expect LC children to display more evident differences (and poorer scores) in reading outcomes compared to the HC and IC, which, in turn, may share more similarities.

3.5.3. Relation between preschool predictors and emerging reading skills

Linear regression models were used to determine the predictive power of Clusters, based on preschool performance, on lexical and sublexical reading skills, both in terms of decoding (speed and accuracy) and comprehension. Effect of type of reading stimulus on reading performance was also explored. Therefore, Cluster (HC, IC, LC) and Item (Words, Nonwords, Text) were used as independent categorical variables, while reading speed and accuracy served as dependent numerical variables, with higher scores indicating poorer performance (slower times or more mistakes). The same model was adopted for reading comprehension, with Clusters as independent variables and reading comprehension accuracy as dependent variable (higher scores associated to higher accuracy). Separate analyses were run for results obtained from the *ReadLet* and the *DDE-2* protocols, and for 1st and 2nd Grade results. The *lm* function from the stats R package (R Core Team, 2023) was used to run the analysis; significant interactions were further explored via the *emmeans* function (emmeans package, R Core Team, 2023).

3.5.3.1. First Grade (T1)

3.5.3.1.1. Reading accuracy

Table 9 displays means and standard deviations for reading errors from the *ReadLet* protocol for each Cluster and Item.

CLUSTER	ITEM	MEAN errors	SD
HC	W ₍₃₀₎	1.09	1.37
	N ₍₃₀₎	3.54	3.47
	T ₍₁₄₅₎	3.27	3.26
IC	W ₍₃₀₎	3.61	3.92
	N ₍₃₀₎	8.09	4.18
	T ₍₁₄₅₎	6.45	5.73
LC	W ₍₃₀₎	5.47	4.47
	N ₍₃₀₎	8.35	6.26

Table 9. Means and standard deviations for raw scores of reading errors (Word, Nonword, Text) for High, Intermediate, and Low-performing Clusters (1st Grade, ReadLet). Numbers between parentheses indicate total stimuli for each Item.

Error means were obtained by dividing each participant's number of reading mistakes by the total number of stimuli for each kind. The overall model for *ReadLet* results was significant ($R^2 = 0.36$, $F(8, 18) = 16.02$, $p < .001$). Linear regression results are visualized in Figure 8.

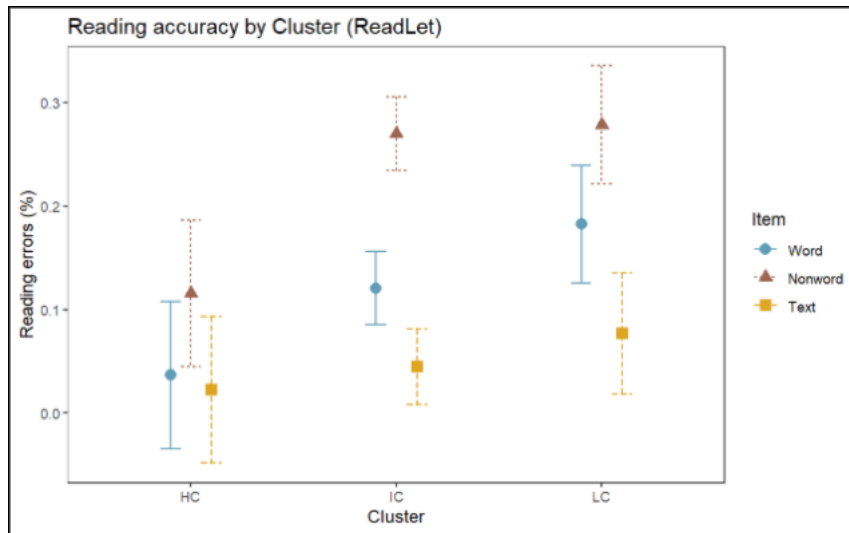


Figure 8. Model output representing the effect of the interaction between Cluster (HC, IC, LC) and reading Item (Word, Nonword, Text) on reading accuracy measured through the ReadLet protocol in 1st Grade (T1).

First, we investigated within-cluster significant interactions between Cluster and Item, looking at significant differences in reading accuracy between Words and Nonwords on the one hand, and Words (read in isolation) and Texts on the other. Overall, Nonwords were read less accurately compared to Words across all Clusters, but this difference was significant only for IC, with Words in isolation read significantly more accurately than Nonwords in isolation ($\beta = 0.15$, $SE = 0.02$, $t = 5.84$, $p < .001$). The fact that only the Intermediate Cluster displayed a significant difference between Words and Nonwords may be indicative of a developmental trajectory of reading accuracy. HC, in fact, read both Words and Nonwords with comparably high accuracy, displaying a near-ceiling accuracy for both Items; for LC, instead, the situation was reversed, meaning that both Items were read with comparably lower accuracy (between 70 and 80%). This pattern may

suggest that, for HC children, both the lexical and the grapheme-phoneme conversion routes are well established and equally exploitable, depending on the context. LC children, instead, probably still rely more on the latter route, even for familiar words. IC, in turn, represents a middle ground between the other Clusters, showing a substantial real-word effect on reading accuracy. No difference was found between Words and Text in any Cluster, suggesting that comparable strategies were used both for words in isolation and in context.

We then explored between-cluster interactions, looking at significant differences in reading accuracy for Words, Nonwords and Text, comparing each Cluster to the others. No significant differences were found for Word reading accuracy between Clusters (HC-IC: $\beta = 0.08$, $SE = 0.04$, $t = -2.09$, $p = 1.00$; HC-LC: $\beta = -0.14$, $SE = 0.05$, $t = -3.16$, $p = 0.06$; IC-LC: $\beta = -0.06$, $SE = 0.03$, $t = -1.812$, $p = 1.00$). As for Nonwords, HC outperformed both IC and LC, while no difference was found between the latter Clusters (HC-IC: $\beta = -0.15$, $SE = 0.04$, $t = -3.84$, $p < .01$; HC-LC: $\beta = -0.16$, $SE = 0.05$, $t = -3.54$, $p < .05$; IC-LC: $\beta = -0.008$, $SE = 0.03$, $t = -0.25$, $p = 1.00$). Finally, no significant differences emerged for Text reading accuracy among Clusters (HC-IC: $\beta = -0.02$, $SE = 0.04$, $t = -0.54$, $p = 1.00$; HC-LC: $\beta = -0.05$, $SE = 0.05$, $t = -1.16$, $p = 1.00$; IC-LC: $\beta = -0.03$, $SE = 0.03$, $t = -0.92$, $p = 1.00$). The almost complete absence of significant differences in reading accuracy between Clusters was expected and matched the mean error results summarized in Table 9. As can be seen from the table and from the plot in Figure 8, the error percentage was rather low for all Clusters, ranging from near 0 to 0.3, meaning that even low-performing children reached an accuracy of at least 70% at the end of 1st Grade across all reading Items. Even though this proportion is lower than that typically observed for transparent orthographies (90%; Seymour et al., 2003), it is still not very distant from that obtained by HC children.

The same analysis was conducted on results obtained from the *DDE-2* protocol (Sartori et al., 2016; means and standard deviations are displayed in Table 10). In this case, the independent variable Item only included two levels (Word and Nonword), as the protocol did not include a textual component. The overall model was significant ($R^2 = 0.19$, $F(5, 136) = 6.23$, $p < .001$). The model output is displayed in Figure 9.

CLUSTER	ITEM	MEAN errors	SD
HC	W ₍₁₁₂₎	6.18	2.93
	N ₍₄₈₎	4.64	4.76

IC	W ₍₁₁₂₎	16.70	12.52
	N ₍₄₈₎	11.56	7.06
LC	W ₍₁₁₂₎	19.82	12.74
	N ₍₄₈₎	12.81	10.55

Table 10. Means and standard deviations for raw scores of reading errors (Word, Nonword) for High, Intermediate, and Low-performing Clusters (1st Grade, DDE-2). Numbers between parentheses indicate total stimuli for each Item.

Within-clusters interaction between Word and Nonword errors yielded significant results only for IC, where Words were read significantly more accurately than Nonwords ($\beta = 0.09$, $SE = 0.03$, $t = 3.16$, $p < .05$).

As for between-cluster interactions, no significant effect of Cluster was found on Word reading accuracy (HC-IC: $\beta = -0.09$, $SE = 0.04$, $t = -2.08$, $p = 0.59$; HC-LC: $\beta = -0.12$, $SE = 0.05$, $t = -2.28$, $p = 0.36$; IC-LC: $\beta = -0.02$, $SE = 0.04$, $t = -0.60$, $p = 1.00$). For Nonword accuracy, the same pattern obtained from the *ReadLet* results emerged again, with HC significantly outperforming IC and LC, but no difference between the latter (HC-IC: $\beta = -0.14$, $SE = 0.04$, $t = -3.16$, $p < .05$; HC-LC: $\beta = -0.17$, $SE = 0.05$, $t = -3.122$, $p < .05$; IC-LC: $\beta = -0.02$, $SE = 0.04$, $t = -0.66$, $p = 1.00$). Therefore, results from the *DDE-2* protocol entirely matched those from the *ReadLet* protocol.

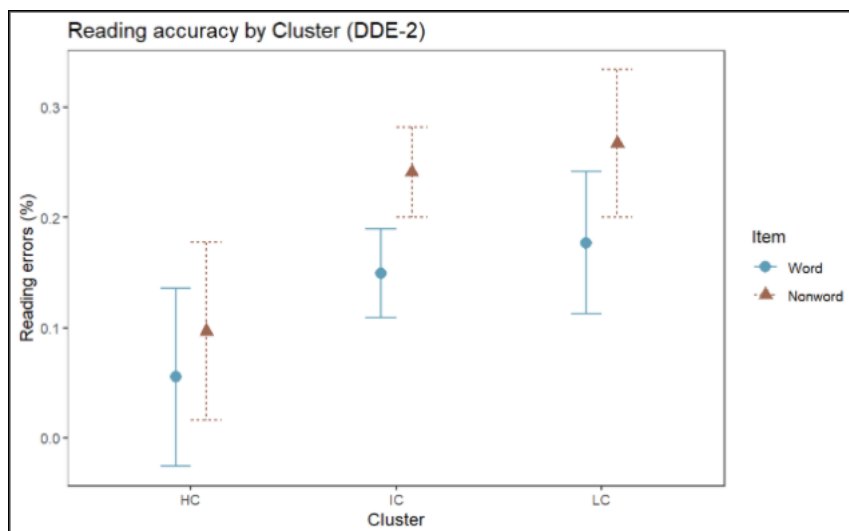


Figure 9. Model output representing the effect of the interaction between Cluster (HC, IC, LC) and reading Item (Word, Nonword) on reading accuracy measured through the DDE-2 protocol in 1st Grade (T1).

3.5.3.1.2. Reading speed

The same analysis conducted for reading accuracy was replicated for reading speed results: regressions were used to verify the predictive power of the interaction between Cluster and Item on reading speed.

The finger-tracking technology recorded individual reading times (in seconds) for each stimulus, both for those in isolation (Words and Nonwords) and for those in context (Text). Reading times equal to 0 or higher than 20 seconds were excluded from the analysis. Means and standard deviations for reading times (in seconds) for Clusters and Items collected on *ReadLet* are displayed in Table 11. The overall regression model was significant ($R^2 = 0.14$, $F(8, 13565) = 274.0$, $p < .001$). Results are displayed on Figure 10.

CLUSTER	ITEM	MEAN seconds	SD
HC	W	1.74	1.39
	N	2.32	1.70
	T	0.82	0.90
IC	W	2.60	2.13
	N	2.87	2.24
	T	1.27	1.44
LC	W	2.87	2.51
	N	2.92	2.34
	T	1.58	1.86

Table 11. Means and standard deviations for reading times in seconds (Word, Nonword, Text) for High, Intermediate, and Low-performing Clusters (1st Grade, ReadLet).

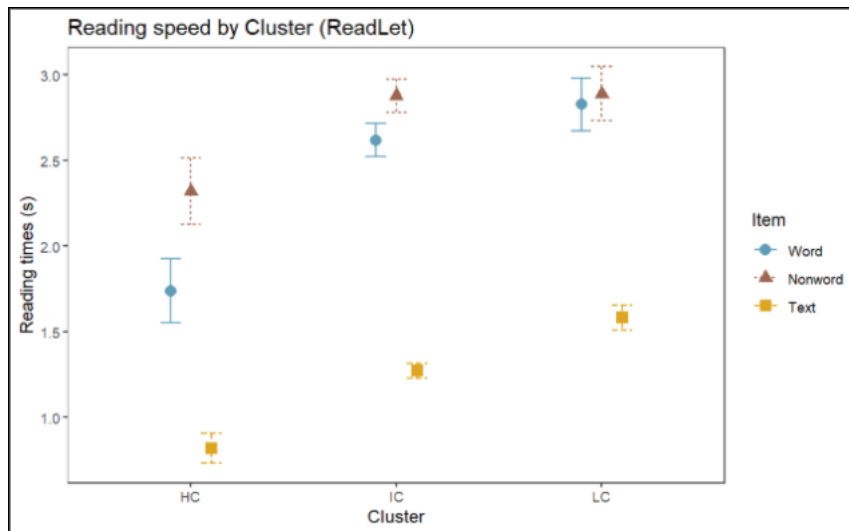


Figure 10. Model output representing the effect of the interaction between Cluster (HC, IC, LC) and reading Item (Word, Nonword, Text) on reading speed measured through the ReadLet protocol in 1st Grade (T1).

Effect of Item within-cluster was further explored. In HC and IC Words were read significantly faster than Nonwords, while this was not the case for LC, for which comparable performance emerged for the two kinds of Item (HC: $\beta = 0.58$, SE = 0.14, $t = 4.22$, $p < .001$; IC: $\beta = 0.26$, SE = 0.07, $t = 3.86$, $p < 0.01$; LC: $\beta = 0.05$, SE = 0.11, $t = 0.45$, $p = 1.00$). These results are in line with the speed-accuracy trade-off typically observed in transparent orthographies (Serrano and Defior, 2008). Observing the speed and accuracy results described so far for Words and Nonwords, we can see that (i) HC accuracy was at ceiling for both Items, but Nonwords were still read slower than Words; to reach comparable levels of accuracy, the former required longer reading times than the latter, whose identification was probably sped up by lexicality effect. (ii) IC is confirmed as middle ground between the remaining Clusters, as Nonwords were read both slower and less accurately than Words, suggesting that this Cluster's reading development trajectory proceeds at a different pace compared to HC's. (iii) LC read Words and Nonwords both slower and less accurately, displaying a still immature reading strategy for Items in isolation. Conversely, a facilitatory effect of Text over Words (in isolation) on reading times was consistently found across all Clusters (HC: $\beta = -0.92$, SE = 0.11, $t = -8.67$, $p < .001$; IC: $\beta = -1.33$, SE = 0.05, $t = -24.87$, $p < .001$; LC: $\beta = -1.29$, SE = 0.09, $t = -14.93$, $p < .001$).

As for the effect of Cluster across Item on reading speed, HC displayed consistent faster times in Word reading compared to IC and LC, while no difference was found between these two Clusters (HC-IC: $\beta = -0.86$, SE = 0.11, $t = -8.00$, $p < .001$; HC-LC: $\beta = -1.13$, SE = 0.12, $t = -9.09$, $p < .001$; IC-LC: $\beta = -0.26$, SE = 0.09, $t = -2.87$, $p = .14$). The same was true for Nonwords (HC-IC: $\beta =$

-0.55, SE = 0.11, $t = -5.00$, $p < .001$; HC-LC: $\beta = -0.60$, SE = 0.13, $t = -4.73$, $p < .001$; IC-LC: $\beta = -0.05$, SE = 0.09, $t = -0.54$, $p = 1.00$). As for Text, significant differences emerged for each contrast (HC-IC: $\beta = -0.45$, SE = 0.05, $t = -9.15$, $p < .001$; HC-LC: $\beta = -0.75$, SE = 0.06, $t = -13.08$, $p < .001$; IC-LC: $\beta = -0.30$, SE = 0.04, $t = -6.98$, $p < .001$). These results further confirm the speed-accuracy trade-off. As for Words, the three Clusters obtained similar accuracy levels, but IC and LC needed significantly longer reading times to reach it. Comparable accuracy outcomes were observed for Nonwords as well, but here HC was both faster and more accurate, while IC and LC were identical on both components. Interestingly, Text appeared to be the reading Item for which the trade-off was more evident across all Clusters: the three reached comparable accuracy, but with significantly different times, which of course were longer for LC.

The same analysis was performed on *DDE-2* results (means and standard deviations are reported in Table 12). Mean reading times (in seconds) for each item were considered for the analysis. Model output is displayed in Figure 11.

CLUSTER	ITEM	MEAN seconds	SD
HC	W	2.35	1.23
	N	3.00	1.37
IC	W	3.68	1.92
	N	3.94	1.69
LC	W	5.88	4.88
	N	4.79	3.06

Table 12. Means and standard deviations for reading times in seconds (Word, Nonword) for High, Intermediate, and Low-performing Clusters (1st Grade, *DDE-2*).

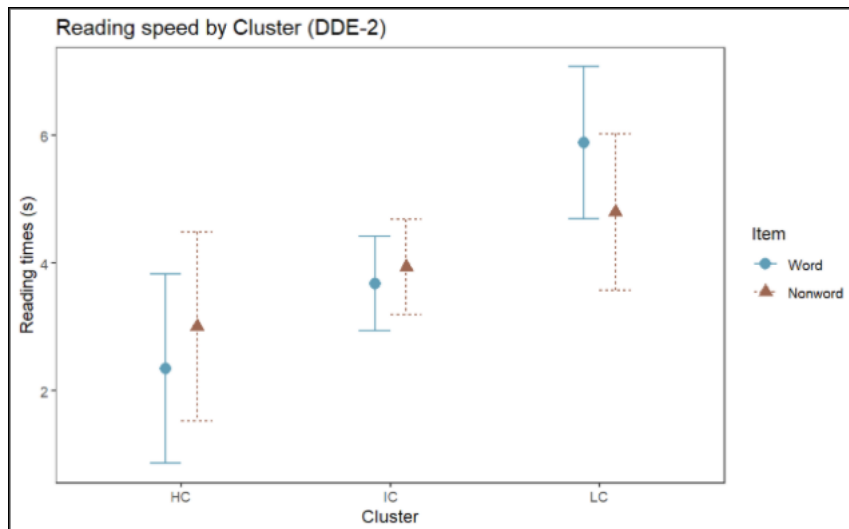


Figure 11. Model output representing the effect of the interaction between Cluster (HC, IC, LC) and reading Item (Word, Nonword) on reading speed measured through the DDE-2 protocol in 1st Grade (T1).

The overall model was significant ($R^2 = 0.12$, $F(5, 136) = 3.77$, $p < .01$). Effect of Item within-cluster was not found to be significant for any Cluster, with Words and Nonwords consistently read at comparable speed (HC: $\beta = 0.65$, $SE = 1.06$, $t = 0.62$, $p = 1.00$; IC: $\beta = 0.26$, $SE = 0.53$, $t = 0.48$, $p = 1.00$; LC: $\beta = -1.09$, $SE = 0.86$, $t = -1.26$, $p = 1.00$). Effect of Cluster was evident for Words, with LC performing significantly slower than HC and IC, but with no difference between these two Clusters (HC-IC: $\beta = -1.33$, $SE = 0.83$, $t = -1.59$, $p = 1.00$; HC-LC: $\beta = -3.53$, $SE = 0.95$, $t = -3.68$, $p < .01$; IC-LC: $\beta = -2.20$, $SE = 0.70$, $t = -3.11$, $p < .05$). Interestingly, while identical patterns emerged between the *ReadLet* and the *DDE-2* protocols for reading errors, this was not the case for reading times, for which *ReadLet* yielded more significant contrasts both between- and within-clusters. This outcome may be indicative of the more fine-grained nature of the reading speed data that can be easily obtained from finger-tracking technology, but can hardly be matched by traditional paper-and-pencil tests.

3.5.3.1.3. Reading comprehension

Reading comprehension data were collected exclusively through the *ReadLet* protocol, where participants had to answer three comprehension questions following each of the two short narrative texts proposed. Children were therefore exposed to six questions in total, each of them including three possible answers (see Paragraph 3.4.2.1). Comprehension accuracy was measured in terms of percentage of correct answers; means and standard deviations for

accuracy percentage are reported in Table 13. The same analysis conducted on speed and accuracy data was replicated also for this measure. The model output is displayed in Figure 12.

CLUSTER	MEAN accuracy	SD
HC	0.88	0.19
IC	0.86	0.19
LC	0.71	0.25

Table 13. Means and standard deviations for percentage of correct answers for High, Intermediate, and Low-performing Clusters (1st Grade, ReadLet).

The overall model was significant ($R^2 = 0.09$, $F(2, 423) = 22.1$, $p < .001$). Post-hoc analyses revealed no significant difference between the performance of HC and IC ($\beta = 0.01$, $SE = 0.03$, $t = 0.53$, $p = 1.00$), while the opposite was true between HC and LC and IC and LC (HC-LC: $\beta = 0.17$, $SE = 0.03$, $t = 5.17$, $p < .001$; IC-LC: $\beta = 0.15$, $SE = 0.02$, $t = 6.32$, $p < .001$). LC's comprehension accuracy was therefore significantly lower than that of the remaining Clusters, which in turn did not differ.

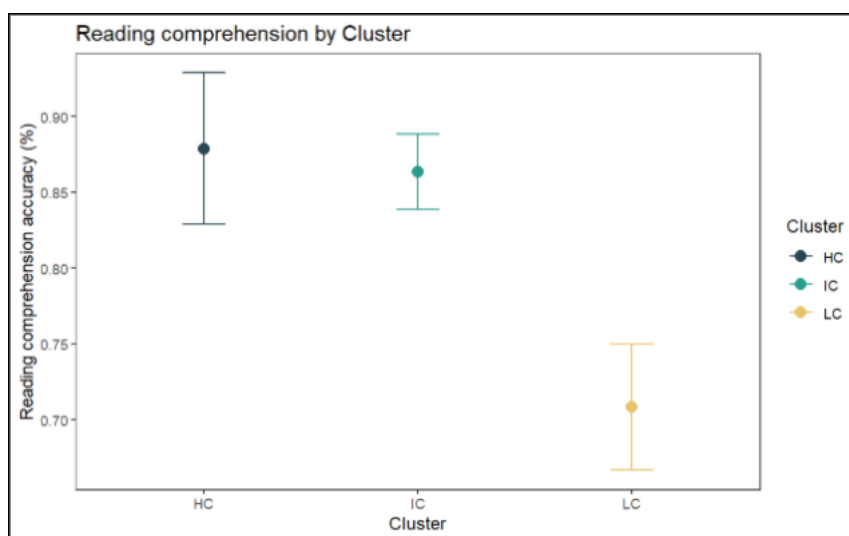


Figure 12. Model output representing the effect of Cluster (HC, IC, LC) on reading comprehension accuracy measured via through the ReadLet protocol in 1st Grade (T1).

3.5.3.1.4. Summary

A cluster analysis performed on the whole sample and including scores from all measures tested at T0 yielded a division into three Clusters, i.e. participant groups based on score similarity. Clusters were characterized by the following features:

- HC: 10 MONO and 1 BI participants with high scores for Nonverbal Intelligence, Nonword Repetition, Letter Knowledge, Phoneme Blending, Rhyme Detection, Listening Comprehension, Narrative Abilities, Receptive Vocabulary, Productive Vocabulary, Rapid Automatized Naming, Morphological Awareness
- IC: 31 MONO and 14 BI participants with high scores for Listening Comprehension, Narrative Abilities, Productive Vocabulary; intermediate scores for Nonverbal Intelligence, Letter Knowledge, Rhyme Detection, Receptive Vocabulary, Rapid Automatized Naming, Morphological Awareness; low scores for Nonword Repetition and Phoneme Blending
- LC: 3 MONO and 15 BI participants, with low scores for all measures.

Monolingual participants were therefore mostly included in the intermediate-performing Cluster, with only a few achieving a high performance, while bilingual participants were equally divided between intermediate- and low-achieving Clusters, with only one exception in HC. This division was statistically supported also by the t-test conducted considering the two linguistic subsamples, with bilingual participants consistently underperforming their monolingual peers, with the exception of Nonverbal Intelligence, where the two groups reached a similar performance.

The pattern observed for Clusters performance on preschool measures was replicated by the results of the regressions run on reading data from 1st Grade, as measured by both *DDE-2* and *Readlet*. As in preschool analyses, HC consistently displayed the best performance, with the lowest scores in reading errors and times, and the highest in comprehension; this group was always followed by IC, with intermediate reading performance, and then by LC, with the slowest and least accurate results. More specifically, HC was significantly faster at reading Words if compared to IC and LC, and this advantage also extended to accuracy when looking at Nonwords. As for Text, all Clusters reached comparable accuracy, but HC displayed lower reading times compared to IC and LC, and IC was in turn faster than LC. HC and IC also displayed

comparable and almost at ceiling reading comprehension performance, while this was not the case for LC.

As for within-cluster contrasts, HC did not show differences in accuracy of Words, Nonwords and Text reading, while Words were read faster than Nonwords but still slower than Text. IC was the only one at displaying different accuracy between Words and Nonwords, and this difference emerged also in reading speed, where Text had the shorter times, followed by Words and then Nonwords. In LC, comparably poor performance emerged for Word, Nonword and Text accuracy, while Text was read faster than Words, which in turn did not differ from Nonwords.

3.5.3.2. Second Grade (T2)

The same analyses for reading speed, accuracy and comprehension were repeated on 2nd Grade results, both for the *ReadLet* and the *DDE-2* protocols.

3.5.3.2.1. Reading accuracy

Means and standard deviations for reading errors considering Cluster and Item are reported in Table 14. The overall model for ReadLet results was significant ($R^2 = 0.42$, $F(8, 213) = 20.05$, $p < .001$). Linear regression results are visualized in Figure 13. Post-hoc analyses revealed a significant effect of Item for IC and LC, as in both Clusters Words were read significantly more accurately than Nonwords (IC: $\beta = 0.17$, $SE = 0.02$, $t = 8.13$, $p < .001$; LC: $\beta = 0.14$, $SE = 0.03$, $t = 4.16$, $p < .01$), while this was not the case for HC ($\beta = 0.12$, $SE = 0.04$, $t = 2.98$, $p = .11$). Reading accuracy for Words in isolation and Texts was comparable across all Clusters. HC and IC results did not differ from those observed in 1st Grade. In both grades, HC displayed comparable accuracy for Words and Nonwords. IC, instead, read Words significantly more accurately than Nonwords in both grades, possibly due to a lexicality effect supporting decoding. The only difference between the two grades was observed for LC: in 1st Grade this Cluster read Words and Nonwords with a comparably poorer accuracy, while in 2nd Grade the performance in the two Items differed, resulting in a significantly greater reading accuracy for Words compared to Nonwords. This result can be tentatively interpreted as evidence for the evolution of the reading strategies adopted by this Cluster: possibly due to a growth in their oral and written lexicon, they become able to read real words more accurately, while grapheme-phoneme decoding still yields less accurate reading outcomes.

CLUSTER	ITEM	MEAN errors	SD
HC	W ₍₃₀₎	1.00	0.60
	N ₍₃₀₎	4.67	4.48
	T ₍₅₈₁₎	7.33	5.61
IC	W ₍₃₀₎	1.93	2.69
	N ₍₃₀₎	7.09	4.15
	T ₍₅₈₁₎	26.60	42.24
LC	W ₍₃₀₎	3.59	2.72
	N ₍₃₀₎	7.89	3.97
	T ₍₅₈₁₎	44.82	32.61

Table 14. Means and standard deviations for raw scores of reading errors (Word, Nonword, Text) for High, Intermediate, and Low-performing Clusters (2nd Grade, ReadLet). Numbers between parentheses indicate total stimuli for each Item.

Looking at between-cluster comparisons, although HC displayed the best performance across all Items, followed by IC and then LC (see mean raw errors in the table above), no significant effect of Cluster was found, meaning that between-cluster differences with respect to accuracy were not significant neither for Words, nor for Nonwords or Texts. This is in line with previous studies on transparent orthographies (Barca et al., 2006; Landerl and Thaler, 2006; Serrano and Defior, 2008; Tressoldi et al., 2001; Wimmer, 1996; Ziegler and Goswami, 2005; Zoccolotti et al., 1999) reporting issues for speed, rather than accuracy, in reading impaired children acquiring literacy in such orthographies. By the end of 2nd Grade, therefore, even children who obtained low scores in pre-reading tasks appear to reach levels of reading accuracy which are statistically comparable, albeit lower, to those of their better-performing peers.

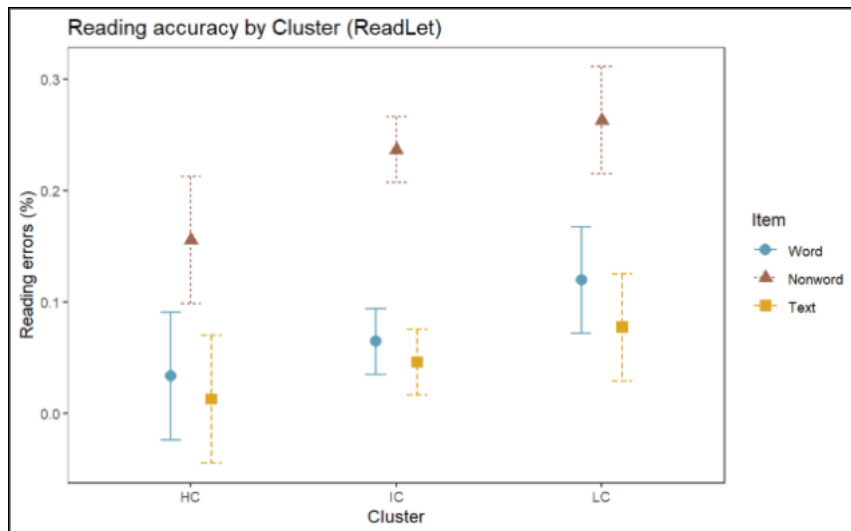


Figure 13. Model output representing the effect of the interaction between Cluster (HC, IC, LC) and reading Item (Word, Nonword, Text) on reading accuracy measured through the ReadLet protocol in 2nd Grade (T2).

Means and standard deviations for the *DDE-2* results are reported in Table 15. The overall model for *DDE-2* results was significant as well ($R^2 = 0.28$, $F(5, 142) = 11.35$, $p < .001$); results are displayed in Figure 14. As in *ReadLet* results, significant effect of Item within-cluster was found only for IC and LC, where Words were read significantly better than Nonwords (IC: $\beta = 0.09$, $SE = 0.02$, $t = 5.35$, $p < .001$; LC: $\beta = 0.08$, $SE = 0.03$, $t = 3.00$, $p < .05$), while no difference was found for HC ($\beta = 0.04$, $SE = 0.04$, $t = 1.22$, $p = 1.00$).

CLUSTER	ITEM	MEAN errors	SD
HC	W ₍₁₁₂₎	4.54	3.30
	N ₍₄₈₎	4.09	2.59
IC	W ₍₁₁₂₎	8.40	6.12
	N ₍₄₈₎	8.22	5.86
LC	W ₍₁₁₂₎	13.11	6.03
	N ₍₄₈₎	9.72	4.67

Table 15. Means and Standard Deviations for raw scores of reading errors (Word, Nonword) for High, Intermediate, and Low-performing Clusters (2nd Grade, DDE-2). Numbers between parentheses indicate total stimuli for each Item.

An effect of Cluster on reading accuracy was found for Nonwords, but limited between HC and IC and between HC and LC, while no difference between IC and LC emerged (HC-IC: $\beta = -0.08$, SE = 0.03, $t = -3.00$, $p < .05$; HC-LC: $\beta = -0.12$, SE = 0.03, $t = -3.59$, $p < .01$; IC-LC: $\beta = -0.03$, SE = 0.02, $t = -1.31$, $p = 1.00$). This means that, in contrast with results from the *ReadLet* protocol, HC outperformed the remaining Clusters on Nonword reading accuracy. This result can be explained by the different content of the protocols administered. Indeed, the same lists of Words and Nonwords were included in the *ReadLet* protocol both in 1st and 2nd Grade; these, however, might be too simple for second graders, hence the null significance. The *DDE-2* protocol, instead, has been designed specifically to be administered from 2nd Grade onwards, and the level of complexity of its Nonword stimuli may be more suitable for more expert readers, therefore highlighting more between-cluster differences. Conversely, no effect of Word was found for the *DDE-2* protocol either, as all Clusters performed comparably on this Item, suggesting that lexical reading was equally exploited in 2nd Grade irrespective of preschool performance.

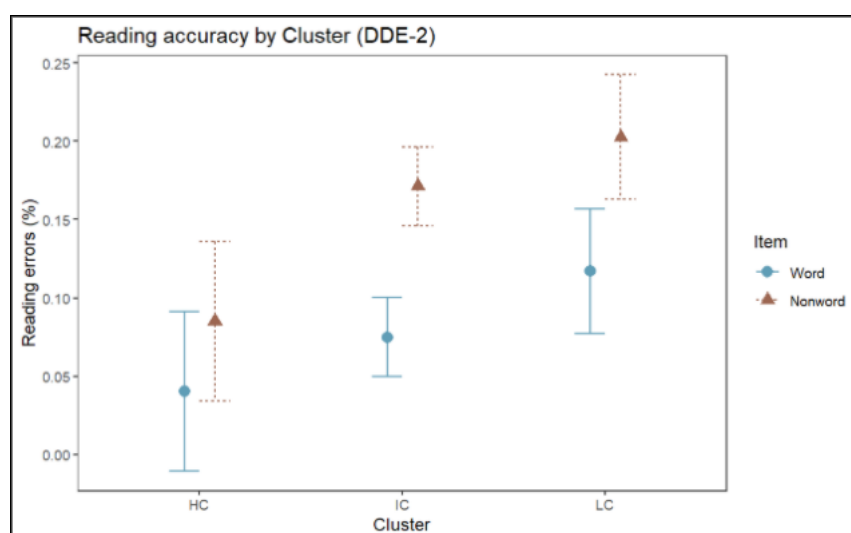


Figure 14. Model output representing the effect of the interaction between Cluster (HC, IC, LC) and reading Item (Word, Nonword) on reading accuracy measured through the DDE-2 protocol in 2nd Grade (T2).

3.5.3.2.2. Reading speed

Means and standard deviations for reading times (in seconds) for Clusters and Items from the *ReadLet* protocol are reported in Table 16. The overall model for *ReadLet* results was significant ($R^2 = 0.09$, $F(8, 44219) = 559.1$, $p < .001$); model output is displayed in Figure 15. Within-cluster comparisons revealed a significant facilitatory effect of Words over Nonwords for all Clusters in reading speed (HC: $\beta = 0.61$, $SE = 0.07$, $t = 8.50$, $p < .001$; IC: $\beta = 0.64$, $SE = 0.03$, $t = 18.57$, $p < .001$; LC: $\beta = 0.47$, $SE = 0.05$, $t = 8.84$, $p < .001$). The same effect was found for Text over Words in isolation (HC: $\beta = -0.28$, $SE = 0.05$, $t = -5.44$, $p < .001$; IC: $\beta = -0.51$, $SE = 0.02$, $t = -20.34$, $p < .001$; LC: $\beta = -0.50$, $SE = 0.04$, $t = -12.98$, $p < .001$). Summing up, reading times were significantly lower for Words compared to Nonwords, and for Texts compared to Words, across all Clusters. Compared to results from T1, the only difference was observed for LC. When assessed at the end of 1st Grade, children belonging to this Cluster had comparable reading times for Words and Nonwords, suggesting that both Items were approached using the same reading strategy, namely grapheme-phoneme conversion. As already observed for accuracy, however, in 2nd Grade reading times for Words and Nonwords appear to differ significantly, possibly indicating a shift toward lexical reading for Words even for the low-performing Cluster.

CLUSTER	ITEM	MEAN seconds	SD
HC	W	0.73	0.55
	N	1.35	0.97
	T	0.45	0.43
IC	W	1.23	1.17
	N	1.87	1.48
	T	0.72	0.80
LC	W	1.32	1.11
	N	1.79	1.59
	T	0.82	0.89

Table 16. Means and Standard Deviations for reading times in seconds (Word, Nonword, Text) for High, Intermediate, and Low-performing Clusters (2nd Grade, *ReadLet*).



Figure 15. Model output representing the effect of the interaction between Cluster (HC, IC, LC) and reading Item (Word, Nonword, Text) on reading speed measured through the ReadLet protocol in 2nd Grade (T2).

An effect of Cluster on Word reading speed emerged only between HC and IC and between the former and LC, but not between IC and LC (HC-IC: $\beta = -0.50$, $SE = 0.06$, $t = -8.89$, $p < .001$; HC-LC: $\beta = -0.59$, $SE = 0.06$, $t = -9.32$, $p < .001$; IC-LC: $\beta = -0.09$, $SE = 0.04$, $t = -1.98$, $p = 1.00$). HC was significantly faster than the remaining Clusters at Word reading. The same picture emerged for Nonwords, with HC outperforming both IC and LC, but with no difference between these two Clusters (HC-IC: $\beta = -0.52$, $SE = 0.06$, $t = -9.21$, $p < .001$; HC-LC: $\beta = -0.45$, $SE = 0.06$, $t = -7.01$, $p < .001$; IC-LC: $\beta = 0.08$, $SE = 0.04$, $t = 1.73$, $p = 1.00$). As for Text, HC reading times were significantly faster than those of the other Clusters, while IC was in turn faster than LC (HC-IC: $\beta = -0.27$, $SE = 0.01$, $t = -22.66$, $p < .001$; HC-LC: $\beta = -0.37$, $SE = 0.01$, $t = -26.74$, $p < .001$; IC-LC: $\beta = -0.09$, $SE = 0.01$, $t = -9.28$, $p < .001$). Results for T2 between-cluster differences with respect to reading times did not differ from those observed at T1. Despite a general improvement in this component, as can be seen in Table 16, HC consistently maintained the lowest reading times across all Items, while IC and LC differed from each other on Text reading only. Reading speed therefore appears to be the most affected by pre-reading skills, as the gap observed in this component between high-, intermediate-, and low-performing children has not yet closed after two years of reading instruction.

Means and standard deviations for reading times (in seconds) from the *DDE-2* are reported in Table 17. Analyses on *DDE-2* results yielded a significant model as well ($R^2 = 0.20$, $F(5, 142) = 7.03$, $p < .001$; see Figure 16). Post-hoc analyses revealed a significant effect of Item only for IC, with Words read significantly faster than Nonwords ($\beta = 0.76$, $SE = 0.18$, $t = 4.14$, $p < .001$), while

no such effect was found for the remaining Clusters. Also, no effect of Cluster on reading times was found, neither for Words nor for Nonwords; all Clusters performed comparably. These results were again indicative of the more detailed nature of the data obtained through the finger-tracking application.

CLUSTER	ITEM	MEAN seconds	SD
HC	W	1.09	0.40
	N	1.84	0.63
IC	W	1.73	0.74
	N	2.49	0.89
LC	W	2.00	1.10
	N	2.44	1.16

Table 17. Means and Standard Deviations for reading times in seconds (Word, Nonword) for High, Intermediate, and Low-performing Clusters (2nd Grade, DDE-2).

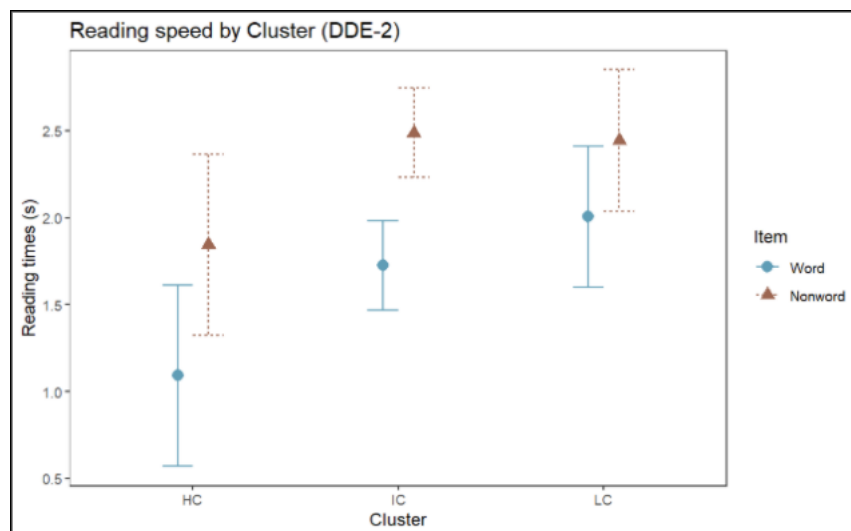


Figure 16. Model output representing the effect of the interaction between Cluster (HC, IC, LC) and reading Item (Word, Nonword) on reading speed measured through the DDE-2 protocol in 2nd Grade (T2).

3.5.3.2.3. Reading comprehension

As in 1st Grade, reading comprehension data were collected exclusively through the *ReadLet* protocol. Means and standard deviations for proportion of correct comprehension answers are reported in Table 18. The overall model exploring the effect of Cluster on reading comprehension accuracy was significant ($R^2 = 0.10$, $F(2, 589) = 33.87$, $p < .001$; see Figure 17). Post-hoc analyses showed that HC outperformed both IC and LC, and that IC in turn was significantly more accurate than LC (HC-IC: $\beta = 0.10$, $SE = 0.02$, $t = 4.73$, $p < .001$; HC-LC: $\beta = 0.19$, $SE = 0.02$, $t = 8.11$, $p < .001$; IC-LC: $\beta = 0.10$, $SE = 0.18$, $t = 5.42$, $p < .001$). At T1, HC and IC results for this component were comparable; the difference reported at T2 between all confronts may be indicative of the greater complexity of the texts and the questions proposed. Reading comprehension, therefore, also appear to be more dependent on preschool performance on reading predictors.

CLUSTER	MEAN accuracy	SD
HC	0.97	0.07
IC	0.87	0.17
LC	0.78	0.25

Table 18. Means and Standard Deviations for percentage of correct answers for High, Intermediate, and Low-performing Clusters (2nd Grade, *ReadLet*).

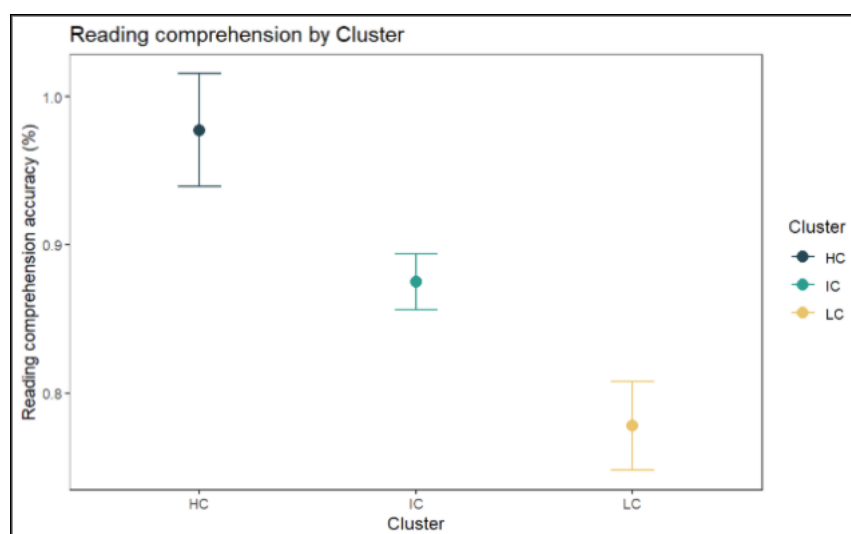


Figure 17. Model output representing the effect of Cluster (HC, IC, LC) on reading comprehension accuracy measured via the ReadLet protocol in 2nd Grade (T2).

3.5.3.2.4. Summary

The pattern observed for preschool and 1st Grade reading results was obtained also for 2nd Grade reading results. As emerged in previous analyses, HC consistently displayed the most accurate and fastest reading performance, followed by IC and then by LC. More specifically, HC reached the fastest reading times across all Items tested through *ReadLet* (Words, Nonwords, Text), while no difference was found between IC and LC. Text was the only Item read at significantly different speed across all Clusters. Accuracy, instead, was comparable across all Clusters according to *ReadLet* results, while *DDE-2* results highlighted an effect of Nonwords, which were read more accurately by HC but comparably by IC and LC. Finally, reading comprehension performance differed significantly among Clusters, with HC displaying the highest results, followed by IC and then LC.

As for within-cluster contrasts, HC reached comparable levels of accuracy across Items, but Nonwords were read significantly slower than Words and Text, which in turn also differed. IC and LC instead yielded the same pattern: for both, Words were read more accurately than Nonwords, while no difference was found between Words and Text; as for speed, significant differences emerged both between Nonwords and Words and between Words and Text.

3.5.4. Bilingual participants' linguistic and SES context and their relation to preschool performance

In order to obtain a complete picture of the preschool performance on reading predictors of our bilingual sample, further analyses were conducted to verify the impact of their linguistic and socioeconomic context on their performance in preschool assessment. To do so, a hierarchical cluster analysis including relevant information derived from the *Q-BEx* questionnaire was run using the cluster R package (R Core Team, 2023).

Specifically, the *Q-BEx* details included were the following: current exposure and use of Italian and family language at home/on holiday/in the local community; level of speaking and understanding of the family language; amount of overheard speech in Italian and in family language; frequency of reading in the family language; age of first exposure to Italian; presence

of language concerns before age 4; kindergarten attendance before or after 3 years of age; highest level of education of the main caregiver in Italian and in family language; gender; number of siblings; child's birth order (see Paragraph 3.4.1.1).

The aim of this analysis was grouping together children with comparable linguistic and socioeconomic backgrounds and verifying the predictive power of these factors on the probability of belonging to IC (intermediate preschool performance) or LC (low preschool performance). HC (high performance Cluster) was not included in the analysis, as only one bilingual child belonged to this Cluster.

Given the mixed nature of the data included in the analysis (continuous and categorical variables), Gower's distance measure was employed to compute the distance matrix, while clustering was obtained through the Partitioning Around Medoid (PAM) algorithm. The algorithm was then set up to split the bilingual sample into two clusters, based on parental answers to the *Q-BEx* questionnaire; cluster division is represented on Figure 18.

As a result, 16 out of 27³ BI participants were included in *Q-BEx* Cluster 1 (Q1) and 11 in *Q-BEx* Cluster 2 (Q2; see Figure 18). Further analyses (t-tests for numerical variables, Chi-square tests for categorical variables; see Tables 19 and 20) showed that participants in Q2 were significantly more exposed and more willing to use Italian in all everyday-life contexts (at home, on holiday, in their local community), were more likely to have started kindergarten before the age of three, had parents with a higher level of education in Italian, and were born as second or third child. Additionally, these children were also those who had been exposed to Italian from earlier on, even though this difference was not a significant discriminating factor between the two *Q-BEx* Clusters. As a consequence, the opposite was true for children belonging to Q1: these participants had a greater engagement with their family language, were more likely to have started kindergarten after three years of age, had less educated parents (in Italian) and were the eldest siblings in the family (Tables 19 and 20).

Conversely, level of speaking and understanding of the family language, frequency of reading in the family language, presence of language development concerns reported by the parents before the child's four years of age, highest education of the main caregiver in the family language, gender and number of siblings did not yield significant differences between the groups.

³ As mentioned in Section 3.3.3, the parents of two participants were not available to complete the questionnaire, but these children were still retained in the sample. One further bilingual child was excluded from this analysis, as she was the only bilingual participant included in HC (high performance cluster).

Tables 19 and 20 show a summary of these results (only significant results reported).

After clarifying the specific features of each *Q-BEx* Cluster, a logistic regression was run to verify the predictive power of *Q-BEx* Cluster (Q1 and Q2) on kindergarten Cluster (IC and LC).

It was found that belonging to Q2 diminished by 83% the possibility of belonging to LC (95% C.I. [0.027, 0.86], $p < .05$), resulting in a higher probability for these participants of belonging to IC. Therefore, those children who were more extensively exposed to Italian in their everyday environments, had an earlier kindergarten onset, were the youngest siblings, and whose parents had a higher education in the community language were more likely to fall into the intermediate-performing Cluster, while those from the opposite linguistic and socioeconomic context were more likely to be included in the low-performing Cluster. Interestingly, Figure 18 shows that the two *Q-BEx* Clusters are neatly separated, meaning that the variables that yielded the bilinguals' division into Q1 and Q2 were highly representative of each Cluster. It follows that children with an overall richer engagement with Italian had greater chances of developing better pre-reading skills. One final point that deserves further consideration is the role played by parental education in the family language in cluster division. This variable did not significantly discriminate participants belonging to Q1 vs. Q2 ($\chi^2(4) = 5.48$, $p = .24$), suggesting that there was no significant association between *Q-BEx* Cluster membership and maximum levels of education in the family language (none, primary, secondary, post-secondary, university). What made a difference in Q1 or Q2 inclusion was the level of education in the community language ($\chi^2(3) = 13.92$, $p < .01$). Some of the parents of our children (7 out of 27) had moved to Italy at a younger age and had completed secondary or post-secondary education paths in Italy. As will be discussed in greater details in the next section, this may have positively affected children's richness of language experience.

Community exposure – family language	67.37 (28.76)	25.72 (28.55)	3.71	21.76	< .01**
Community use – family language	33.31 (23.63)	12.50 (15.01)	2.79	24.91	< .01**

Table 19. Mean (sd) percentages of language exposure and use derived from Q-BEx answers, together with results from t-tests run to explore the differences in Italian and family language use and exposure between Q1 and Q2.

Q-BEx categorical variables	χ^2	df	p-value
Overheard speech – Italian	11.64	4	< .05*
Overheard speech – family language	15.72	4	< .01**
Kindergarten attendance before or after 3	4.80	1	< .05*
Highest level of education of main caregiver in Italian	13.92	3	< .01**
Child's birth order	9.43	3	< .05*

Table 20. Results from Chi-square tests run to explore the differences in categorical variables between Q1 and Q2.

3.6. Discussion

3.6.1. Monolingual and bilingual performance on preschool linguistic predictors of reading skills

The first aim of our study was verifying whether monolingual and bilingual children with a migration background differ in the performance on pre-reading skills (phonological and morphological awareness, oral skills, orthographic knowledge, lexical access, and vocabulary) tested during the final year of kindergarten, namely before formal reading instruction onset.

Our results showed that the two groups differed significantly across all language measures, with greater effect sizes for Nonword Repetition ($d = 1.03$), Listening Comprehension ($d = 0.84$), Narrative Abilities ($d = 1.16$), Receptive ($d = 1.59$) and Productive Vocabulary ($d = 1.41$), and Morphological Awareness ($d = 1.08$).

These findings are generally in line with previous studies examining reading predictors in bilingual and monolingual children learning to read in Italian. Bellocchi et al., (2017), for instance, reported a poorer bilingual performance in letter knowledge, morphosyntactic comprehension, and vocabulary, while their groups did not differ in nonverbal intelligence, pseudoword repetition, syllable blending, and RAN. Their participants were assessed on reading predictors at the beginning of 1st Grade, so presumably only a few months after the time at which our T0 investigation took place. Nonverbal intelligence did not differ between the two groups in either study, as expected. Results were aligned also for letter knowledge and vocabulary, in which monolinguals outperformed bilinguals. The contrastive results observed for nonword repetition can be explained by the structure of the tasks used to assess this skill. In Bellocchi et al. study (2017), in fact, the nonword repetition task consisted of 15 stimuli including exclusively bisyllabic or trisyllabic nonwords, for which syllabic complexity was not specified. The task adopted for our study, instead, included 40 items, ranging from 2- to 5-syllable length, and built with syllables of heterogeneous complexity (from CV to CCVC; Vender et al., 2020). Overall, our task may have been more demanding and have highlighted more fine-grained between-group differences. Similar conclusions can be reached for Vender and colleagues' study (2016), who did not find differences in preschool bilinguals and monolinguals' performance on nonword repetition. However, as in Bellocchi et al. (2017), the task comprised very few items with simple syllabic structures. The same battery (*PRCR-2*, Cornoldi, 2010) was also used by Casani (2021), who did not report differences between monolingual and bilingual kindergarteners in nonword repetition either.

The difficulties displayed by our bilingual children in vocabulary and rhyme detection were in line with Casani (2021), whose study is the only one, to our knowledge, to have investigated the relationship between preschool reading predictors and later reading in bilingual and monolingual children. The author also found an effect of bilingualism on phoneme blending, although this skill was assessed at 1st Grade. Furthermore, in line with our findings, but in contrast with Bellocchi et al. (2017), bilingualism was also found to affect RAN speed. This contrast may be explained by participants' age, which was slightly higher in Bellocchi et al.'s study.

Concerning morphological awareness, to our knowledge no study had explored the outcomes of this ability in bilingual and monolingual preschoolers. Vernice and Pagliarini (2018), however, had reported a poorer bilingual performance across different morphological awareness tasks administered to a sample of children attending from 1st to 5th Grades. The fact that bilingualism affects this skill in younger children, as we found, is therefore not surprising. The low bilingual performance in Listening Comprehension and Narrative Abilities had already been reported in previous studies on beginning readers as well (Vettori et al., 2024).

Taken together, ours and previous findings consistently support the evidence that bilingual children with a migration background lag behind their monolingual peers in those (meta)linguistic skills that are needed for an effective reading acquisition. As largely discussed in Chapter 1, this discrepancy may be interpreted as the result of poor language competence, which is a typical feature of bilingual children who are extensively exposed to their family language in early years and then to the community language after school onset (Cummins, 1979b). As shown in Section 2.2, both language and reading competence have a reciprocal impact on all reading predictors: even tasks that are superficially purely phonological, such as nonword repetition, have actually been found to correlate with vocabulary development (Farabolini et al., 2022; Verhagen et al., 2019), which may have influenced performance.

Furthermore, language skills at kindergarten mostly depend on the competence acquired in the home environment. As a matter of fact, the home literacy environment of BCMB is often less stimulating, with limited attention devoted to shared reading or other more linguistically stimulating activities (Bello et al., 2024; Eisenwort et al., 2018; Ginsborg, 2006; Luo et al., 2021; Novita and Kluczniok, 2022; Parks and Smeriglio, 1986; Valcárcel Jiménez et al., 2024; see Paragraphs 1.3.2.4 and 1.3.2.5). This unfavourable background may have placed bilingual children at a disadvantage, despite being equal to their monolingual peers in terms of formal reading instruction. These results are in line with our expectations.

3.6.2. Relationship between preschool predictors and emerging reading skills

The second aim of our study was verifying the predictive power of preschool performance in a variety of pre-reading language skills (phonological and morphological awareness, oral skills, orthographic knowledge, lexical access, and vocabulary) on later reading outcomes (speed, accuracy, and comprehension for words, nonwords, and texts). To do so, first we grouped participants based on scores obtained in preschool tasks; then, a series of linear regressions

was run to verify the longitudinal predictive power of patterns of performance in kindergarten on 1st and 2nd Grade reading outcomes. If significant correlations had to be found between these measures, pre-reading skills assessment would prove as an effective method for early identification of children at risk for reading impairments, irrespective of language status (monolingual or bilingual).

A cluster analysis performed on all kindergarten language measures, without an *a priori* distinction between monolinguals and bilinguals, yielded three clusters: HC (high-performing cluster), including 10 monolinguals and 1 bilingual, with overall high performance across all tasks; IC (intermediate-performing cluster), including 31 monolinguals and 14 bilinguals, showing high performance in Listening Comprehension, Narrative Abilities, and Productive Vocabulary, low performance in Nonword Repetition and Phoneme Blending, and intermediate levels in the remaining tasks; and LC (low-performing cluster), including 3 monolinguals and 15 bilinguals, with low performance across all tasks. On the one hand, the exploratory nature of the cluster analysis allowed us to go beyond the predetermined internal divisions of our sample, revealing differences that had not emerged from the t-test results. On the other hand, these findings confirmed those presented in the previous paragraph, as bilinguals almost entirely fell within the intermediate- or low-performing clusters, even when the language variable was not included, highlighting once again the initial difficulties displayed by this group. Additionally, cluster analysis enabled us to go beyond collinearity issues typically arising when the variables assessed are all measures of the same construct (e.g., language skills), avoiding potential false significant values.

Interestingly, the pattern observed for pre-reading skills was also reflected in reading outcomes from 1st and 2nd Grade. This means that HC children displayed the highest accuracy, the shortest reading times, and the most accurate comprehension, followed by IC and LC, although not all contrasts were significant.

Separate analyses were run for 1st and 2nd Grade results and for reading speed, accuracy and comprehension. For each of these components, we verified the effect of Item (Words, Nonwords, and Texts) and Cluster (HC, IC, LC) on reading outcomes. If not otherwise specified, results from the *ReadLet* protocol are taken into account for the present discussion. As shown in the paragraphs above, results from this protocol and from the *DDE-2* converged for reading accuracy, while the former were more fine-grained for the speed component.

First, within-cluster contrasts were observed. The aim of this analysis was exploring whether differences between Words and Nonwords, and between Words (in isolation) and Texts in reading speed and accuracy, emerged for each Cluster. In 1st Grade, HC read Words and Nonwords with a comparable (almost at-ceiling) accuracy, but the former were read faster than the latter. IC, instead, read Words both faster and more accurately than Nonwords. Finally, LC read Words and Nonwords with the same (low) accuracy and at comparable (low) speed. As partially anticipated in the Results section, these comparisons can be interpreted as revealing different reading strategies adopted by each Cluster. In HC, both the lexical and sublexical routes are well-developed and allow these children to reach high reading accuracy irrespective of Item, as typically observed in transparent orthographies (Seymour et al., 2003). Lexicality effects are nevertheless present, given that Words are read faster than Nonwords, as already observed by Marzi et al. (2022, 2023) and Mazzarino and Marzi (2023). LC, the kindergarten low-performing children, displayed the opposite pattern: since their accuracy was comparably low and their times comparably high for both Words and Nonwords, it may be concluded that these children cannot yet exploit the lexical reading route and that they still rely on a (immature) grapheme-phoneme conversion strategy for all Items in isolation. IC, instead, represents a middle ground between the other Clusters: lexicality effects have a strong impact on these children's reading, as Nonwords are read both slower and less accurately.

Contrasts between Words and Texts yielded instead the same pattern across Clusters: the two Items were consistently read with the same level of accuracy, but Texts were read faster than Words in isolation. This is indicative of the facilitatory effect of context on reading fluency, that appears to be equally exploited even by poorer readers.

The second testing session (T2, 2nd Grade) allowed us to measure the development of Clusters' reading strategies. HC results mirrored those observed at T1: Words and Nonwords were read with comparable accuracy, but reading times for the former were shorter, possibly still due to lexicality effects. IC also displayed the same performance as in 1st Grade: Words were read both faster and more accurately than Nonwords. LC, instead, yielded different results compared to T1: in this case, significant differences emerged for both reading speed and accuracy between the two Items, meaning that Words were read faster and more accurately than Nonwords, as in IC. As in 1st Grade, Texts and Words in isolation were read with comparable accuracy by all Clusters, while Text had a consistent facilitatory effect on speed.

Within-cluster contrasts allowed us to determine that preschool performance on reading predictors appears to be predictive of the developmental trajectories of children's reading

strategies. Specifically, those with a generally high level of pre-reading skills seem to apply the lexical and sublexical routes effectively even after only one year of reading instruction. Those with a low pre-reading level, instead, appear to rely exclusively on a slow sublexical decoding at 1st Grade, although improvements are observed one year later. Finally, those children (the majority) who had an intermediate level in reading predictors represented a middle ground between the other Clusters, showing a stronger facilitatory effect for Words until the end of 2nd Grade. Interestingly, the textual dimension did not represent an excessive cognitive load for children, who were actually facilitated in obtaining faster reading times.

If within-cluster confronts could be interpreted as indicative of the reading strategies adopted by beginning readers, and how these were affected by preschool performance, between-cluster analysis allowed us to investigate how preschool patterns affected reading outcomes. In 1st Grade, no difference was found between Clusters for Word reading accuracy, meaning that, despite HC was more accurate than IC, who in turn was more accurate than LC, this gap was not significant. However, HC displayed significantly faster times for this Item. As for Nonwords, HC was both faster and more accurate, while the remaining Cluster did not differ. Finally, Text reading accuracy did not yield any significant difference, while speed differed across all Clusters, HC being the fastest, followed by IC and then LC.

Despite the internal discrepancies, therefore, all Clusters eventually reached comparable accuracy for Words. This is in line with findings on transparent orthographies, for which accuracy is relatively high even after only one year of reading instruction (Seymour et al., 2003). Reading speed, instead, may be more problematic in these orthographies, when it comes to reading difficulties (Serrano and Defior, 2008); the fact that HC outperformed IC and LC in this component is therefore not surprising. HC's highest accuracy in Nonword reading may be also indicative of better sublexical skills, as shown by preschool patterns. The speed-accuracy trade-off emerges clearly for Clusters' performance on Texts: all children managed to reach comparable accuracy, but belonging to High, Intermediate, or Low performing cluster had a direct impact on their speed. This result is particularly relevant, as children, while they proceed in their formal instruction, are required to deal with increasingly longer and more complex connected texts, and a slow reading may negatively impact their comprehension. As a matter of fact, turning now to this component, we observed that LC was significantly less accurate in answering comprehension questions, possibly due to slow reading; HC and IC, instead, did not differ.

In 2nd Grade, Word accuracy confirmed as equal across Clusters, while HC was faster for this Item. According to the *DDE-2* results, this Cluster was also more accurate in Nonword reading, and the same pattern emerged from *ReadLet* results for Nonword reading speed as well. Text results were identical to those from 1st Grade (equal accuracy, different reading times across Clusters). Reading comprehension, instead, differed across Clusters, highlighting a significant difference between HC and IC as well.

Taken together, these results show that, although not all contrasts were significant, children who obtained higher preschool language scores were also faster and more accurate in reading, followed by children with an intermediate pattern and then by those with low scores. Belonging to the low-performing Cluster prevented children from effectively exploiting the lexical reading route, as shown by within-cluster contrasts, and led them to be slower in Text reading and less accurate in reading comprehension, even after two years of reading instruction. Reading accuracy, instead, appeared to be less affected by poor kindergarten performance.

As anticipated at the beginning of this chapter, to our knowledge no study has employed cluster analysis to group participants based on pre-reading skills and then used this division to predict later reading outcomes, so drawing a direct comparison is challenging. However, studies comparing bilingual and monolingual reading acquisition trajectories in transparent languages have decoding to be the strongest component (Droop and Verhoeven 2003; Verhoeven, 2000; see Paragraph 1.3.3.1), while comprehension is weaker (Duzy et al., 2014; Lervåg and Aukrust, 2010; see Paragraph 1.3.3.2). Results for Italian are mixed, as sometimes a clear distinction between word vs. nonword decoding is found, where monolinguals and bilinguals perform differently on the former and comparably on the latter (Murineddu et al., 2006, Melloni et al., 2022), in other cases no difference is found across reading stimuli (Persici et al., 2022), while in others differences are more fine-grained (Bonifacci and Tobia, 2016). The fact that our findings do not completely align with any from previous studies is likely due to the analysis adopted. Our aim, in fact, was finding a method to detect at-risk children, irrespective of language background. After performing a cluster analysis, it emerged that low-performing children were mostly bilinguals, although few monolinguals were included as well. Nevertheless, even among bilinguals a distinction emerged between intermediate and low performance. Section 3.6.4 attempts to interpret this result in light of the influence of external factors.

The main advantage of the analysis adopted was the possibility of going beyond the predetermined division between monolingual and bilingual participants. By exclusively including the outcomes of pre-reading tasks in the cluster analysis, we were able to obtain a competence-

based division of our sample, rather than a language-based one. Although bilinguals and monolinguals tended to be distributed across clusters with opposite characteristics, an overlap was observed in the Intermediate Cluster. This suggests that this kind of approach may be more informative when searching for a method to identify at-risk children beyond their language status.

3.6.3. Testing the original ReadLet protocol developed for first graders

One further interesting aspect emerged from these analyses is the consistency of the data obtained from the *ReadLet* and *DDE-2* protocols. For reading accuracy in 1st Grade, the two protocols yielded exactly the same results for Words and Nonwords, thus supporting the adequacy of the original *ReadLet* protocol that we specifically designed for first graders. Speed results, instead, slightly differed between the two assessment methods, with *ReadLet* providing more within- and between-cluster significant differences. This might be due to the fine-grained nature of the data obtained through the finger-tracking methodology: as anticipated, the application is able to record tracking times for single words, whereas in offline protocols only mean reading times, either at single-item or at syllable-level, can be obtained by manually dividing overall reading time for total number of items or syllables. This feature may have captured subtle but meaningful individual differences in reading times, providing further evidence to the high quality of finger-tracking as reading assessment measure, even in beginning readers.

In 2nd Grade, no between-cluster differences were found for Words and Nonwords in the *ReadLet* results, whereas the *DDE-2* results did show such a difference, albeit limited to Nonwords being read more accurately by HC compared to IC and LC. The discrepancy between *ReadLet* and *DDE-2* results could be due to the characteristics of the Nonwords included in the *ReadLet* protocol, which were kept identical between the 1st and 2nd Grade assessments but might have been too simple for second graders. The *DDE-2* protocol, by contrast, is specifically designed to be administered starting from 2nd Grade, and therefore includes stimuli suitable for highlighting individual differences even among more experienced readers. Greater speed differences, on the other hand, again emerged from the *ReadLet* protocol, confirming its validity even for slightly more advanced readers.

3.6.4. Bilingual participants' linguistic and SES context and their relation to preschool performance

As anticipated above, our bilingual participants equally divided between the intermediate and the low performing Clusters. As expected, bilinguals' linguistic history and SES had an impact on determining this division. In fact, those children who were exposed earlier to high-quality input in their community language – that is, those who began kindergarten before the age of three and those who had older siblings already exposed to school-level language – were also more likely to fall into the intermediate-performing cluster. Moreover, the same pattern was observed for children coming from families whose parents held a secondary or post-secondary study title obtained in the community language, who were likely exposed to a higher-quality home literacy environment (Eisenwort et al., 2018). It is also worth noting that the two clusters obtained from the parental questionnaire analysis did not show any overlap (Figure 16), providing excellent internal validity for this division and clearly highlighting two distinct tendencies among bilingual families: a greater use of the family language was associated with lower parental education and later enrolment in formal education, and vice versa.

It must be acknowledged that the present results represent preliminary evidence of the influence of low/medium SES and bilingualism on pre-literacy and reading outcomes in beginning readers in Italian. Indeed, previous studies targeting bilingual and monolingual populations with low and high SES have evidenced a differential impact of these factors on linguistic and reading skills. As already mentioned in Paragraph 1.3.3.1, a study run on BCMB learning to read in French showed that children with a migration background were slower in text reading and less accurate in irregular word decoding, irrespective of SES, while children from low-SES families were more inaccurate in regular word reading (Bellocchi and Bonifacci, 2024). Similar findings were also obtained in Dutch, a language with a transparent orthography (Droop and Verhoeven, 2003), but were not replicated for Italian, where bilingual-monolingual differences were limited to reading comprehension and low-SES children underperformed high-SES peers exclusively in oral comprehension, while reading fluency was comparable across groups – possibly due to the absence of irregular stimuli in the testing protocol (Bonifacci et al., 2020; see Paragraph 1.3.3.1). More broadly, it was shown that bilingualism and SES differentially impact language and cognitive functions: the former appears to affect language abilities such as vocabulary, while also enhancing executive functions irrespective of SES, whereas the latter mainly influences more cognitively demanding tasks (Calvo and Bialystok, 2014).

Future studies should expand our knowledge on the independent effects of bilingualism and SES on reading acquisition trajectories in Italian beginning readers. To do so, samples controlled for these parameters should be recruited, and additional socioeconomic measures should be included in family questionnaires. Most importantly, these details should be obtained for monolingual families as well, something that we were not able to do through the *Q-BEx* questionnaire.

3.7. Limitations and conclusive remarks

To date, very little is known about language abilities in preschool monolinguals and, more importantly, in preschool bilingual children with a migration background and Italian as their community language. More research on this topic is needed, as it would make a crucial contribution to reducing the risk of misdiagnosing reading impairments in this population. In fact, screening preschoolers' language skills would allow for the timely identification of those children most at risk of developing reading difficulties.

Our study has tentatively contributed to this scenario. Starting from evidence showing that different pre-reading skills concurrently predict reading outcomes, we decided to assess a variety of language abilities, assuming the multicomponential nature of the reading process. A cluster analysis supported this hypothesis, showing that children displayed either high, intermediate, or low performance across all tasks. Crucially, bilingual children were equally distributed between the intermediate- and low-performing clusters, and their kindergarten performance mirrored their reading outcomes in 1st and 2nd Grades. The fact that children with the lowest kindergarten language scores were also those displaying difficulties in emergent reading does not necessarily mean that these children will always lag behind their peers. It may simply indicate that they need more time to acquire reading automaticity and might eventually catch up. One limitation of this study is that we could not obtain information concerning the potential diagnosis of reading impairments for our participants, as the study ended before the standard age at which dyslexia is typically diagnosed (3rd Grade).

However, the crucial point is that almost all children included in the low-performing cluster were bilinguals. This suggests that our protocol may not have served to detect children at risk for dyslexia, but has proven effective in reinforcing the fact that bilingual children often display language vulnerabilities that may lead them to display reading acquisition trajectories that differ substantially from those of their monolingual peers. As shown by the parental questionnaire

analysis, the primary reason why these children lag behind is that they are not supported by adequate socioeconomic and family contexts. This factor alone cannot, of course, account for risk of dyslexia – which is a neurodevelopmental disorder – but can hinder BCMBs' initial academic trajectory, with critical consequences for their future.

This leads to two conclusive remarks: first, protocols assessing reading and pre-reading skills in bilinguals should not exclude external factors, like language history or socioeconomic status; second, even though bilinguals' language difficulties may not show through their everyday language skills, it should be reminded that this does not exclude that more subtle, academic-related issues may still manifest during their initial formal education path. Therefore, adequate didactic interventions should be proposed with the aim of supporting fundamental pre-reading skills. This is precisely the topic of our Studies 2 and 3, that are presented in the next chapters.

One final consideration deserves clarification. Despite the evident difficulties displayed by many bilingual children in our sample, this result should not be interpreted as discouraging the use of the family language in families with a migration background. In contrast with claims once supported by early literature on bilingualism (e.g., Saer, 1923), it is now clear that dealing with two or more languages is not the cause of language or cognitive impairments *per se*. Conversely, bilingualism has been consistently associated with advantages in the cognitive domain, and, when language costs are observed, these are typically framed within a trade-off perspective (Leivada et al., 2023; see Paragraph 1.3.5). As recently shown in a meta-analysis, a high percentage of studies reporting a bilingual disadvantage claim that this has a sociolinguistic origin, while those evidencing an advantage argue that it stems from cognitive factors (Masullo et al., 2024). As previously discussed, BCMB often come from disadvantaged socioeconomic contexts, and this appears to be the major factor preventing them from taking advantage of their bilingual status (see Section 1.3.2). As will be further discussed in the final chapter of this dissertation, the use of the family languages of BCMB should be encouraged and supported by society, and children should have access to varied and rich input not only in their community language but also in the languages spoken in their families. As observed by Cummins (1979b), this is the first and fundamental step in allowing children exposed to two languages to fully exploit all the benefits that bilingual development brings.

Chapter 4 – Study 2: Phonological awareness in monolingual and bilingual preschool children: short- and long-term effects of a didactic intervention

4.1. Introduction

4.1.1. Developmental trajectories of phonological awareness

As widely discussed throughout this dissertation, phonological awareness plays a fundamental role in literacy acquisition.

Although reading comprehension has been shown to be differently predicted across transparent and opaque languages – with a greater role of language comprehension in the former, and stronger predictive power of decoding in the latter (Florit and Cain, 2011) – reading acquisition in both types of alphabetic systems must begin with the acquisition of the alphabetic principle, namely the understanding that written letters represent phonemes. Depending on the degree of orthographic transparency, then, children may require more time (in opaque systems) or less time (in transparent) to develop a fully automatic mapping between phonemes and graphemes. This difference results in more effortful reading and a greater reliance on decoding resources for beginning readers of opaque orthographies (Florit and Cain, 2011; Seymour et al., 2003).

Phonological awareness is typically defined as the ability to identify and manipulate speech sounds (Stahl and Murray, 1994). As noted in Section 2.2.1, speakers can be aware of different phonological units (words, syllables, rhymes, phonemes) and can manipulate these units through various tasks, such as identification, segmentation, blending, cancellation, or substitution. Crucially, the acquisition of both increasingly less salient phonological units and more complex operations develops progressively. According to Stanovich (1992), phonological sensitivity follows a continuum, starting from more salient and ‘shallow’ units (such as whole words) to less salient and ‘deep’ ones (e.g., phonemes). At the same time, the ability to perform phonological operations is also gradually acquired – from basic tasks (e.g., remembering familiar rhymes) to more demanding ones (e.g., phoneme deletion or substitution), as hypothesised by Adams (1998).

However, individuals rarely progress in acquiring less salient phonological units and more demanding operations unless they are exposed to print. As empirically demonstrated by Perfetti

and colleagues (1987), children entering school are already able to perform simple phoneme blending tasks, but accuracy in more complex tasks such as deletion or tapping significantly improves after a few months of reading instruction. According to the authors, learning orthographic principles enables emergent readers to discover more fine-grained phonemic principles in turn. Evidence for this reciprocal relationship also comes from research on dyslexic or illiterate individuals, who display markedly reduced phonological competence (Adrián et al., 1995; Snowling, 2001).

In addition, a substantial body of research has supported the predictive relationship between early, basic phonological skills and later reading outcomes (Bryant et al., 1990; Leather and Henry, 1994; Lonigan et al., 2000; Melby-Lervåg et al., 2012; Orsolini et al., 2006; Pinto et al., 2016, 2017; Stahl and Murray, 1994; Storch and Whitehurst, 2002; Torgesen and colleagues, 1989; see Section 2.2.1).

4.1.2. Early phonological training and its effects on reading skills

Building on these premises, it follows that anticipating children's phonological awareness development – which typically occurs as a consequence of reading acquisition – would enable young learners to acquire the basic principles more effortlessly. Indeed, a long line of research has shown that specific phonological training administered in kindergarten benefits both this skill and subsequent reading abilities (see Paragraph 2.4.1).

The landmark study for phonological training is that of Bradley and Bryant (1983), who were among the first to empirically demonstrate the existence of a link between the benefits obtained from preschool phonological training and later reading, up to higher grades. Similar findings were later replicated by Lundberg and colleagues (1988), who proposed phonological training activities to preschoolers over an eight-month period. The authors designed the intervention around entertaining and interactive activities and, most importantly, focused on progressively smaller phonological units (rhymes, sentences and words, syllables, phonemes). Children who received the training became substantially more accurate in specific phonological awareness tasks (syllable blending and segmentation, phoneme blending, segmentation and deletion), while the effect was weaker for others (rhyme detection⁴). Additionally, beneficial effects

⁴ According to the authors, rhyme sensitivity is less dependent on formal training, as it requires “sensitivity to sound similarity” (Morais et al., 1986), rather than explicit and conscious segment manipulation. Supporting this hypothesis, Adrián et al. (1995) have shown that rhyme sensitivity is found also in illiterate individuals.

extended to 1st Grade reading outcomes. The authors suggested that phonological skills can be trained independently of reading, although some appear to develop regardless of specific training (e.g., rhyme detection).

Further positive evidence for the effectiveness of phonological intervention comes from studies including disadvantaged populations. Kleeck and colleagues (1998) trained a group of preschoolers with language impairments on phoneme and rhyme awareness over a nine-month period and observed significant improvements in both areas for their sample. Comparable findings were obtained by Brady and colleagues (1994), who administered a phonological intervention to children from disadvantaged inner-city areas. The benefits gained from the training also extended to emergent reading.

To our knowledge, very few studies examined the effectiveness of phonological awareness interventions in bilingual preschoolers. Casani (2021) administered a 20-hours intervention to a group of monolingual and bilingual children with a migration background enrolled in the final year of Italian kindergartens. Children took part in the sessions (40 in total, 3 times a week) in small groups of 3 or 4 participants. The training focused exclusively on salient phonological units (syllables and rhymes) and proposed activities of increasing difficulty (syllable and rhyme identification, minimal pair recognition, syllable blending and segmentation). Intervention materials were adapted from existing protocols, such as Brignola and Perrotta (2010), Dutto (2014), Perrotta and Brignola (2010). Results pointed to a positive effect of training on syllable blending and on minimal pair and rhyme identification. However, given the small sample taking part in the training (12 children, 7 monolinguals and 5 bilinguals) the author did not provide results specific to monolinguals and bilinguals, so we can only assume that both groups benefitted equally from the intervention. Engel de Abreu and colleagues (2020), on the other hand, trained exclusively non-Luxembourgish children attending kindergarten in Luxembourg on phonological awareness tasks. Significant gains in phonological awareness were observed, which were maintained even nine months after the training and also had effects on emergent reading, albeit limited to word identification (written word – picture matching).

Overall, studies on phonological training in bilingual children have consistently shown benefits for phonological skills, while findings on transfers on later reading are more mixed (Bodé and Content, 2011; Herrera et al., 2011; Patscheke et al., 2016; Stuart, 1999, 2004). As suggested by results of the meta-analyses conducted by Bus and Van IJzendoorn (1999) and Ehri et al. (2001), long-term effects of trainings may be more evident in children learning to read in an opaque orthography, possibly due to the inconsistent grapheme-phoneme mapping, that may

particularly benefit from explicit phonological training. However, since little research has been done on phonological training for bilingual children learning to read in Italian as a community language, this topic clearly warrants further investigation. Results from Study 1 have shown that BCMB lag behind their monolingual peers in early linguistic predictors of reading outcomes, and this gap extends also to specific components of reading in early grades (text reading speed and comprehension). Supporting phonological pre-reading skills before formal instruction onset could be particularly beneficial for this population.

4.1.3. Relevant features of phonological training

Meta-analyses and reviews carried out throughout the years have identified the main features characterizing successful phonological training programs (Bonifacci and Tobia, 2017a; National Institute for Literacy, 2008; National Reading Panel, 2000; Pullen and Justice, 2003; Schuele and Boudreau, 2008). An extensive description of these features has already been provided in Section 2.4.5. The main points are reported in the present section.

The first fundamental feature shared by all studies on phonological training is the sequentiality of the proposed activities (Lundberg et al., 1988; National Reading Panel, 2000; Schuele and Boudreau, 2008). This means that, as suggested by the theoretical framework for the phonological continuum put forward by Stanovich (1992), initial activities should enable children to become familiar with more salient phonological units, such as words and rhymes, and only after this initial phase should smaller units (syllables, phonemes) be introduced. Although children might already be familiar with larger units – for instance, rhymes are often found in child-oriented literary works – it is very rare that they are given the opportunity to actively reflect upon them in their daily activities. Moreover, moving immediately toward less salient units would probably demotivate children, who might find these activities too difficult for their current level. For the same reason, following Adams (1998), initial activities should involve simpler phonological operations, such as listening and identification of salient units (e.g., rhymes and syllables), before gradually introducing more cognitively demanding tasks like blending or segmentation.

Another crucial point concerns the way in which activities are presented. Especially with younger children, proposing tasks or instructions in an overly abstract way would likely lead to confusion or demotivation. Instead, whenever possible, tangible representations of the target units or operations should be provided (Brady et al., 1994; Lundberg et al., 1988). Additionally, research

from other educational fields has shown that active, movement-based activities can be particularly beneficial for young learners (scientific concepts, Doğru and Şeker, 2012; foreign language vocabulary, Toumpaniari et al., 2015; geometry, Kraur, 2020).

Regarding the method, training has been shown to be more effective when explicit and targeted instructions are provided. Along the same lines, the National Reading Panel (2000) promotes the use of letters to enhance the correspondence between phonemes and graphemes.

As for delivery variables, the meta-analysis conducted by the National Reading Panel (2000) suggests that the ideal duration of an intervention ranges between 5 and 18 hours, noting that longer durations do not necessarily lead to greater improvements. At the same time, the intervention studies included in their analysis typically distributed activities on a period of 7 to 12 weeks, with 3-5 sessions of 15-30 minutes each, on average. The studies showing the most significant improvements were also those that administered activities to small groups of children (between 2 and 7 participants).

Finally, the review by Schuele and Boudreau (2008) provides useful guidelines regarding the trainers' attitude toward the activities. Specifically, besides carefully planning the program to allow for a gradual transition from simpler to more demanding units and operations, administrators should ensure that all the processes underlying the phonological operations are demonstrated repeatedly, enabling children to reason autonomously (*think-aloud* strategy). Furthermore, administrators should bear in mind that *training* differs from *testing*: during intervention activities, the focus should not be on the correctness of the response but on the process that led to it. Scaffolding should also always adapt to children's answers – both correct and incorrect – to maximise learning.

4.2. The study

As emerged, very little is known about the potential benefits that bilingual children with a migration background learning to read in Italian may gain from participating in phonological awareness training. However, if this kind of intervention proved effective also for this bilingual population, it could play a crucial role in helping linguistically fragile children close the gap they often exhibit with their monolingual peers.

Building on these premises, we designed an intervention study guided by the following research question:

(RQ1) What is the effectiveness of a didactic intervention focused on phonological awareness on concurrent phonological skills and later decoding abilities in preschool children?

(RQ2) Does the effectiveness of the phonological training differ between Italian monolingual and bilingual preschoolers with a migration background?

We expect our training to be effective on phonological skills for both monolinguals and bilinguals. As for potential transfer on reading skills, we hypothesise that training benefits may be levelled out by the effect of the easiness with which decoding is acquired in transparent orthographies.

4.3. Participants

The sample included in this study was identical to that involved in Study 1: 44 Italian monolingual children (MONO) and 30 bilinguals with Italian as community language and heterogeneous languages as family languages, characterized by a migration background (BI). All children were attending the final year of Italian kindergartens at the time of testing (for more details, see Section 3.3).

For the purpose of the present study, the sample ($N = 74$; age $M = 5.84$, $SD = 0.3$) was divided into two groups, based on whether or not they took part in a phonological training. Due to practical and organizational reasons, children could not be assigned randomly to the two groups. The group that participated in the didactic intervention (henceforth experimental group, EX) included 38 children (27 MONO, 11 BI), all attending the same kindergarten (“Mons. G. Ciccarelli”, San Giovanni Lupatoto, Verona). The control group (CON) consisted of 36 children (17 MONO, 19 BI), recruited from two different kindergartens (“Federico Garofoli” and “Giovanni XXIII”). These children did not participate in the training activities and were involved in regular activities in their kindergartens.

To ensure a voluntary and informed participation, all parents received a consent form together with an information sheet including all relevant details of the study. The document explained the duration of the study, the non-invasive and playful nature of the tests and the intervention, and the possibility to withdraw their consent at any time; pseudonymisation of all collected data was also guaranteed.

4.4. Study design

The aim of the present study was to evaluate the effectiveness of a didactic intervention focused on phonological awareness and administered to a group of bilingual and monolingual children who had not received prior formal reading instruction. To achieve this, we designed an intervention study articulated into four phases.

Phase 1 (pre-test) was dedicated to the evaluation of phonological awareness skills, measured in terms of Nonword Repetition, Rhyme Detection, and Phoneme Blending. This testing session was included in the assessment administered at T0 in Study 1 (see Section 3.4.1). Nonverbal Intelligence (*Raven's Coloured Progressive Matrices*, Raven et al., 1998) and bilingual participants' linguistic history (*Q-BEx* questionnaire, De Cat et al., 2023) were collected as additional measures.

Phase 2 consisted of a didactic intervention aimed at enhancing children's phonological skills. The decision to focus on this specific predictor for the administration of the intervention was motivated by the core role that these skills play in literacy development (Bryant et al., 1990). The aim was to verify whether this kind of training programme could effectively enhance sublexical skills that are essential for correct reading development: previous studies on other languages have shown positive effects of phonological training not only on phonological skills but also on later reading acquisition (for English, see Brady et al., 1994; for German, Schneider et al., 1997; for Norwegian, Lyster, 2002; for Swedish, Wolff and Gustafsson, 2022; see Section 2.4), although the latter appear to be more consistent for opaque orthographies (Bus and Van IJzendoorn, 1999). These results have also been replicated for Italian preschool children, although not extensively (Casani, 2021; Giovagnoli et al., 2015; Goffredo et al., 2016; Majorano et al., 2021; Savelli et al., 2011; Terribili et al., 2011; Trambagioli et al., 2015; Zanchi et al., 2012; see Section 2.4.3). Designing targeted phonological interventions suitable for both monolingual and bilingual populations would be of the utmost importance, as it could diminish the initial language and literacy difficulties that often characterize bilingual children with a migration background, with the benefits of an inclusive education approach.

During Phase 3 (post-test), all the children were tested again with the same measures adopted in Phase 1: this step was necessary to evaluate the effect of the didactic intervention on children's phonological skills.

Finally, Phase 4 (follow-up) evaluated the potential transfer of the benefits obtained from the kindergarten intervention to 1st Grade decoding skills. This phase coincided with T1 testing moment from Study 1 (see Section 3.4.2). Specifically, children's emergent decoding skills were tested during the final months of 1st Grade by means of the finger-tracking application *ReadLet* (Taxitari et al., 2020).

4.4.1. Phase 1: pre-test on phonological awareness

4.4.1.1. Procedure and materials

As illustrated in more detail in Section 3.4.1, children were tested on the measures selected (Nonword Repetition, Rhyme Detection, Phoneme Blending) during three distinct testing sessions, to minimize fatigue risk. Testing and training sessions took place in a quiet room of children's kindergartens. For every test, answers were manually annotated by the experimenters; 1 point was awarded to correct answers, 0 otherwise.

The Nonword Repetition task (Vender et al., 2020) consisted in 40 non-existing words, designed following Italian phonotactic rules, that children were asked to repeat after hearing them from the experimenter.

The Rhyme Detection task (Vender and Melloni, 2021) required children to point to a word rhyming with a given one, avoiding phonological and semantic distractors.

In the Phoneme Blending task, participants were asked to derive whole words from the sounds that were spelled one-by-one by the experimenter.

4.4.2. Phase 2: didactic intervention on phonological skills

4.4.2.1. Materials

Weeks 1-2: words and rhymes

The first two weeks were dedicated to phonological units with grater salience, such as words and rhymes. The aim of this phase was allowing children to focus on word sound, by separating it from its meaning, and to familiarise themselves with the concept of rhymes. Activities revolving around words included exercises on sound-meaning discrimination, long and short words production, and nonword repetition. As for rhymes, these were introduced to the children as

words that end with the same sounds, referring to nursery rhyme books as a familiar example to help them better grasp this concept. The experimenter also provided a few examples and encouraged children to do the same. Before beginning the training activities, children were free to recall and share with the group personal experiences with rhymes, talking about books, songs, or nursery rhymes they knew.

Rhyme training focused on identification and production.

In the sound-meaning discrimination activity, for instance, children were told to focus exclusively on the sounds of words and to decide whether the words uttered by the experimenter were short (two syllables, like *topo*, ‘mouse’) or long (four or five syllables, like *frigorifero*, ‘fridge’). Although these examples were provided, children were not explicitly instructed to count syllables; rather, they were simply asked to judge whether the words *sounded* long or short. Once this distinction was clarified, they were told to “become like the words” they heard: if the word was long, they had to jump, whereas if it was short, they had to crouch down. In the first rounds, short words referring to small objects (e.g., *mano*, ‘hand’, *mela*, ‘apple’, *ape*, ‘bee’) and long words referring to big objects (*elefante*, ‘elephant’, *grattacielo*, ‘skyscraper’, *rinoceronte*, ‘rhino’) were used. As the game progressed, sound-meaning mismatching words were introduced, namely long words referring to small objects (*coccinella*, ‘ladybug’, *uccellino*, ‘little bird’, *albicocca*, ‘apricot’) and short words referring to big objects (*nave*, ‘ship’, *treno*, ‘train’, *mare*, ‘sea’). This second phase constituted the real training, where children could no longer rely on meaning to perform the correct action. Whenever incorrect reactions occurred, their attention was redirected to the sounds of the words.

In the rhyme production task with nursery rhymes, the experimenter read some short poems from children’s books. These rhymes featured animals as main characters and described what they did across the four seasons. To promote active listening and familiarisation with rhymes, children were told that some words were missing from the book and that they needed to help the experimenter find them. After a brief familiarization phase, the children were asked to complete the rhymes with appropriate words, which could differ from those originally present in the book. The following example is taken from *50 filastrocche corte corte per un anno lungo lungo* by Maria Loretta Giraldo and Nicoletta Costa (2023):

‘[...] *Alla donnola Nicola*

piace molto andare a scuola.

E colora con impegno

*un bellissimo ... [disegno, or any word rhyming with *impegno*]*

[...] Sulla spiaggia, Neo porcello,

con la pala e col secchiello,

fa un castello con la sabbia.

*Se lo pestano sì ... [arrabbia, or any word rhyming with *sabbia*]*

A summary of the other activities and the skills trained during Weeks 1-2 is reported in Table

1. Complete intervention stimuli can be found in Appendix D.

Skill	Activity
Word sound-meaning discrimination	Children had to jump when hearing a long word (four or five syllables) and crouch down when hearing a short word (two syllables).
Long and short words production	Imitating the experimenter, children had to find long or short words while passing a ball among each other.
Nonword repetition	‘Whispers’: a nonword had to pass, whispered in the ear, from a child to another, and complete a round without being changed.
Rhyme detection	Children had to find, among distractors, the word rhyming with their name or surname, and then invent a short nursery rhyme.
Rhyme production	The experimenter read some nursery rhymes omitting some rhyming words. Children were invited to complete the rhymes with appropriate words.
Rhyme production	After receiving a prompt from the experimenter, children had to find words rhyming with the target while passing a ball among each other.

Table 1. Word- and rhyme-related skills and corresponding activities proposed during Weeks 1 and 2 of the intervention.



Figure 1. An example from activities with rhymes: after hearing a word from the experimenter, the child with the ball had to find a rhyming word, and then pass the ball to another classmate.

Weeks 3-4: syllables

Despite the absence of tasks tapping syllabic awareness in the testing phase, two weeks of the intervention were allocated to train this specific skill, to facilitate children to move gradually towards smaller phonological units (phonemes). Syllables were introduced as small pieces of words that, when assembled like in a puzzle, form a complete word. To verify that children were familiar with this concept – which, in a language with highly regular syllabic patterns like Italian, is typically acquired quite spontaneously – the experimenter first demonstrated how simple words with a regular syllabic structure (CVCVCV patterns, such as *banana*) could be divided into syllables while clapping hands to keep the pace, and then encouraged the whole group to try themselves.

During this period, activities focused on the familiarisation with the concept of syllables, on syllable identification, production and segmentation.

For instance, in the Memory game, a set of cards was placed face down on the floor. Unlike the traditional memory game, the goal here was to match pairs of words sharing the same initial syllable (in the first version) or the same final syllable (in the second version), rather than identical images (e.g. *na-so*, *na-ve*; *budi-no*, *cami-no*). At each round, children could flip two cards and reveal the corresponding pictures. They were then asked to isolate the initial or final syllable. If the syllables matched, the child could keep the pair; otherwise, the cards were turned face down again.

In the Handkerchief game, children were divided in two teams; the members of each team stood next to one another, facing the members of the opposite team. Each pair of facing children was assigned two words beginning with the same syllable (e.g., *lupo* and *luce*; *fata* and *fame*; *foto* and *foglio*). Participants were instructed to listen carefully to the syllables pronounced by the experimenter: if the syllable matched to the initial syllable of their assigned word, they had to run towards the experimenter and try to be the first to grab a handkerchief she was holding. For example, if the experimenter uttered the syllable *fa-*, the children associated with *fata* and *fame* had to run. In case of a “false start”, children were invited to review their word and its initial syllable.

The description of the other activities and the skills trained during weeks 1-2 is reported in Table 2. Complete intervention stimuli can be found in Appendix D.

Skill	Activity
Syllable identification	Children had to colour black and white pictures following specific instruction: either only pictures corresponding to words with a given number of syllables could be coloured, or to words starting with a specific syllable.
Syllable identification	‘Handkerchief game’: each pair of children, belonging to opposite teams, was assigned a word starting with the same syllable. When the experimenter called that syllable, children had to run toward her and be the fastest at stealing the handkerchief she held in her hand.
Syllable identification and segmentation	‘Memory game’: a set of cards represented figures whose words started with the same syllables, in pairs. Children had to identify the initial syllables, isolate them, and find the syllable-matching pairs.
Syllable identification and segmentation	After receiving a prompt from the experimenter, children had to find words starting with the same syllable of the target word while passing a ball among each other.
Syllable segmentation	‘Hopscotch’: children were assigned a word and had to segment it into syllables while jumping into circles.
Syllable segmentation and blending	‘Syllabic chain’: the experimenter uttered a word. The child sitting next to her had to identify the final syllable and find a word starting with that syllable, and so on with all participants.

Table 2. Syllable-related skills and corresponding activities proposed during Weeks 3 and 4 of the intervention.



Figure 2. An example from activities with syllables: after hearing a word, children had to segment it into syllables while jumping into circles.

Weeks 5-6: phonemes

The final two weeks of the intervention program were dedicated to phonemes. Phonemes (or “sounds”, as were presented to the children), were also introduced as even smaller puzzle pieces making up words. Specifically, children were told that a word such as *cane* (‘dog’) can be composed using two syllable-pieces (*ca-ne*), but requires four sound-pieces (*c-a-n-e*). They were then encouraged to think of familiar sounds, such as the initial sound of their own names, which were also used in the first activity of this period.

After a few activities to get familiar with the concept of phoneme, exercises focused on phoneme discrimination via minimal pairs, production and segmentation.

In the Alien game, for instance, children were introduced to Tina, an extraterrestrial character who struggled with Italian pronunciation and frequently produced phonological errors. They were asked to listen carefully to the sentences she said and correct her. Her sentences could be correct (e.g., *Siete proprio dei bambini simpatici!*), contain nonwords (e.g., *Che freddo! Chiudete la dorta!*, or *Ieri mia mamma mi ha letto un bellissimo libro di ravole*), or include minimal pairs (*Ho un po’ paura a guardare giù dalla minestra*, or *La mia merenda preferita è cane e Nutella*).

In the minimal pairs activity, children were divided into pairs and asked to stand next to their classmate in the room. When the experimenter pronounced pairs of words, they had to decide whether the two words were identical or differed in their sounds. In the first case, they had to hug each other; otherwise, they had to run away from each other. Initially, the stimuli included only minimal pairs of real words (*cane-pane*, *sole-sale*, *foto-moto*); subsequently, minimal pairs of nonwords were introduced to avoid meaning interference (e.g., *dila-dima*, *coti-cati*, *deto-reto*).

The description of the other activities and the skills trained during weeks 1-2 is reported in Table 3. Complete intervention stimuli can be found in Appendix D.

Skill	Activity
Phoneme identification	Children were given black and white representations of the initial letters of their names and surnames. They were then encouraged to find words starting with the same sound, and colour the letter to make it become similar to the chosen word (e.g., Sara -> <i>stella</i> -> colouring the S letter so that it looks like a star).
Phoneme identification	‘Handkerchief game’: the instructions were identical to those from the syllable game, but here pairs of children were assigned words starting with the same phoneme.
Phoneme identification	‘The alien’: children were introduced to an extraterrestrial character who would make phonological mistakes in her sentences, producing either nonwords (e.g., <i>dorta</i> instead of <i>porta</i>) or minimal pairs (<i>testa</i> instead of <i>festa</i>). Children had to detect the mistakes and correct her.
Phoneme identification	Children were divided into pairs. The experimenter uttered pairs of words or nonwords, which could be identical or differ for one phoneme (minimal pairs). If the two words were identical, children had to hug each other; otherwise, they had to run away from each other.
Phoneme identification and segmentation	‘The ship’: the experimenter uttered the sentence ‘a ship is coming, and it’s full of...’ followed by a word. Children had to identify the initial sound and find other words starting with the same phoneme to ‘load the ship’.
Phoneme blending	The experimenter pronounced words split into phonemes. After receiving a ball, the designated child had to blend the sounds together and say the whole word.

Table 3. Phoneme-related skills and corresponding activities proposed during Weeks 5 and 6 of the intervention.



Figure 3. An example from activities with phonemes: children were instructed to colour the letters corresponding to their name and surname initials to make them look like an object, food, animal starting with the same phoneme.

4.4.2.2. Procedure

The phonological training programme was designed for the purpose of the present study. The experimental group ($N = 38$, 27 MONO, 11 BI) was involved in a 9-hour intervention that was distributed in three half-an-hour sessions per week, for an overall duration of six weeks. All the activities were structured as games and administered to small groups of four to five children, who were temporarily moved from their classrooms for the duration of the session. Both the children grouping and the timing followed the recommendations of the National Reading Panel (2000).

The games were structured to facilitate children to gradually move from larger and more salient phonological units (words, rhymes) to smaller ones (syllables, phonemes) (Adams, 1998; Lundberg et al., 1988; National Reading Panel, 2000; see section 2.4). Specifically:

- Weeks 1-2: word sound-meaning discrimination and rhyme identification and production
- Weeks 3-4: syllable identification and manipulation
- Weeks 5-6: phoneme identification and manipulation

An additional two-week period was allocated to allow children who missed school to complete the activities.

Each session included two distinct activities lasting 15 minutes each. Following Gardner (1983), given the young age of our sample, we tried to design most of the activities as physical games, in which children had to involve and move their body, and to alternate them with more static exercises.

To reinforce learning, all the activities were presented twice, with the same structure but different stimuli. As an example, Table 4 reports how activities were distributed during Week 1.

WEEK 1	
Days	Activities
Day 1	Sound-meaning discrimination + nursery rhymes reading
Day 2	Nursery rhymes reading + rhymes production
Day 3	Sound-meaning discrimination + rhymes production

Table 4. Distribution of activities on words and rhymes in Week 1.

The intervention structure followed a progressive difficulty approach, meaning that games involving simpler phonological operations (identification, blending) were proposed in the initial sessions, moving gradually towards the more complex ones (production, segmentation; Stanovich, 1992).

Throughout the training sessions, children received continuous feedback and support as needed.

4.4.3. Phase 3: post-test

During this phase, participants from both the experimental and the control group were tested again on phonological awareness tasks, the same tasks that had been used in the pre-test phase

(i.e. Nonword Repetition, Rhyme Detection, Phoneme Blending). The tests were administered right after the end of the phonological training period. The aim of this phase was to assess the potential effectiveness of the phonological training program.

4.4.4. Phase 4: follow-up

The final phase of the study was aimed at verifying the effectiveness of the didactic intervention on emergent reading skills. As described in greater details in Section 3.4.2, children's decoding skills were measured in terms of accuracy and speed by means of the finger-tracking, tablet-based web application *ReadLet* (Taxitari et al., 2020). The original testing protocol consisted of thirty words and thirty nonwords to be read in isolation, plus two short narrative texts with three comprehension questions each. Tracking times for single words were automatically recorded by the application, while reading errors were manually annotated by the experimenter. Reading comprehension was not evaluated in this study.

4.5. Results

4.5.1. Descriptive statistics

Performance of Monolingual and Bilingual Experimentals and Monolingual and Bilingual Controls was compared on all tasks administered in pre-test phase. Assumptions of normality and homoscedasticity were verified via Shapiro-Wilk (*shapiro.test* function on R) test for normality and Levene's test (*leveneTest* function on R) for homoscedasticity. When these assumptions were not met (p -value < .05), Kruskal-Wallis test (*kruskal.test* function on R) was used to compare raw score means between groups; otherwise, ANOVAs were employed (*aov* function on R; R Core Team, 2023). Results are reported in Table 5. F values refer to results from ANOVAs (Nonverbal Intelligence, Rhyme Detection), while χ^2 values to results from Kruskal-Wallis test (Nonword Repetition, Phoneme Blending).

EX (N=38)		CON (N=36)		F/χ^2	p
MONO (N=27)	BI (N=11)	MONO (N=17)	BI (N=19)		

	<i>Mean acc.</i> (SD)	<i>Mean acc.</i> (SD)	<i>Mean acc.</i> (SD)	<i>Mean acc.</i> (SD)		
NVI ₍₃₆₎	20.00 (4.98)	20.36 (6.05)	22.65 (6.46)	17.10 (6.58)	F = 2.65	.055
NWR ₍₄₀₎	25.52 (3.75)	20.91 (3.96)	24.35 (6.49)	18.63 (6.91)	$\chi^2 = 15.02$	< .01**
RD ₍₁₀₎	6.59 (2.37)	4.45 (2.94)	6.12 (3.12)	4.35 (2.40)	F = 3.41	< .05*
PB ₍₁₂₎	2.04 (2.98)	0.36 (0.67)	4.59 (4.80)	1.53 (3.10)	$\chi^2 = 7.58$	.055

Table 5. Descriptive statistics (*M*, *SD*) for monolingual and bilingual EX and CON accuracy (raw scores) on pre-test Nonverbal Intelligence (NVI), Nonword Repetition (NWR), Rhyme Detection (RD), and Phoneme Blending (PB), together with *F* or χ^2 and *p*-value from one-way ANOVA or Kruskal-Wallis test. Numbers between parentheses in the first column indicate maximum possible score for each task.

Significant results from ANOVAs and Kruskal-Wallis confronts were further explored using post-hoc tests (TukeyHSD for ANOVAs, non-parametric Pairwise Wilcoxon for Kruskal-Wallis). TukeyHSD performed on RD results showed that the only significant difference emerged between EX M and CON B, where the former obtained a significantly higher score in Rhyme Detection at pre-test ($p < .05$); the same picture emerged for Nonword Repetition (Experimental Monolinguals significantly better than Control Bilinguals, Pairwise Wilcoxon significant at $p < .01$). The four groups did not differ in Nonverbal Intelligence and Phoneme Blending. Therefore, pre-test differences were observed exclusively between experimental monolinguals and control bilinguals. This gap in Rhyme Detection and Nonword Repetition could be attributed to an influence of language competence, as already hypothesised in Study 1. Importantly, no differences emerged here within monolinguals and bilinguals between experimental and control groups, allowing us to conclude that experimental and control children belonging to the same language group tackled the experimental protocol with comparable (meta)linguistic skills.

Since between-group differences were very limited, we decided to proceed with the administration of the intervention as planned; also, comparable levels of Nonverbal Intelligence ensured comparable cognitive levels among groups.

Bilinguals' linguistic history and familial context was also compared between the two groups (χ^2 test for categorical variables). EX ($N = 11$) and CON ($N = 19$) bilingual children did not differ in first age of exposure to Italian ($\chi^2(7) = 11.38, p = .12$), first age of kindergarten attendance ($\chi^2(1) = 0.15, p = .69$), presence of language concerns before 4 ($\chi^2(1) = 0, p = 1.00$), highest education of

the main caregiver in Italian ($\chi^2(3) = 2.95, p = .40$) and in the family language ($\chi^2(4) = 2.23, p = .69$), gender ($\chi^2(1) = 0.39, p = .53$), number of siblings ($\chi^2(3) = 4.65, p = .21$) or birth order ($\chi^2(3) = 4.95, p = .17$).

The overall homogeneity of age, Nonverbal Intelligence, phonological measures and bilingual experience of the BI sample ensured the equal initial conditions necessary for the administration of the didactic intervention.

4.5.2. Effectiveness of phonological training on phonological skills

Raw scores (means and standard deviations) for post-test results from Nonword Repetition, Rhyme Detection, and Phoneme Blending are reported in Table 6. Group means were compared through Kruskal-Wallis tests.

	EX (N=38)		CON (N=36)		χ^2	<i>p</i>
	MONO (N=27)	BI (N=11)	MONO (N=17)	BI (N=19)		
	Mean acc. (SD)	Mean acc. (SD)	Mean acc. (SD)	Mean acc. (SD)		
NWR ₍₄₀₎	26.37 (4.57)	24.64 (5.43)	26.65 (5.74)	21.31 (7.11)	7.45	.06
RD ₍₁₀₎	7.30 (2.43)	5.36 (3.20)	7.35 (2.37)	4.10 (2.35)	18.49	< .001***
PB ₍₁₂₎	3.37 (3.31)	2.18 (1.99)	5.00 (4.62)	1.63 (3.35)	9.37	< .05*

Table 6. Descriptive statistics (*M*, *SD*) for monolingual and bilingual EX and CON accuracy (raw scores) on post-test Nonword Repetition (NWR), Rhyme Detection (RD), and Phoneme Blending (PB), together with χ^2 and *p*-value from Kruskal-Wallis test. Numbers between parentheses in the first column indicate maximum possible score for each task.

Effectiveness of the phonological training was analysed with mixed-effect models using the lmerTest package (Kuznetsova et al., 2017). Normalized scores (raw scores divided by number of total items) from NWR, PB and RD were fitted as dependent variables to distinct mixed-effect models. The contribution of Time (pre- vs. post-test), Language (MONO vs. BI), Group (EX vs.

CON), and of their interactions to the models' fit was tested by a stepwise removal procedure. Participants were included as random effects and always contributed to the model's fitting.

As for Nonword Repetition, the final model only included main effects of Language and Time. Analysis of fixed effects reported a significant effect of Time ($F(1, 73) = 15.81, p < .001$) and Language ($F(1, 72) = 15.62, p < .001$). Both effects were further explored by post-hoc analyses run with emmeans (R Core Team, 2023). These evidenced a significant increase of accuracy in Nonword Repetition for the whole sample at post-test, irrespective of intervention (Estimate = 0.05, SE = 0.01, $t(73) = 3.98, p < .001$). Post-hoc analyses also revealed a significant poorer performance of the BI group (Estimate = 0.12, SE = 0.03, $t(72) = 3.95, p < .001$).

Rhyme Detection final model yielded the same result, with only main effects of Time and Language included. Fixed effect of Time ($F(1, 71.44) = 5.78, p < .05$) and Language ($F(1, 72.49) = 19.98, p < .001$) were significant. Post-hoc analyses revealed a significant improvement of the whole sample, irrespective of intervention (Estimate = 0.06, SE = 0.03, $t(71) = 2.40, p < .05$), and a significantly less accurate performance by the BI group (Estimate = 0.24, SE = 0.05, $t(72.1) = 4.47, p < .001$). To sum up, post-test results showed that the phonological training was not effective on Nonword Repetition and Rhyme Detection, as the four groups improved comparably.

The final model for Phoneme Blending included Time, Language and Group main effects and Time $\times$ Group interaction. Analysis of fixed effects reported a significant effect of Language ($F(1, 71) = 8.94, p < .01$) and of Time $\times$ Group interaction ($F(1, 72) = 6.38, p < .05$). Post-hoc analyses on Language revealed a significantly poorer performance for the BI group (Estimate = 0.19, SE = 0.07, $t(71) = 2.99, p < .01$). As for Time $\times$ Group interaction, a significant improvement in this task was found for the EX group (Estimate = 0.12, SE = 0.03, $t(72) = 4.36, p < .001$), but not for the CON group (Estimate = 0.02, SE = 0.03, $t(72) = 0.72, p = 0.89$). Results of the interaction are displayed on Figure 4, indicating that the training was effective, for both monolingual and bilingual children.

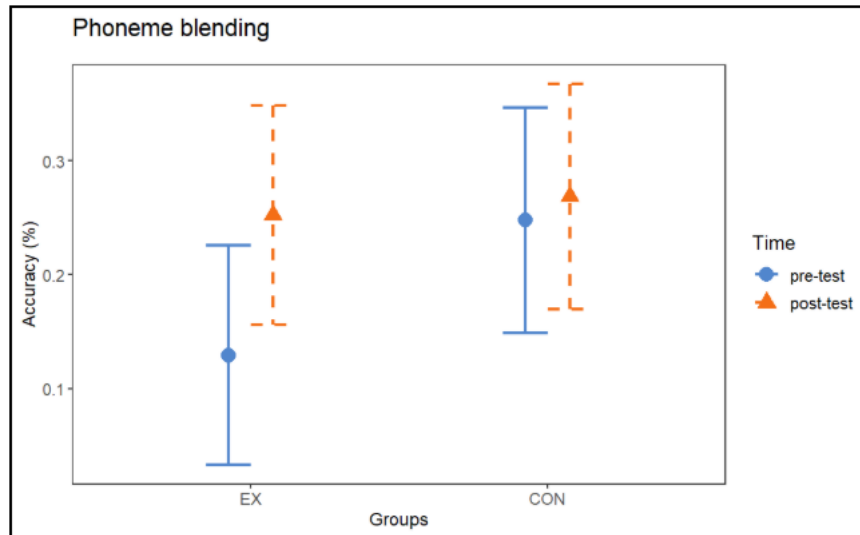


Figure 4. Effects of the interaction between Group and Time on Phoneme Blending task accuracy.

4.5.3. Effectiveness of phonological training on reading skills

Long-term effect of kindergarten phonological training was also verified. Specifically, mixed-effects models were run to explore potential differences between EX and CON groups in 1st Grade reading skills. Models included reading outcomes (speed and accuracy) as dependent variables, while the effects of Group (EX and CON), Language (MONO and BI), and Item (Word, Nonword, Text) and of their interactions were fitted as independent variables. Participants were included as random effects and always contributed to the model's fitting. Descriptive statistics and results from Kruskal-Wallis tests for reading accuracy are reported in Table 7.

	EX (N=38)		CON (N=36)		χ^2	<i>p</i>
	MONO (N=27)	BI (N=11)	MONO (N=17)	BI (N=19)		
	Mean errors (SD)	Mean errors (SD)	Mean errors (SD)	Mean errors (SD)		
WORDS (30)	2.78 (2.22)	3.45 (3.47)	2.40 (2.26)	6.05 (6.02)	4.04	.26
NONWORDS (30)	6.96 (3.12)	7.73 (6.72)	6.33 (5.79)	8.89 (5.15)	2.94	.40

TEXTS ⁽¹⁴⁵⁾	5.38 (4.09)	4.82 (4.26)	6.07 (5.55)	11.82 (9.84)	5.55	.13

Table 7. Descriptive statistics (*M*, *SD*) for Monolingual and Bilingual Experimental and Control groups reading errors for Words, Nonwords, and Texts measured in 1st Grade, together with χ^2 and *p*-value from Kruskal-Wallis test. Numbers between parentheses in the first column indicate overall stimuli for each Item.

As for reading accuracy, the final model only included main effects of Language ($F(1, 57.57) = 6.26, p < .05$) and Item ($F(2, 125.23) = 92.16, p < .001$), but no interactions. Post-hoc analyses revealed that MONO children were generally more accurate than BI (Estimate = -0.06, *SE* = 0.02, $t(70.1) = -2.50, p < .05$), and that Nonwords were read slower than Words in isolation (Estimate = 0.13, *SE* = 0.01, $t(139) = 9.02, p < .001$), which were in turn read slower than Text (Estimate = -0.06, *SE* = 0.01, $t(139) = -4.37, p < .001$) for the whole sample.

Descriptive statistics and results from Kruskal-Wallis tests for reading times (in seconds) are reported in Table 8. The final model for reading speed included the interaction between Group, Language and Item, which resulted significant ($F(2, 13511) = 60.19, p < .001$). Interactions between variables' levels were further explored via emmeans. This analysis revealed that, for the MONO group, EX children were faster than CON in Nonword reading (Estimate = 0.60, *SE* = 0.29, $z(\sim 0) = 2.07, p < .05$). For the BI group the opposite effect emerged: EX children were slower than CON in Nonword reading (Estimate = -0.79, *SE* = 0.35, $z(\sim 0) = -2.27, p < .05$). Results are visualized in Figure 5.

This result suggests that the training had a long-term impact on sublexical reading, but exclusively for Monolinguals; Experimental Bilinguals' reading outcomes, instead, were not affected by the phonological training.

EX (N=38)		CON (N=36)		χ^2	<i>p</i>
MONO (N=27)	BI (N=11)	MONO(N=17)	BI (N=19)		
Mean seconds (SD)	Mean seconds (SD)	Mean seconds (SD)	Mean seconds (SD)		

WORDS	2.20 (1.68)	3.21 (2.63)	2.53 (2.28)	2.62 (2.28)	35.28	< .001***
NONWORDS	2.50 (1.82)	3.46 (2.82)	3.13 (2.36)	2.55 (2.03)	36.97	< .001***
TEXTS	1.18 (1.33)	1.46 (1.66)	1.16 (1.42)	1.40 (1.67)	65.38	< .001***

Table 8. Descriptive statistics (*M*, *SD*) for Monolingual and Bilingual Experimental and Control groups reading times for single stimuli (in seconds) for Words, Nonwords, and Texts measured in 1st Grade, together with χ^2 and *p*-value from Kruskal-Wallis test.

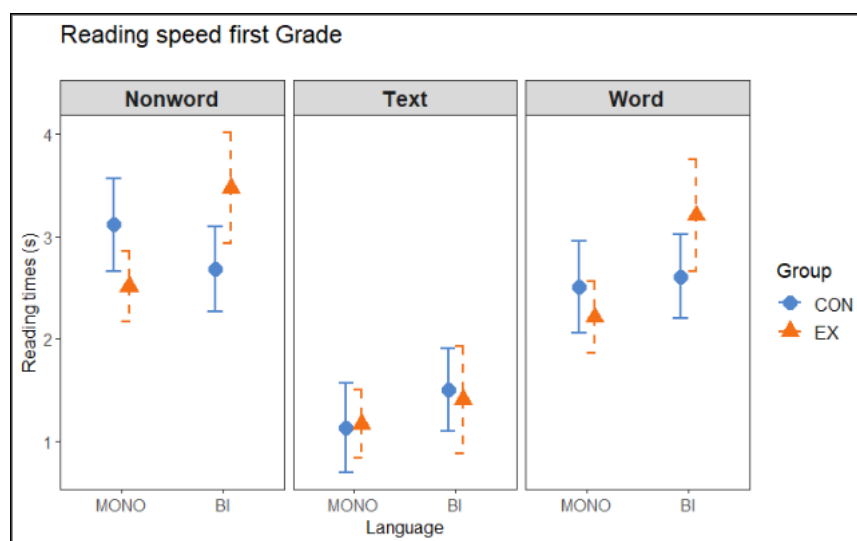


Figure 5. Effects of the interaction between Group, Language and Item on reading speed in 1st Grade.

No other interaction resulted significant, as both MONO and BI children from EX and CON groups performed comparably in Word and Text reading speed (see Figure 5).

4.6. Discussion

The aim of the present study was to verify the effectiveness of a didactic intervention on phonological awareness in improving concurrent phonological skills and later decoding abilities of preschoolers. Additionally, potential differences between monolingual and bilingual children with a migration background in the training effectiveness was also explored.

4.6.1. Training effectiveness on concurrent phonological skills

Preschoolers' phonological skills were assessed in terms of Nonword Repetition, Rhyme Detection, and Phoneme Blending. After this initial phase, a selected group of children (N = 38, 27 MONO, 11 BI) took part in a 9-hour didactic intervention on phonological awareness that, by means of games focused on progressively less salient units and more complex operations, was aimed at enhancing children's phonological skills and later reading acquisition.

As for effectiveness on phonological skills, data analysis revealed that the proposed training was effective for Phoneme Blending, but not for Rhyme Detection or Nonword Repetition. Specifically, a significant effect of Time (pre- vs. post-test) for both Rhyme Detection and Nonword Repetition, but no effect of Group (EX vs. CON), indicated that these two skills improved in both the experimental and control groups, that is, irrespective of the intervention.

Training effects on rhyme detection are usually found (Brady et al., 1994; Engel de Abreu et al., 2020; McIntosh et al., 2007; Muñoz et al., 2018; Patscheke et al., 2016; see Section 2.4); however, as observed by Lundberg and colleagues (1988), improvements in this task may be limited, compared to other units more directly related to decoding (e.g., phonemes). According to the authors, this reduced effect may be due to a greater independence of rhyme sensitivity from explicit training or literacy acquisition. As claimed by Morais and colleagues (1986), rhyme detection does not involve the explicit manipulation of phonological segments, but rather a sensitivity to sound similarity, that may develop independently from reading. Another possible explanation for the absence of training effects may be linked to the limited time allocated for this skill: due to organizational issues, the meetings of the first two weeks had to include both word- and rhyme-centred activities, and this may have reduced the potential effectiveness of the intervention on this skill.

The fact that Nonword Repetition was not affected by intervention could be attributed to the nature of this task. Nonword repetition, in fact, taps directly into phonological memory, which is more closely related to short-term and working memory than to purely phonological skills. Although specific sessions dedicated to nonword repetition were included, this skill would probably have benefitted more from activities targeting memory abilities. As hypothesised for Rhyme Detection, the reduced time dedicated to this skill during the training may have also played a role.

Finally, the gains displayed by the experimental group in Phoneme Blending are perhaps the most relevant for claiming the effectiveness of our original intervention program. As shown in Table 5, all groups initially struggled with this task, presumably because it taps a skill which is strongly influenced by orthographic knowledge. However, after gradually approaching increasingly smaller phonological units, the experimental children were eventually able to blend single sounds into words, even prior formal reading instruction. This result is in line with previous studies reporting that the greatest gains are observed for small-sized phonological units, as these are typically less salient and accessible (Anthony et al., 2002; Treiman and Zukowski, 1996) and may benefit more from explicit reflection (Cunningham, 1990; Lundberg et al., 1988; see Section 2.4). Beneficial effects of didactic interventions on phoneme-based operations have also been found in transparent orthographies (Kartal et al., 2016; Kozminsky and Kozminsky, 1995; Pfof et al., 2019; Wolff and Gustafsson, 2022), including Italian (Casani, 2021; Goffredo et al., 2016; Majorano et al., 2022, 2023; Zanchi et al., 2012; see Section 2.4.3). Interestingly, no Language effect was found in the model examining effectiveness on Phoneme Blending, meaning that both monolingual and bilingual children displayed equal gains. This partially contrasts what has been frequently observed in past studies, namely that individuals with poorer language competence are those showing the greatest gains (Ehri et al., 2001; Pfof et al., 2019; Suggate, 2016; Wolff and Gustafsson, 2022). However, this result may have been influenced by the very low scores displayed by both language groups in this task at pre-test, which may have set a comparable baseline for improvement. To summarize, considering phonological skills, our intervention program was effective on operations involving small-grained units (Phoneme Blending), but not on large-grained and more accessible ones (Rhyme Detection) or on those involving phonological memory (Nonword Repetition), possibly due to the nature of these units and operations, or to the shorter time allocated to these activities. In order to rule out the latter possibility, future research should plan intervention programs with a more balanced time distribution across phonological units.

4.6.2. Training effectiveness on later decoding skills

When enrolled in 1st Grade, children were tested on reading skills to verify the potential long-term effects of the preschool didactic intervention. This was done through a finger-tracking technology tool, *ReadLet* (Taxitari et al., 2020), which allowed for the collection of fine-grained data on reading decoding (speed and accuracy) across different reading stimuli (Words, Nonwords, Texts). To verify the impact of the didactic intervention on these skills, linear regressions were run

separately for each reading component, looking at potential interactions between Group (EX vs. CON), Language (MONO vs. BI) and Item (Words vs. Nonwords vs. Text). As for reading accuracy, no effect of Group was found, meaning that both Experimental and Control children read all Items at comparable accuracy. Further details on the effects of Language and Item on reading outcomes can be found in Study 1 (see Section 3.5.3). This result was expected, as, overall, very few studies have reported long-term effectiveness of didactic interventions administered in kindergarten, and most of them involved children learning to read in an opaque orthography (Brady et al., 1994; Bus and Van IJzendoorn, 1999; Ehri et al., 2001; Stuart, 1999, 2004; Suggate, 2016). As largely discussed in this dissertation, transparent orthographies allow children to reach high levels of accuracy in a relatively short amount of time, thanks to the consistent grapheme-phoneme mapping (Seymour et al., 2003).

The linear regression model for reading speed, instead, yielded a significant interaction between Group, Language and Item, showing that Monolingual children from the Experimental group outperformed their Control peers in Nonword reading speed. Conversely, this was not the case for Bilingual Experimental children, who underperformed their Control peers. The result observed for MONO EX participants can be tentatively interpreted as a long-term transfer of the benefits acquired from the phonological training. As discussed above, gains were observed in Phoneme Blending, a task tapping sublexical skills. These skills are precisely those involved in the phoneme-grapheme conversion route, the only reading strategy that can be exploited when approaching nonwords. The fact that this benefit did not extend to bilingual children might be due to the relatively short duration of the intervention (nine hours) and the long time gap between the training and the reading assessment. Given their weak language skills, they might have derived more lasting benefits from a longer training period (Gunn et al., 2000; Konerding et al., 2020).

Very few studies have examined long-term effects of kindergarten phonological training on later reading outcomes in Italian children (Casani, 2021; Majorano et al., 2023). These studies have found benefits on 1st Grade reading, especially in the speed component, in line with our results (Casani, 2021); however, the long-term transfer of phonological training benefits in Italian readers clearly warrants further investigation.

4.7. Limitations and conclusive remarks

The present study, albeit limited in scope, confirmed that phonological awareness can be trained in both monolingual and bilingual preschoolers. This finding suggests that carefully designed

training protocols should complement early screening tools, such as the one presented in Study 1, to help bilingual children reduce the initial language gap that separates them from their monolingual peers.

As mentioned, the study was limited in terms of sample size and duration of the intervention. Furthermore, since the pre-test protocol was part of a larger study (Study 1; see previous chapter) tapping a variety of reading predictors, the number of phonological skills assessed was relatively low. Additionally, due to organizational reasons, our participants were not randomly assigned to the Experimental and Control groups, and this might have affected our results. Finally, the time allocated for each phonological unit (words, rhymes, syllables, phonemes) was not perfectly balanced. Future research should consider these variables in order to design potentially more effective training programs.

Overall, given the limited transfer of phonological training to reading skills evidenced also by previous studies targeting languages with a transparent orthography, and considering the difficulties that BCMB experience in reading comprehension, future intervention studies could focus on this skill and its predictors. For instance, younger children could be involved in dialogic shared reading sessions with the aim of enhancing oral comprehension skills. Alternatively, vocabulary training could also stimulate concurrent or later reading comprehension. Finally, older populations could benefit from morphological training, a skill that has been found to predict reading comprehension in Italian (Vernice and Pagliarini, 2018) and that could foster the processing of complex words.

Chapter 5 – Study 3: Supporting emerging reading skills: effectiveness of phonological training in multilingual primary school classes

5.1. Introduction

5.1.1. Profile of literacy and literacy-related abilities of monolingual and bilingual beginning readers

As largely discussed in this dissertation, children learning to read in a transparent orthography such as Italian typically reach high levels of decoding accuracy in a shorter amount of time compared to beginning readers acquiring literacy in an opaque orthography (Seymour et al., 2003). This is because, in transparent orthographies, the mapping between phonemes and graphemes is shallow, and children need to learn relatively few and highly consistent correspondences between oral and written forms of speech sounds, unlike for opaque ones.

The relatively quick acquisition of automatization in word processing allows for the allocation of more cognitive resources to oral language comprehension, which in fact has greater predictive power in emergent readers of transparent orthographies than in those learning to read in opaque ones (Florit and Cain, 2011). Nevertheless, other metalinguistic skills such as phonological awareness have been found to predict subsequent reading skills even in Italian, particularly for decoding (Orsolini et al., 2006; Pinto et al., 2016, 2017; Mascheretti et al., 2024; Tobia and Marzocchi, 2014). Findings from these studies have shown that children who achieved better scores in kindergarten assessments of phonological skills also displayed better decoding and comprehension in subsequent reading outcomes. Additionally, studies on opaque orthographies have suggested that reading acquisition itself fosters improvement in phonological abilities (Perfetti et al., 1987; Wagner et al., 1994).

However, very few studies have focused on the reading profile of Italian beginning readers, namely on how these children perform on reading and reading-related skills. In fact, most data collected on reading skills have been used to verify the longitudinal predictive power of earlier language abilities or of later reading outcomes. Furthermore, there is currently no standardised test for assessing reading components in first graders. Nonetheless, previous longitudinal studies that tested reading abilities in emergent readers consistently found that monolingual

children acquiring reading in Italian reach high decoding accuracy in a relatively short amount of time, confirming previous research on transparent languages (Seymour et al., 2003).

Desimoni and colleagues (2012), for instance, tested a sample of first graders on text reading, measuring accuracy, speed and comprehension in Italian. They observed that the average number of reading errors made by beginning readers was as low as 7.48, over a total of 75 words. Results obtained by administering the same test (*Prove MT*, Cornoldi and Colpo, 1998) to another sample of first graders yielded comparable results, namely 10.18 errors (Pinto et al., 2016). A similar proportion of mistakes was reported by Majorano and colleagues (2021), who assessed reading accuracy with a word-in-isolation reading task (Martini, 1995), finding an average of 4.51 errors over 40 words. Overall, first graders in Italian studies therefore reach an accuracy rate around 90%, while children of the same age learning to read in opaque orthographies achieve only about 50% (Seymour et al., 2003). On the other hand, the same studies report hardly comparable values for reading speed: 66.79 syllables per minute in Desimoni et al. (2012), 1.57 seconds per syllable in Pinto et al. (2016), and 158.92 syllables per minute in Majorano et al. (2021).

In addition, research on beginning reading skills in bilingual children with a migration background is very scarce in Italian. To our knowledge, only Casani (2021) compared bilingual and monolingual first graders on reading measures. Specifically, the author found that the two groups performed comparably in sublexical reading speed, but bilinguals were less accurate; at the same time, bilinguals were both less accurate and slower in text reading, as well as in text comprehension. These results align with our findings from Study 1, where low-performing children in kindergarten pre-reading skills – almost exclusively BCMB – were also weaker in several reading measures in 1st Grade. These results are in line with findings from other languages (English, August et al., 2009; French, Bellocchi and Bonifacci, 2024; Bignon et al., 2025; German, Duzy et al., 2014; Norwegian, Lervåg and Aukrust, 2010; Dutch, Droop and Verhoeven, 2003; Janssen et al., 2011; Verhoeven, 1990, 2000; see Section 1.3.3).

Specific components of reading, such as word and text decoding or reading comprehension, appear to be challenging to acquire for BCMB. As previously discussed, these initial difficulties are mainly attributable to the linguistic gap existing between bilinguals and monolinguals (see Sections 1.3.2, 1.3.3, and 1.3.5). However, further research is needed to obtain a clearer profile of emerging bilingual reading competence in Italian.

5.1.2. Phonological training on beginning readers and its effect on reading performance

Besides comprehensive screening protocols, in Study 2 we have seen that both bilingual and monolingual preschoolers can benefit from phonological training, with gains in both phonological skills and sublexical reading for monolinguals, and limited to the former for bilinguals. Our hypothesis to explain this result considered the possibility that bilinguals would have benefitted more from a longer intervention or from one administered closer to the time of the reading assessment. Engel de Abreu and colleagues (2020), for instance, found a positive effect of a 20-hour intervention administered in kindergarten on reading outcomes measured nine months later in bilingual children⁵. Our intervention, by contrast, lasted only nine hours, and children were assessed on reading skills about one year later. Additionally, previous studies have suggested that long-term effects of phonological training on reading tend to be more consistent for opaque orthographies (Bus and Van IJzendoorn, 1999; Ehri et al., 2001; Suggate, 2016; see Section 2.4)

However, as discussed in Section 2.4.4, phonological training programs have proven effective also for children who had already started their reading acquisition path (Cunningham, 1990; Defior and Tudela, 1994; Gillon et al., 2019; Gunn et al., 2000; Konderding et al., 2020; Lie, 1991; Ludwig et al., 2019; Poskiparta et al., 1999; Reading and Van Deuren, 2007; Uhry and Shepherd, 1993). The rationale behind these studies was the idea that the acquisition of basic reading principles allows children to manipulate less salient phonological units and perform more demanding operations, and that the benefits obtained from this active reflection can, in turn, enhance reading performance. All these studies have shown an improvement in decoding skills for words, nonwords and texts. In the initial phase of literacy acquisition, when decoding is still developing and plays a crucial role in reading strategies, children could derive the greatest benefits from a training that focuses on the abilities underlying decoding.

As observed in Study 2, bilingual children can also benefit from phonological training. To our knowledge, the effectiveness of phonological training on bilingual and monolingual Italian first graders was explored only by Casani (2021), who found positive effects on word reading speed, nonword decoding, and text speed and accuracy (limited to monolinguals) after an 11-hour training focused on rhymes, syllables, and phonemes manipulation. However, this training was

⁵ Even though benefits on reading were observed exclusively for word comprehension, a task consisting in matching a picture with the correct written word among four. No benefits, instead, were found for word and nonword reading.

administered after a 20-hour intervention delivered to the same sample in kindergarten, so that disentangling the impact of the two is challenging.

5.2. The study

Building on these premises, our intervention study was guided by the following research questions:

- (RQ1) What is the profile of reading and reading-related (phonological) skills in Italian monolingual and bilingual first graders with a migration background?
- (RQ2) What is the effectiveness of a didactic intervention focused on phonological awareness on concurrent phonological skills and decoding in first graders learning to read in a transparent orthography?
- (RQ3) Does the effectiveness of the phonological training differ between Italian monolingual and bilingual first-graders with a migration background?

We expect bilingual children to perform more poorly than monolinguals, especially in more complex phonological tasks. As for reading skills, bilinguals' difficulties should emerge particularly for the speed component. Finally, we expect the didactic intervention to provide benefits for both language groups, both on phonological skills and reading.

The guidelines followed for the design of the intervention have already been described in Section 2.4.5. Given the validity of the *ReadLet* protocol for first graders, as shown by our results from Study 1, fine-grained data on decoding and comprehension were again collected by means of finger-tracking (Taxitari et al., 2020).

5.3. Participants

5.3.1. Groups

The sample for the present study included 76 children ($M = 6.65$, $SD = 0.78$), all enrolled in the 1st Grade of Italian primary schools (*scuola primaria*) and with at least 6 months of formal reading instruction at the time of testing.

Among them, 53 were monolingual speakers of Italian (hereafter, MONO group) and 23 were bilingual speakers with heterogeneous family languages and Italian as community language (BI

group). All bilingual participants, with the exception of two, were born and raised in Italy. Of the two born abroad, only one did not attend kindergarten in Italy. All bilingual children came from families with a migration background.

The family languages spoken by the BI group were Romanian (6), Arabic (4), Chinese (3), Moldovan (3), Sri Lankan (2), English (1), Albanian (1), Hindi (1), Spanish (1), and Kosovan (1).

Participants were further divided into groups based on attendance at the phonological training sessions. For practical reasons, we decided to adhere to the pre-existing classroom division, selecting two classes for the phonological training (experimental group, EX) and two as controls (control group, CON). As a result, the experimental group included 34 participants (25 MONO, 9 BI), while the control group 42 (28 MONO, 14 BI).

5.3.2. Recruitment

Participants were recruited through collaboration with the *Istituti Comprensivi (IC)* 1 and 2 of San Giovanni Lupatoto, near Verona, in northern Italy. A connection with the primary schools of these institutes had already been established in the context of the longitudinal study, as many participating children were enrolled in those schools. After presenting the project to the headmasters, two 1st Grade classes expressed their interest in participating: one from the school “Antonio Cesari”, and one from the school “Don Bernardo Antonini”, both part of IC2. To reach the target number of participants, we also contacted the private school “Virgo Carmeli”, whose teachers had previously collaborated with our research team. The headmaster approved the project, allowing both 1st Grade classes of the institute to take part. This school, located in the suburban area of Verona (specifically in the Golosine neighborhood), enabled us to involve children from a sociocultural context comparable to that of the other participating schools.

To ensure voluntary and informed participation, all parents received a consent form together with an information sheet with details on the study. The document included information about the duration of the project, the non-invasive and playful nature of both the tests and intervention, and the participants’ right to withdraw at any time. Pseudonymisation of all collected data was also guaranteed.

5.3.3. Inclusion criteria

To be included in the sample, participants had to meet the following criteria: (i) having Italian as the only language or Italian as community language and another language as family language; (ii) being enrolled in the first year of an Italian primary school; (iii) not having received a formal reading or writing instruction in other languages than Italian; (iv) not being diagnosed with cognitive or linguistic impairments.

The initial sample for this study consisted of 76 children. However, two bilingual children from the control group were excluded from data analysis as they were unable to complete at least 70% of the tasks due to poor language competence, possibly due to undiagnosed language impairments. Data from one monolingual control child were also excluded due to a prolonged absence during the post-test phase, which prevented participation in any testing session. Finally, language background information could not be collected for eight participants due to parents' unavailability to complete the questionnaire; however, these participants were retained in the sample.

The final sample included in the analyses thus comprised 73 children: 52 monolinguals and 21 bilinguals.

5.4. Study design

The present study aimed to obtain a comprehensive profile of reading and reading-related phonological skills in monolingual and bilingual beginning readers acquiring literacy in Italian. Additionally, we wanted to evaluate the effectiveness of a didactic intervention focused on phonological awareness, both in improving this specific ability and in enhancing reading skills more broadly. To address these aims, we conducted an intervention study divided into three phases.

In Phase 1, our sample was tested on a range of phonological awareness skills and on reading, measuring both decoding and comprehension. The phonological tasks were selected based on prior research identifying them as significant predictors of reading development (see Chapter 2), and included the following: Nonword Repetition, Rhyme Detection, Syllable Blending and Deletion, Phoneme Blending and Deletion.

Reading abilities were assessed using a finger-tracking methodology, allowing for fine-grained measures of decoding and comprehension processes (see Section 1.2). In addition, data on working memory, lexical access, vocabulary, and morphosyntactic comprehension were collected as complementary measures. Finally, the *Q-BEx* questionnaire (De Cat et al., 2023) was administered to parents of bilingual children, to obtain quantitative measures of linguistic competence and exposure (see Table 2).

Phase 2 consisted of the implementation of a phonological training program. Given the pivotal role of phonological awareness in reading development, we wanted to investigate whether explicit instruction of this skill would yield benefits for reading performance as well. Although previous studies and meta-analyses have demonstrated that targeted training can enhance reading abilities in beginning readers (see Section 2.4.4), to our knowledge no study has yet explored this effect within monolingual and bilingual pupils in Italian classrooms.

Only a subset of participants (experimental group) received the intervention. To ensure maximal equity and balance, one class from the San Giovanni Lupatoto institute (“Cesari” school) and one from the school located in the suburban area of Verona (“Virgo Carmeli”) were selected to constitute the experimental group (N = 34, 25 MONO, 9 BI). The two remaining classes were assigned to the control group and were involved in regular school activities for the duration of the intervention (N = 39, 27 MONO, 12 BI; see Table 1). Methodological and procedural details are available in the following section.

Phase 3 involved post-intervention testing. All children were assessed again using the same measures employed in Phase 1. This final stage of the project served to evaluate the potential impact of the phonological training both on phonological and reading skills.

	Experimental (N = 34)		Control (N = 39)	
Language	MONO (N = 25)	BI (N = 9)	MONO (N = 27)	BI (N = 12)
Mean age (sd)	6.81 (0.32)	6.80 (0.48)	6.49 (1.19)	6.70 (0.29)
Gender	13 F, 12 M	4 F, 5 M	16 F, 11 M	8 F, 4 M

Table 1. Participants divided by Group (Experimental and Control) and Language (Monolinguals and Bilinguals), with mean age (sd) and gender.

Bilinguals		
	Experimental (N = 5)	Control (N = 8)
Age (months) of first exposure to Italian	16.80 (31.29)	8.75 (12.37)
First age (months) of kindergarten attendance	25.80 (11.69)	29.75 (16.58)
Number of siblings	1.4 (1.14)	1.5 (1.51)
Birth order		1 st birth = 1
	2 nd birth = 3	2 nd birth = 4
	3 rd birth = 1	3 rd birth = 1
	no siblings = 1	6 th birth = 1
		no siblings = 1
Cumulative exposure Italian (%)	43.02 (25.74)	56.62 (19.84)
Cumulative exposure family language (%)	35.99 (18.44)	35.38 (18.76)
Cumulative use Italian (%)	41.58 (22.69)	57.12 (17.32)
Cumulative use family language (%)	33.54 (22.38)	27.51 (14.24)
Understanding family language	pretty well = 4	not very well = 2
	very well = 1	pretty well = 1
		very well = 5
Speaking family language	not very well = 1	not very well = 3
	pretty well = 3	pretty well = 2
	very well = 1	very well = 3
Highest education main caregiver	secondary school or equivalent = 2	none = 1
	post-secondary school training (no university degree) = 1	primary school = 1
		secondary school or equivalent = 3

	university degree = 2	post-secondary school training (no university degree) = 2
		university degree = 1

Table 2. Mean (sd) data for bilingual participants obtained from the Q-BEx questionnaire. Birth order, Understanding and Speaking family language, and Highest education main caregiver (categorical variables) report number of answers for each value.

5.4.1. Phase 1: pre-test on phonological awareness and reading skills

5.4.1.1. Materials

5.4.1.1.1. Phonological awareness

Nonword Repetition

The same task used in Study 1 was included in the present research (see Paragraph 3.4.1.1). The test, designed by Vender and colleagues (2020), consisted of forty nonwords constructed according to Italian phonotactic rules.

Rhyme Detection

The same test employed in Study 1 was used here as well (Vender and Melloni 2021; see Paragraph 3.4.1.1). After being presented with a word and its corresponding image, children were asked to select the rhyming word among a phonological distractor, a semantic distractor, and the target.

Syllable Blending

The syllable blending task was developed specifically for the present study. It included twelve stimuli, each consisting of a high-frequency noun (*Nuovo vocabolario di base della lingua italiana*, De Mauro, 2016) varying for syllabic structure (CV, CVC, CCV syllables) and length (two to five syllables).

All stimuli were orally segmented into syllables by the experimenter, and the child was asked to blend them and say the complete word immediately afterward.

Syllable Deletion

This task was also created for the present study. It consisted of twelve items, all high-frequency trisyllabic nouns selected from the *Nvdb* (De Mauro, 2016) and beginning with structurally different syllables (CV, CVC, CCV, V). After hearing a word, the child was asked to identify and say aloud the first syllable, then repeat the word without it.

Phoneme Blending

The same task employed in Study 1 was used in the present protocol. After hearing a word segmented phoneme by phoneme, participants were asked to blend the individual sounds and say the whole word.

Phoneme Deletion

The final phonological awareness task followed the same procedure as the syllable deletion task. In this case, children were required to identify the first phoneme of a given word, remove it, and then pronounce the remaining part. The stimuli (twelve items) were high-frequency nouns selected from the *Nvdb* (De Mauro, 2016). Complete pre-test materials can be found in Appendix E.

5.4.1.1.2. Reading skills

Reading abilities, in terms of decoding and comprehension, were assessed using the finger-tracking web application *ReadLet* (Ferro et al., 2018; see Section 1.2). The protocol included the same reading tasks used in Study 1, namely a Word and Nonword in isolation reading task, and two short narrative Texts accompanied by comprehension questions (see Paragraph 3.4.2.1). For the purpose of the present study, the Word and Nonword lists were randomized in two different orders and randomly assigned to participants for the pre- and post-test phases. Additionally, two new short narrative Texts with comparable structure were created to avoid facilitation effects across testing phases. To ensure comparability and readability, all texts were uploaded to the *READ-IT* platform (Dell’Orletta et al., 2011); Table 3 below summarizes the main textual parameters considered for the four stories, while Table 4 reports the text and the comprehension questions of one of the stories in the protocol, *L’uccellino*.

Words (tokens)	N° of periods	GULPEASE index	Words belonging to the VdB

Il coniglietto	73	6	63,5	87,2%
Il riccio	72	6	66,4	92,3%
La Befana	66	6	64,6	88%
L'uccellino	71	7	66,3	86%

Table 3. Parameters considered for textual comparison on the READ-IT platform.

	L'uccellino	The little bird
Text	Marta gioca spesso a palla con il papà. Un giorno, mentre giocano in giardino, vede un uccellino che è caduto dal nido. “Povero uccellino, deve essere ferito! Portiamolo a casa.”	Marta often plays ball with her dad. One day, while they’re playing in the garden, she sees a little bird that has fallen from its nest. “Poor little bird, it must be hurt! Let’s take it home,” she says.
	Dopo qualche giorno, l'uccellino sta meglio ed è pronto a tornare a volare. Marta allora lo porta in giardino per farlo volare verso il nido.	After a few days, the bird is feeling better and is ready to fly again. So Marta brings it back to the garden to help it fly up toward its nest.
	Da quel giorno, Marta e l'uccellino diventano amici inseparabili e vivono insieme tante avventure.	From that day on, Marta and the little bird become inseparable friends and share many adventures together.
Comprehension question and multiple-choice answers	Dove trova Marta l'uccellino?	Where does Marta find the little bird?
	*In giardino	*In the garden
	A casa	At home
	A scuola	At school

Table 4. One of the stories included in the ReadLet protocol for this study. In the comprehension questions, the asterisk marks the correct answer.

Given the young age of the participants and their limited reading experience, the number of comprehension questions was reduced from three to one to minimize fatigue or cognitive load. As in Study 1, comprehension questions were presented as multiple-choice questions testing textual comprehension of the stories' content. Three possible answers followed each question, including the correct answer, an answer containing an element present in the story but unrelated to the question, and an answer containing an element potentially related to the question but not present in the story. Complete pre-test materials can be found in Appendix D.

5.4.1.1.3. Additional measures

Working Memory was assessed using the *Working Memory Test Battery for Children (WMTB-C*, Pickering and Gathercole, 2001), including both a Forward and a Backward Digit Span Task. According to the model proposed by Baddeley and Hitch (1994), in which working memory is a multi-component system including a phonological loop, a visuospatial sketchpad, a central executive system, and an episodic buffer (Baddeley, 2000), activities like the Forward Digit Span task involve only the phonological loop, namely the component used to temporarily store and refresh phonological information. The Backward Digit Span task, instead, since it requires the manipulation of temporarily stored phonological information (i.e., reversing the order in which digits are presented), also involves the central executive system, responsible for the attentional control of working memory (Baddeley, 2003). Taken together, the two tasks represent a reliable measure of distinct working memory components.

Lexical access was assessed using two Rapid Automatized Naming tasks (RAN). One was the object RAN task used at T0 in Study 1 (see Paragraph 3.4.1.1). The second was a letter RAN task, where children were required to name five letters (A, B, D, M, S), arranged in a 10x5 matrix in a random order, as quickly and accurately as possible.

Finally, Receptive Vocabulary and Morphosyntactic Comprehension were assessed using two subtests from the *Batteria per la Valutazione del Linguaggio in Bambini dai 4 ai 12 anni (BVL_4-12*, Marini et al., 2015). In the vocabulary task, children were shown 42 slides on a tablet, each containing four images. After hearing a target word, they were asked to point to the image that best matched the word. The same procedure was followed for the morphosyntactic comprehension task, which used short sentences instead of single words. Sentences included

in the test were aimed at assessing the comprehension of a variety of syntactic structures, including subject-verb (*L'uccello vola*, 'the bird flies') and noun-adjective (*La bambina sporca*, 'The dirty girl') agreement, passives (*La bambina è spinta dal bambino*, 'the girl is pushed by the boy'), reflexives (*Il bambino si lava*, 'the boy washes himself'), negation (*Il bambino non dorme*, 'the boy does not sleep'), clitics (*Il bambino li tiene*, 'the boy holds them'), subject and object relatives (*Il gatto salta sul topo che è sulla sedia*, 'the cat jumps on the mouse that is on the chair'), adversatives (*La bambina, ma non il bambino, sta correndo*, 'the girl, but not the boy, is running'), and a combination of these.

To obtain quantitative data on language exposure and proficiency, the *Q-BEx* questionnaire (De Cat et al., 2023) was administered to the parents of bilingual children. The following modules were selected: Background information and Risk factors (compulsory), Language exposure and use, Language proficiency, Richness of linguistic experience.

The questionnaire was administered in person by the experimenter during individual meetings with the parents, which took place at children's schools and lasted approximately 30 minutes. This phase was carried out when children were enrolled in 2nd Grade.

5.4.1.2. Procedure

In this phase, participants took part in two pre-test sessions, each lasting approximately 30 minutes. During the first session, the following tasks were administered: Nonword Repetition, Rhyme Identification, Syllable Blending and Deletion, Phoneme Blending and Deletion, Short Term and Working Memory, and Morphosyntactic Comprehension. The second session included the reading, Rapid Automatized Naming, and Receptive Vocabulary tasks. The tasks were presented in this specific order, which was kept identical across participants. Approximately five days separated the two sessions to prevent children from missing two classes in a short time span. All sessions were conducted in a quiet room in the participants' schools. Both testing and intervention phases were carried out by the author of this dissertation. To reduce performance anxiety and create a comfortable testing environment, the experimenter always made sure to put children at ease, allowing for informal conversation and playful interactions. All tests were introduced as playful games.

Different means of administration were used: the Rhyme Detection, Vocabulary, Morphosyntactic Comprehension and reading tasks were implemented on a tablet; the Nonword

Repetition, Syllable Blending and Deletion, Phoneme Blending and Deletion and Working Memory tasks were presented orally; finally, the Rapid Automatized Naming task (lexical access) was administered on paper. Each task, except for those tapping reading skills, was preceded by practice items. For every phonological awareness or complementary measure test, answers were manually annotated by the experimenter; 1 point was awarded to correct answers, 0 otherwise. For the Rapid Naming tasks, time (in seconds) was recorded. For the reading tasks, the web application *ReadLet* automatically recorded reading times, answers to comprehension questions and response times, while reading errors were manually annotated. All tasks – except for the Nonword Repetition and the collateral measures – were designed in two parallel versions with comparable stimuli. To avoid item or memory effects, children were randomly assigned to one version for the pre-test and to the other for the post-test.

5.4.2. Phase 2: didactic intervention on phonological skills

5.4.2.1. Materials

At the beginning of each session, large *Lego*-like bricks were used to draw children's attention to the phonological unit of the day. Four-unit bricks were used during the rhyme period to represent whole words. When these were introduced, a child was asked to say a word composed of four letters (e.g., *pera*, 'pear'). During the syllable period, two-unit bricks were added on top of the longer ones, to provide a tangible representation of how syllables form words. Children were then asked to propose a word and segment it into syllables (e.g., *pe-ra*). Finally, in the phoneme period, one-unit bricks were added on top of the syllable bricks, and children were asked to segment a word first into syllables, then into phonemes (e.g., *p-e-r-a*). The aim of this activity was to provide children with a tangible representation of abstract concepts such as rhymes, syllables, and phonemes (Brady et al., 1994; Cunningham, 1990; Lundberg et al., 1988).

At the end of each period, a modified *Gioco dell'oca* ('Goose game') was used to review the concepts covered or to anticipate those coming in the next meetings. In the traditional version of the game, players move along a board based on a dice roll, with the goal of reaching the final square first. In our collaborative version, each square was associated with a category – rhyme, syllable, or sound (phonemes). After landing on a square, the child in turn answered a question related to the corresponding phonological unit, with feedback always provided. Geese represented 'rest' squares (see Figure 1).

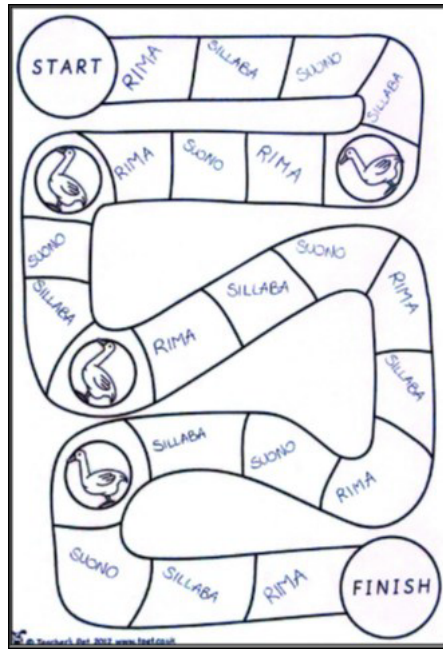


Figure 1. Board of the Goose game used to revise phonological units and operations during the intervention.

After landing on a rhyme square, for instance, children were asked questions such as ‘*Limone fa rima con balcone?*’ (‘Does *limone* rhyme with *balcone*?’) or ‘*Dimmi una parola che fa rima con rumore*’ (‘Tell me a word that rhymes with *rumore*’). Examples of syllable-related questions include ‘*Nella parola cuscino, c’è la sillaba -mo?*’ (‘Is the syllable *-mo* present in the word *cuscino*?’) or ‘*Dimmi tre parole che iniziano con la sillaba co-*’ (‘Tell me three words starting with the syllable *co-*’). Finally, questions for the phoneme squares included ‘*Che parola è p-r-a-t-o?*’ (‘What word is *p-r-a-t-o*?’) or ‘*Cosa rimane se tolgo il primo suono alla parola gallo?*’ (‘What is left if I remove the first sound from the word *gallo*?’). In this activity, questions were presented exclusively orally.

Throughout the training sessions, children received continuous feedback and support as needed.

Complete intervention materials can be found in Appendix F.

Hours 1-2: rhymes

The first two meetings were dedicated to the phonological units with a greater salience among those included in the testing protocol, namely rhymes. Rhymes were introduced to the children as words that end with the same sounds, referring to nursery rhyme books as a familiar example

to help them better grasp this concept. To make them feel at ease and familiarise with rhymes, they were encouraged to spontaneously produce pairs of rhyming words or to talk about their favourite nursery rhymes books.

To allow children to gradually get familiar with this concept, initial activities involved nursery rhyme reading and completion, moving then to exercises on rhyme identification and production.

In the nursery rhymes reading activity, two stories were selected from the book *Il Gruffalò* by Julia Donaldson and Axel Scheffler. The experimenter told the children that some rhyming words were missing from the stories and that they had to help her find them. After an introductory phase, in which the initial parts of the stories were read in full, selected rhyming words were intentionally omitted. An example follows:

“[...] *Ha ginocchia nodose*

e terribili unghione

e un bitorzolo verde

in cima al ... [nasone, or any word rhyming with unghione]

“[...] *Un grigio serpente sbucò tra l'erbetta:*

“Ma guarda quel topo...” pensò “che cenetta!”

“Ehi, topo, che fai solo nella foresta?”

Dài, vieni da me, che facciamo una ... [festa, or any word rhyming with foresta]”

Children were encouraged to complete the rhymes with any appropriate word, even if it was not originally included in the book.

The first version of the rhyme detection activity mirrored the task included in the testing protocol but used different stimuli. Children were shown four pictures at a time, representing a given word, a phonological distractor, a semantic distractor, and a target word, which were named out loud by the experimenter (e.g., *anello – arancia – collana – fratello; canestro – capelli – pallone – maestro*). They were asked to identify which word rhymed with the given one. Once the correct word was chosen, the orthographic forms of the rhyming pairs appeared on the interactive whiteboard, with the rhyming ending highlighted in red to draw attention to the relevant phonological unit (see Figure below). To increase engagement, children were encouraged to invent a short nursery rhyme using the proposed words.

The second version of the game required children to generate rhyming words independently. Images of animals were displayed on an interactive whiteboard, and, one at a time, children were asked to produce a rhyming word for each animal (e.g., *cane*, *pinguino*, *cammello*, *leone*). The corresponding orthographic forms of the given words appeared below each image, with the rhyming endings again highlighted in red. As before, children were invited to create a short nursery rhyme if they wished.



Figure 2. An example from activities with rhymes: children saw four pictures appearing one at a time on the interactive board, accompanied by the corresponding noun uttered by the experimenter. As in the experimental task, each trial included a given word (here, *cintura*, ‘belt’), a semantic distractor (*camicia*, ‘shirt’), a phonological distractor (*cinghiale*, ‘boar’) and a target rhyming word (*verdura*, ‘vegetables’). Children had to select the correct rhyming word; after that, the written forms of the relevant words appeared on the screen, with a focus on the rhyming parts.

Hours 3-6: syllables

As anticipated above, syllables were introduced as large bricks that make up words, also using a tangible representation (*Lego*-like bricks). To make children feel comfortable and to verify that they were familiar with this concept, which is typically introduced from quite early in formal reading instruction, they were asked to divide some words into syllables spontaneously, while clapping their hands to keep the pace.

During the four meetings dedicated to syllables, activities initially focused on syllable identification and production, including both simpler (open, CV) and more complex structures

(CVC or CCV(C)). After this familiarization phase, exercises shifted towards the abilities tested in the experimental session, namely blending and deletion.

In the Ship activity, at the start of the game, children heard the sentence *È in arrivo un bastimento carico di...* ('A ship is coming, and it's full of...') while viewing an image of a ship. On the next slide, a syllable was displayed along with a picture of an object beginning with that syllable (see Figure below). Children were then invited, one at a time, to suggest additional words starting with the given syllable to 'load the ship'. In the first version, only open syllables were used (e.g., *co-lore*, *so-gno*, *ca-ramella*); in the second, closed syllables and syllables with complex onsets were also included (e.g., *per-sona*, *com-pagno*, *sta-gioni*).

In the syllable deletion activity, children were shown words in written form on the interactive whiteboard. They were asked to identify the first syllable, remove it, and pronounce the remaining part. The initial items were words that turned into other real words when the first syllable is removed (e.g. *cemento* – *mento*, *capanna* – *panna*, *cucina* – *cina*); later items resulted in nonwords (*regalo* – *galo*, *nipote* – *pote*, *pavone* – *vone*). Syllables to be deleted were exclusively open at the beginning, while closed syllables or syllables with complex onsets were introduced later (*serpente* – *pente*, *programma* – *gramma*). Once children successfully identified the remaining part, its orthographic form appeared on the screen.

Other activities are described in Table 5.

Skill	Activity
Syllable identification	Children were read first words in isolation, then sentences, and finally short stories. They were asked to focus on specific syllables and, whenever they heard them, to clap their hands.
Syllable identification and segmentation	'The ship': Children had to find other words starting with the same syllable of a given word to 'load the ship'. Words starting with open, closed, and complex onsets were included.
Syllable segmentation and blending	'Syllabic chain': after the experimenter pronounced a word, a child was asked to divide it into syllables and individuate the final one. Then, the child had to find a new word starting with that syllable. The next child in the circle would repeat the process. Each word found was written on the board by the experimenter, and the complete word chain was revised at the end of each round.

Syllable deletion	Children were shown words in written form on the interactive whiteboard. They were asked to identify the first syllable, remove it, and pronounce the remaining part.

Table 5. Syllable-related skills and corresponding activities proposed during Hours 3 to 6 of the intervention.



Figure 3. An example from activities with syllables: in this modified version of the game Il bastimento ('The ship'), children heard the sentence È in arrivo un bastimento carico di... ('A ship is coming, and it's full of...') followed by a syllable displayed on the interactive board screen and the picture of an object starting with that syllable. After that, children were asked to find more words starting with that syllable to 'load' the ship.

Hours 7-10: phonemes

Similarly to syllables, phonemes (sounds) were introduced as very small bricks that first make up syllables and then whole words. This concept was also conveyed with the use of small *Lego*-like bricks at the beginning of each session (see above). Children were further encouraged to familiarize themselves with sounds by saying the first sound of their names.

Initial moments of this period were dedicated to phoneme identification and production, moving then to activities on phoneme blending and deletion.

In the Alien activity, children were introduced to Dimo, an extraterrestrial character who struggled with Italian pronunciation and often made phonological mistakes. In the first version of

the activity, children saw on the interactive board a series of words written as Dimo believed they should be pronounced (see Figure below). These could be either correct or include phonemic omissions (e.g., *stazone* for *stazione*, *aceo* for *aceto*, *caicia* for *camicia*), additions (*soldateo* for *soldato*, *mapestra* for *maestra*, *crinceto* for *criceto*), or inversions (*tarmento* for *tramonto*, *moppiere* for *pompieri*, *forseta* for *foresta*). Children had to judge whether the word was spelled correctly, provide the correct form, and explain the type of error that had occurred. In the second version, Dimo wanted to teach them the names of his friends. Children were introduced to various alien characters with fictional names – nonwords designed according to the same principles used in the experimental task (e.g., *supe*, *delto*, *somentri*, *lituvame*). After hearing each name from the experimenter, children repeated it and were then shown the written form, which they were encouraged to read aloud.

In the word blending activity, as in the experimental task, children were presented with words spelled out one phoneme/letter at a time. As a hint, they were first told how many letters the target word contained. Then the spelling began, and children had to identify the word as quickly as possible. Letters appeared one by one on the interactive whiteboard. Version 1 included only short words (4 to 6 letters; e.g., *foca*, *lago*, *spada*, *prato*), while version 2 included also longer ones (up to 8; e.g., *chiodo*, *capitano*, *quaderno*, *gomitolo*).

Other activities are described in Table 6.

Skill	Activity
Phoneme identification and nonword repetition	‘The alien’: children were introduced to an extraterrestrial character who made phonological mistakes. In the first version of the activity, children had to correct the alien’s mistakes. In the second version, children were asked to repeat the alien’s friends’ names, namely nonwords.
Phoneme identification and segmentation	‘The ship’: the experimenter uttered the sentence ‘a ship is coming, and it’s full of...’ followed by a word (pictures and orthographic representations were shown on the interactive board screen). Children had to identify the initial and final phonemes and find other words starting and ending with the same phonemes to ‘load the ship’.
Phoneme inversion	In the first version of the activity, two options for the same word – containing a closed syllable or a syllable with a complex onset – were shown on the interactive board screen. One version always contained a phoneme inversion in the complex syllable; children had to indicate the correct option. In the second version, words

	were displayed with the complex syllable missing, and children had to reconstruct it phoneme-by-phoneme.
Phoneme blending	Children were presented with words spelled out one phoneme/letter at a time (orthographic representations were shown on the interactive board screen). They were asked to identify the word as quickly as possible.
Phoneme deletion	Children were asked to remove a phoneme/letter from a word and pronounce its new form. The target phoneme could be located at the beginning, end, or inside the word. To facilitate the deletion process, the written form of the original words was shown; however, the transformed version was displayed only after the child had pronounced it.

Table 6. Phoneme-related skills and corresponding activities proposed during Hours 7 to 10 of the intervention.



Figure 4. An example from activities with phonemes: children were introduced to Dimo, an extraterrestrial character that made many phonological mistakes. After seeing a picture, children heard the corresponding word as if it was uttered by the character (here, albREgo instead of albERgo, 'hotel'), and they had to judge whether it was correct or not. After that, they got access to the written form and had to determine the error made by the alien.

5.4.2.2. Procedure

The phonological training program was specifically designed for the present study. The intervention was administered to a selected group of children (experimental group, $N = 34$), including 25 Italian monolinguals and 9 bilingual children with Italian as community language. These participants belonged to two different classes, and this pre-existing division was

maintained for the purposes of the intervention. The total duration of the training was 10 hours, divided into ten one-hour sessions over the course of two weeks. All the activities were carried out in the classroom setting and were presented as games, designed to be aged-appropriate and suitable for the school context. Since the training activities were conducted during school time, the control group ($N = 39$, 27 MONO, 12 BI) attended regular school classes in the meantime. While maintaining the focus on phonological skills, we decided to include orthographic representations of the stimuli to further reinforce grapheme-phoneme correspondence, in line with the guidelines of the National Reading Panel (2000). Both the pictures and the orthographic forms of the stimuli were displayed on the interactive whiteboards present in the classrooms.

The training focused on the phonological units and abilities assessed during the testing phase. The sequence of activities was structured to gradually guide children from more salient phonological units (rhymes, syllables) to less salient ones (phonemes; Stanovich, 1992). The 10 hours were divided into the following periods: the first two hours dedicated to rhyme activities, followed by four hours dedicated to syllables, and finally four hours dedicated to phonemes.

Within each period, activities were ordered to allow a gradual shift from easier skills (identification) to more complex ones (blending, deletion; Adams, 1998). Two activities were included in the rhyme period, four in the syllable period, and five in the phoneme period. Each session involved two 30-minute activities. To reinforce learning, all the activities were presented twice, with the same structure but different stimuli.

During the training, each stimulus used in the activities always targeted individual children, so that all students had equal opportunities to actively participate in the intervention. Children were free to express themselves and provide answers to the best of their abilities, without being given prompts other than the initial instructions. When incorrect or no answers were given, the experimenter modelled the reasoning process aloud and then, if still no response followed, provided the final solution to the class, explaining the rationale behind it. For instance, in the *Ship* activity with syllables, some children struggled to differentiate between open and closed syllables: if the target initial syllable was *co-* and they were asked to find other words beginning with that syllable, they sometimes proposed words such as *compagno*, which instead begins with the closed syllable *com-*. In such cases, the experimenter practiced the correct syllable segmentation with the children, explaining the difference between *co-* and *com-*, and ultimately clarifying that, despite being a good attempt, that syllable was too “heavy” and could not be loaded onto the ship.

5.4.3. Phase 3: post-test

During this phase, which took place immediately after the end of the intervention period and involved the entire sample, children were administered the same tasks proposed in the pre-test phase, with the exception of the additional measures. The post-test consisted of a single session lasting approximately 30 minutes, during which the tasks were administered in the following order: reading tasks on *ReadLet* (Words, Nonwords, Texts), Nonword Repetition, Rhyme Detection, Syllable Blending and Deletion, and Phoneme Blending and Deletion. For those tasks with alternative stimuli lists, participants were assigned the list they had not encountered during the pre-test. The purpose of this phase was to evaluate the potential effectiveness of the didactic intervention.

5.5. Results

5.5.1. Monolingual and bilingual performance on phonological awareness and reading skills

5.5.1.1. Preliminary measures

A series of t-tests (*t.test* function on R, R Core Team, 2023) was run to compare MONO and BI performance on preliminary measures (Short-term Memory, Working Memory, Rapid Automatized Naming, Receptive Vocabulary, Morphosyntactic Comprehension). Descriptive statistics are summarized in Table 7.

	MONO Mean (SD)	BI Mean (SD)	<i>p</i>
AGE	80.17 (3.84)	80.28 (4.63)	.92
FDS ₍₅₄₎	23.45 (3.51)	19.40 (3.23)	< .001***
BDS ₍₃₆₎	8.60 (2.42)	7.70 (2.15)	.13
RAN-Objects	55.73 (14.08)	74.50 (10.43)	< .01**
RAN-Letters	47.18 (17.21)	57.25 (18.65)	< .05*
RV ₍₄₂₎	27.89 (4.29)	22.70 (5.73)	< .01**
MC ₍₄₀₎	32.58 (3.38)	26.20 (6.28)	< .001***

*Table 7. Means (SDs) of age (months) and raw scores for accuracy in Forward Digit Span, Backward Digit Span, Receptive Vocabulary, and Morphosyntactic Comprehension, and of time in seconds for Rapid Automatized Naming (Objects and Letters), together with *p* values from *t*-tests. When appropriate, maximum possible scores are indicated between parentheses in the first column.*

Monolingual and bilingual groups were age-matched ($t(31.73) = -0.10$, $p = 0.92$). Monolingual children outperformed bilinguals in FDS ($t(36.98) = 4.66$, $p < .001$), RAN-O ($t(46.15) = -2.89$, $p < .01$), RAN-L ($t(31.96) = -2.10$, $p < .05$), RV ($t(27.44) = 3.68$, $p < .01$) and MC ($t(23.27) = 4.32$, $p < .001$), but not in BDS ($t(38.24) = 1.54$, $p = .13$). Comparable performance in the Backward Digit Span task ensured homogeneity in cognitive resources between the language groups. The poorer performance displayed by bilingual children in Rapid Automatized Naming, Receptive Vocabulary and Morphosyntactic Comprehension is in line with the limited language competence that bilingual children with a migration background often display in initial stages of formal education. This lower proficiency might have affected also their performance in the Short-term Memory task, in which they were required to repeat sequences of numbers.

5.5.1.2. Phonological awareness measures

In order to determine monolinguals and bilinguals beginning readers profile on reading and reading related abilities, we conducted analyses by means of *t*-tests to compare language groups on phonological awareness and reading skills. Descriptive statistics for the phonological awareness measures are reported in Table 8.

	MONO Mean (SD)	BI Mean (SD)	<i>p</i>
NWR ₍₄₀₎	25.34 (6.04)	23.00 (6.58)	.17
RD ₍₁₀₎	7.22 (2.73)	5.15 (2.60)	< .01**
SB ₍₁₂₎	11.81 (0.44)	10.35 (2.77)	< .05*
SD ₍₁₂₎	5.38 (2.43)	4.10 (2.97)	.09
PB ₍₁₂₎	8.36 (3.20)	5.55 (3.70)	< .01**
PD ₍₁₂₎	7.51 (3.26)	4.25 (4.04)	< .01**

Table 8. Means (SDs) of raw scores for accuracy in Nonword Repetition, Rhyme Detection, Syllable Blending and Deletion, Phoneme Blending and Deletion, together with p values from t-tests. Maximum possible scores are indicated between parentheses in the first column.

Monolingual children obtained significantly higher scores in Rhyme Detection ($t(35.81) = 3.00$, $p < .01$), Syllable Blending ($t(19.36) = 2.34$, $p < .05$), Phoneme Blending ($t(30.31) = 2.99$, $p < .01$) and Phoneme Deletion ($t(28.87) = 3.23$, $p < .01$), while no differences emerged for Nonword Repetition ($t(31.81) = 1.38$, $p = .17$) and Syllable Deletion ($t(29.10) = 1.72$, $p = .09$).

It is interesting to note that, compared to Study 1, in which preschoolers were also assessed on Nonword Repetition, Rhyme Detection, and Phoneme Blending (using the same tests), only Nonword Repetition yielded a different result between the monolingual and bilingual groups. In other words, the significantly better performance of monolinguals observed in Rhyme Detection and Phoneme Blending at kindergarten (i.e., before the onset of formal reading instruction) is maintained also in 1st Grade, while bilinguals appear to have caught up in Nonword Repetition by 1st Grade. This comparison should be interpreted cautiously, as the two studies were conducted on different samples; however, this result appears to be more in line with previous findings showing that bilingual and monolingual children do not differ in phonological working memory (Casani, 2021; Taha et al., 2022; Vender et al., 2020; Vender and Melloni, 2021). As will be discussed below, age or reading acquisition might have contributed to this result.

5.5.1.3. Reading skills measures

The same analysis was conducted on reading skills as well, measured in terms of speed, accuracy and comprehension by means of finger-tracking technique. Separate analyses were run for Words, Nonwords and Text, comparing bilinguals and monolinguals performance.

Descriptive statistics for reading accuracy and times for Words, Nonwords and Text, and reading comprehension accuracy are summarized in Table 9.

		MONO Mean (SD)	BI Mean (SD)	p
WORDS	<i>accuracy (%)</i>	0.83 (0.17)	0.68 (0.20)	< .01**

NONWORDS	<i>speed (s)</i>	3.81 (3.15)	4.97 (3.88)	< .001**
	<i>accuracy (%)</i>	0.73 (0.21)	0.70 (0.22)	.53
TEXTS	<i>speed (s)</i>	3.90 (3.09)	4.89 (3.51)	< .001**
	<i>accuracy (%)</i>	0.89 (0.12)	0.85 (0.09)	.23
READING COMPREHENSION		2.10 (2.38)	2.86 (3.14)	< .001**
		0.82 (0.38)	0.66 (0.48)	.08

Table 9. Descriptive statistics (Mean, SD) for Monolingual and Bilingual groups' reading accuracy (% of correctly read stimuli out of total stimuli) and reading times for single stimuli (in seconds) for Words, Nonwords, and Texts, and reading comprehension (% of correct answers out of total answers). T-test p-values are reported in the final column.

Mean accuracy for each reading Item (W, N, T) was calculated by dividing total stimuli by number of reading errors. Results are reported in terms of percentage of accuracy, with higher values associated with higher accuracy.

Monolingual emergent readers were significantly more accurate than their bilingual peers only in Word reading ($t(26.07) = 2.94, p < .01$), while the two groups performed comparably on Nonwords ($t(26.59) = 0.53, p = .60$) and Text ($t(26.28) = 1.23, p = .23$). The fact that bilingual children could reach the same level of the monolingual group in terms of accuracy in two out of three Items is not surprising, since transparent orthographies typically allow emergent readers to reach considerably high levels of accuracy even after a short exposure to print, and even in reading impaired populations (Serrano and Defior, 2008). This was particularly evident for *ReadLet* Nonwords, for which the consistent grapheme-phoneme rules acquired by children during the first months of reading instruction might have allowed the two groups to read these Items equally accurately (73% of accuracy in MONO children, 70% in BI children). The significant difference emerged in Words could be associated to the reduced vocabulary typically displayed by bilingual children (Bialystok et al., 2010), confirmed here also by the poorer performance displayed in Receptive Vocabulary. This might have required a greater cognitive effort to read these stimuli, with a negative effect on accuracy. The fact that this difference did not extend to Text accuracy might be indicative of the facilitatory effect of context, which of course is provided by connected text, but not by stimuli to be read in isolation (López et al., 2011).

As for reading speed, tracking times (in seconds) for single written stimuli were automatically recorded by the finger-tracking application *ReadLet* (Taxitari et al., 2020). Stimuli displaying reading times equal to 0 or higher than 20 seconds were excluded from the analysis.

Monolingual children outperformed bilinguals in Word ($t(818.34) = -6.20, p < .001$), Nonword ($t(746.22) = -5.48, p < .001$), and Text ($t(2720.1) = -9.84, p < .001$) reading speed.

The slowest reading times displayed by bilingual children provide further evidence to the fact that issues in acquiring reading skills in a transparent orthography typically affect this component, rather than accuracy, as it has been shown crosslinguistically (Wimmer, 1993, for German; Holopainen et al., 2001, for Finnish; Tressoldi et al., 2001, for Italian; Serrano and Defior, 2008, for Spanish).

Finally, reading comprehension was measured by means of comprehension questions at the end of short narrative texts. Raw scores for accuracy were included in the analysis, with higher scores associated with higher accuracy.

Difference in reading comprehension between Monolinguals and Bilinguals only reached marginal significance ($t(43.94) = 1.79, p = .08$). The comparable performance between the two groups could be attributed to the relatively high accuracy that children displayed in Text reading, despite slower reading times in the Bilingual group. However, we could not rule out the possibility that the absence of difference could be attributed to design of the reading protocol, which included only one comprehension question with three possible answers for each text, meaning that children were exposed to only two questions for each testing session.

5.5.2. Effects of phonological training on phonological awareness and reading skills

5.5.2.1. Descriptive statistics

Performance of Monolingual (MONO) and Bilingual (BI) children from Experimental (EX) and Control (CON) groups was compared on all preliminary measures administered in pre-test phase. Assumptions of normality and homoscedasticity were verified via Shapiro-Wilk (*shapiro.test* function on R) test for normality and Levene's test (*leveneTest* function on R) for homoscedasticity. When these assumptions were not met ($p\text{-value} < .05$), Kruskal-Wallis test (*kruskal.test* function on R) was used to compare raw score means between groups; otherwise, ANOVAs were employed (*aov* function on R; R Core Team, 2023). *F* values refer to results from ANOVAs (Forward Digit Span, Receptive Vocabulary), while χ^2 values to results from Kruskal-

Wallis test (Backward Digit Span, Rapid Automatized Naming, Morphosyntactic Comprehension). Results are reported in Table 10.

	EX		CON		F/ χ^2	p
	MONO	BI	MONO	BI		
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		
FDS ₍₅₄₎	23.40 (3.77)	18.89 (3.37)	23.50 (3.33)	19.82 (3.22)	F = 6.69	< .001***
BDS ₍₃₆₎	8.20 (2.53)	8.00 (2.24)	8.96 (2.30)	7.45 (2.16)	χ^2 = 4.67	0.19
RAN- OBJECTS	52.48 (15.27)	66.11 (10.44)	58.64 (12.50)	63.18 (10.74)	χ^2 = 10.66	< .05*
RAN- LETTERS	44.40 (20.31)	58.33 (26.84)	49.68 (13.78)	56.36 (9.09)	χ^2 = 11.47	< .01**
RV ₍₄₂₎	29.16 (4.41)	20.22 (5.36)	26.75 (3.91)	24.73 (5.42)	F = 9.3	< .001***
MC ₍₄₀₎	32.12 (3.32)	24.33 (6.42)	33.00 (3.43)	27.73 (6.02)	χ^2 = 18.40	< .001***

Table 10. Descriptive statistics (Mean, SD) for monolingual and bilingual EX and CON accuracy (raw scores) on Forward Digit Span, Backward Digit Span, Receptive Vocabulary, and Morphosyntactic Comprehension, and time (in seconds) for Rapid Automatized Naming (Objects and Letters) together with F or χ^2 and p-value from one-way ANOVA or Kruskal-Wallis test. When appropriate, numbers between parentheses in the first column indicate maximum possible score for each task.

Significant results from ANOVAs and Kruskal-Wallis confronts were further explored using post-hoc tests (TukeyHSD for ANOVAs, non-parametric Pairwise Wilcoxon for Kruskal-Wallis). TukeyHSD performed on Forward Digit Span task showed that, overall, bilingual children significantly underperformed monolinguals, irrespectively of experimental group (Control vs. Experimental; $p < .05$), while no difference emerged between monolinguals and bilinguals across the two experimental groups. As for Rapid Naming, Pairwise Wilcoxon post hoc tests revealed that Experimental Bilinguals were significantly slower than Experimental Monolinguals ($p < .05$) in the Object version, while Control Bilinguals were slower than Experimental Monolinguals in the Letter version ($p < .05$). In the Receptive Vocabulary task Experimental Bilinguals performed more poorly than Control and Experimental Monolinguals ($p < .01$ and $p < .001$, respectively). In

addition, Control Bilinguals displayed significantly lower scores than Experimental Monolinguals ($p < .05$). Finally, in Morphosyntactic Comprehension Experimental Bilinguals underperformed both Control and Experimental Monolingual ($p < 0.01$ and $p < .05$, respectively), while Control Bilinguals underperformed Control Monolinguals ($p < .05$). However, since all significant differences observed only involved confronts between Monolinguals and Bilinguals (except for RAN with Objects), we still considered the two experimental groups as equal. Differences in language tasks are in fact expected between monolinguals and bilinguals with a migration background (see Chapter 1); moreover, no significant differences in the Backward Digit Span task ensured comparable cognitive baselines.

The same procedure was adopted for phonological measures. Results are reported in Table 11.

	EX		CON		F/χ^2	p
	MONO	BI	MONO	BI		
	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>		
NWR ₍₄₀₎	25.80 (6.93)	21.22 (6.10)	24.93 (5.21)	24.45 (6.89)	$\chi^2 = 4.02$	0.26
RD ₍₁₀₎	6.88 (3.22)	4.44 (2.50)	7.53 (2.22)	5.73 (2.65)	$\chi^2 = 8.90$	$< .05^*$
SB ₍₁₂₎	11.80 (0.41)	9.11 (3.76)	11.82 (0.47)	11.36 (0.92)	$\chi^2 = 12.86$	$< .01^{**}$
SD ₍₁₂₎	4.76 (2.82)	3.33 (2.96)	5.93 (1.90)	4.73 (2.97)	$\chi^2 = 5.08$	.17
PB ₍₁₂₎	8.64 (3.59)	4.44 (4.00)	8.11 (2.84)	6.45 (3.36)	$\chi^2 = 10.53$	$< .05^*$
PD ₍₁₂₎	6.60 (3.64)	2.78 (3.99)	8.32 (2.69)	5.45 (3.83)	$F = 6.68$	$< .001^{***}$

Table 11. Descriptive statistics (Mean, SD) for monolingual and bilingual EX and CON accuracy (raw scores) on Nonword Repetition, Rhyme Detection, Syllable Blending, Syllable Deletion, Phoneme Blending, and Phoneme Deletion, together with F or χ^2 and p -value from one-way ANOVA or Kruskal-Wallis test. Numbers between parentheses in the first column indicate maximum possible score for each task.

Post-hoc analyses performed on significant values revealed that Experimental Bilinguals performed significantly worse than Control Monolinguals in Rhyme Detection ($p < .05$). The same group (Experimental Bilinguals) underperformed Experimental and Control Monolinguals in Syllable Blending as well ($p < .05$ and $p < .01$, respectively). In Phoneme Blending, Experimental

Bilinguals obtained lower scores compared to Experimental Monolinguals ($p < .05$). Finally, Experimental Bilinguals underperformed both Monolingual groups in Phoneme Deletion ($p < .001$ for Control Monolinguals, $p < .05$ for Experimental Monolinguals). As observed for preliminary measures, significant differences only emerged between bilinguals and monolinguals, as expected. In particular, Experimental Bilinguals appeared to be weaker than Monolinguals in several measures; this might be also due to the size of this subgroup, which was particularly small (9 participants).

Finally, pre-test performance in Word, Nonword and Text reading accuracy and speed, together with comprehension, was compared between Monolinguals and Bilinguals from Experimental and Control groups as well. Results are summarized in Table 12.

		EX		CON		χ^2	p
		MONO Mean (SD)	BI Mean (SD)	MONO Mean (SD)	BI Mean (SD)		
WORDS	accuracy (%)	0.83 (0.17)	0.71 (0.23)	0.84 (0.17)	0.66 (0.19)	10.06	< .05*
	speed (s)	3.50 (2.61)	3.87 (3.60)	4.10 (3.57)	5.96 (3.86)	105.19	< .001***
NONWORDS	accuracy (%)	0.75 (0.18)	0.63 (0.24)	0.72 (0.24)	0.75 (0.21)	1.87	.60
	speed (s)	3.44 (2.37)	3.25 (2.99)	4.35 (3.59)	6.00 (3.41)	151.91	< .001***
TEXTS	accuracy (%)	0.91 (0.07)	0.89 (0.11)	0.86 (0.15)	0.82 (0.08)	6.59	.09
	speed (s)	1.95 (2.17)	1.79 (2.29)	2.24 (2.55)	3.52 (3.41)	303.9	< .001***
READING COMPREHENSION		0.88 (0.32)	0.78 (0.42)	0.78 (0.41)	0.56 (0.50)	525.42	< .001***

Table 12. Descriptive statistics (Mean, SD) for Monolingual and Bilingual groups' reading accuracy (% of correctly decoded stimuli out of total stimuli) and reading times for single stimuli (in seconds) for Words, Nonwords, and Texts, and reading comprehension (% of correct answers out of total answers). Kruskal-Wallis p -values are reported in the final column.

Post-hoc tests performed on significant results revealed that Control Bilinguals were significantly less accurate than Experimental and Control Monolinguals ($p < .05$). As for reading speed, significant differences emerged for almost all post-hoc contrasts between Language (Monolingual vs. Bilingual) and Group (Experimental vs. Control). This was the case for reading comprehension as well.

Bilingual participants both from the Experimental and the Control group were also compared on linguistic history and familial context, based on answers obtained from the parental questionnaire *Q-BEx* (De Cat et al., 2023), by means of t-tests for numerical variables and χ^2 tests for categorical variables. More precisely, EX ($N = 5$) and CON ($N = 8$) bilinguals⁵ did not differ in cumulative exposure to Italian ($t(6.97) = 1.01, p = .35$), cumulative exposure to their family language ($t(8.75) = -0.06, p = .95$), cumulative use of Italian ($t(6.92) = 1.31, p = .23$), cumulative use of the family language ($t(6.06) = -0.54, p = .61$), first age of exposure to Italian ($\chi^2(4) = 2.94, p = .57$), first age of kindergarten attendance ($\chi^2(1) = 0.24, p = .62$), presence of language concerns before 4 ($\chi^2(1) = \sim 0, p = 1$), highest education of the main caregiver in Italian ($\chi^2(3) = 2.26, p = .52$) and in the family language ($\chi^2(3) = 2.74, p = .43$), gender ($\chi^2(1) = \sim 0, p = 1$), number of siblings ($\chi^2(4) = 2.74, p = .60$) and birth order ($\chi^2(3) = 1.43, p = .70$).

To summarize, the only significant differences emerged when comparing pre-test scores for preliminary measures, phonological awareness tasks and reading outcomes were those between Monolinguals and Bilinguals, irrespective of Group. This is in line with previous findings, highlighting poorer performances of vulnerable bilingual populations in reading and reading related skills (Duzy et al., 2014; Lervåg and Aukurst, 2010; Melloni et al., 2022; Persici et al., 2022; Verhoeven, 1990; see Section 1.3.3). Differences within Monolinguals and within Bilinguals were observed only for reading speed across Items and for reading comprehension, where Experimental children were overall faster and more accurate. These results could be explained by the fact that children were receiving reading instruction from three different teachers, who might have adopted slightly different methodologies for literacy teaching⁶. Therefore, we cannot rule out that individual differences might have played a role in children's performance at pre-test. However, since the majority of the reading and reading-related components tested did not yield any significant difference within Language groups, we proceeded with the intervention administration as planned.

⁶ One of the three schools ("Virgo Carmeli") included one class assigned to the experimental group and one to the control group; the same teacher was responsible for literacy teaching in both classes. Children from the remaining classes, one from the "Antonio Cesari" school (experimental group) and one from the "Don Bernardo Antonini" school (control group) were taught by two distinct teachers.

5.5.2.2. Effectiveness of phonological training

Effectiveness of phonological training on phonological and reading skills was analysed with mixed-effect models using the lmerTest package (Kuznetsova et al., 2017). Normalized scores (raw scores divided by number of total items) from NWR, RD, SB, SD, PB and PD were fitted as dependent variables to distinct mixed-effect models. The same was done with reading times (measured in seconds for each reading stimulus), accuracy (percentage of correctly read stimuli over total stimuli) and comprehension (percentage of correct answers). The contribution to the models' fit of Time (pre- vs. post-test), Language (MONO vs. BI), Group (EX vs. CON), and of their interactions was tested by a stepwise removal procedure. Participants were included as random effects and resulted significant for all models. Descriptive statistics for phonological awareness tasks and reading outcomes (pre- vs. post-test means and standard deviations) are reported in Tables 13 and 14, respectively.

	EX				CON			
	MONO		BI		MONO		BI	
	Pre- test (mean, SD)	Post- test (mean, SD)	Pre- test (mean, SD)	Post- test (mean, SD)	Pre- test (mean, SD)	Post- test (mean, SD)	Pre- test (mean, SD)	Post- test (mean, SD)
NWR ₍₄₀₎	25.80 (6.93)	28.88 (5.48)	21.22 (6.10)	26.22 (6.06)	24.93 (5.21)	27.68 (5.29)	24.45 (6.89)	24.73 (7.64)
RD ₍₁₀₎	6.88 (3.22)	8.56 (1.98)	4.44 (2.50)	5.11 (3.55)	7.53 (2.22)	8.68 (1.66)	5.73 (2.65)	5.91 (3.33)
SB ₍₁₂₎	11.80 (0.41)	11.88 (0.33)	9.11 (3.76)	10.89 (1.69)	11.82 (0.47)	11.86 (0.36)	11.36 (0.92)	11.27 (1.27)
SD ₍₁₂₎	4.76 (2.82)	7.96 (2.71)	3.33 (2.96)	6.78 (3.38)	5.93 (1.90)	5.50 (1.79)	4.73 (2.97)	5.36 (1.86)
PB ₍₁₂₎	8.64 (3.59)	9.32 (3.09)	4.44 (4.00)	6.11 (3.69)	8.11 (2.84)	8.46 (2.71)	6.45 (3.36)	5.91 (4.16)
PD ₍₁₂₎	6.60 (3.64)	8.60 (3.53)	2.78 (3.99)	5.00 (4.00)	8.32 (2.69)	9.00 (2.24)	5.45 (3.83)	6.91 (3.83)

Table 13. Descriptive statistics (Mean, SD) for monolingual and bilingual EX and CON accuracy (raw scores) on Nonword Repetition, Rhyme Detection, Syllable Blending, Syllable Deletion, Phoneme Blending, and Phoneme Deletion at pre- and post-test. Numbers between parentheses in the first column indicate maximum possible score for each task.

		EX				CON			
		MONO		BI		MONO		BI	
		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
WORDS	accuracy (%)	0.83 (0.17)	0.92 (0.10)	0.71 (0.23)	0.87 (0.18)	0.84 (0.17)	0.87 (0.13)	0.66 (0.19)	0.77 (0.11)
	speed (s)	3.50 (2.61)	2.43 (1.71)	3.87 (3.60)	3.25 (3.15)	4.10 (3.57)	2.69 (2.12)	5.96 (3.86)	4.23 (2.66)
NONWORDS	accuracy (%)	0.75 (0.18)	0.87 (0.09)	0.63 (0.24)	0.76 (0.17)	0.72 (0.24)	0.72 (0.20)	0.75 (0.21)	0.67 (0.16)
	speed (s)	3.44 (2.37)	2.79 (1.83)	3.25 (2.99)	2.33 (1.65)	4.35 (3.59)	2.99 (2.12)	6.00 (3.41)	3.82 (2.49)
TEXTS	accuracy (%)	0.91 (0.07)	0.94 (0.08)	0.89 (0.11)	0.90 (0.09)	0.86 (0.15)	0.94 (0.07)	0.82 (0.08)	0.85 (0.14)
	speed (s)	1.95 (2.17)	1.42 (1.52)	1.79 (2.29)	1.39 (1.50)	2.24 (2.55)	1.52 (1.59)	3.52 (3.41)	2.13 (2.24)
READING COMPREHENSION		0.88 (0.32)	0.93 (0.24)	0.78 (0.42)	0.72 (0.45)	0.78 (0.41)	0.90 (0.30)	0.56 (0.50)	0.80 (0.40)

Table 14. Descriptive statistics (Mean, SD) for Monolingual and Bilingual groups' reading accuracy (% of correctly read stimuli out of total stimuli) and reading times for single stimuli (in seconds) for Words, Nonwords, and Texts, and reading comprehension (% of correct answers out of total answers) at pre- and post-test.

Phonological skills

As for Nonword Repetition, the final model included the interaction between Time, Language and Group. Analysis of fixed effects reported a significant effect of Time $\times$ Language $\times$ Group interaction ($F(1, 69) = 6.02, p < .05$). This effect was further explored by post-hoc analyses run with emmeans (R Core Team, 2023). These evidenced a significant increase of accuracy after the intervention in Nonword Repetition for MONO (Estimate = 0.08, SE = 0.02, $t(69) = 4.53, p < .001$)

and BI children (Estimate = 0.12, SE = 0.03, $t(69) = 4.41$, $p < .001$) from the experimental group, but also for MONO children from the control group (Estimate = 0.07, SE = 0.02, $t(69) = 4.28$, $p < .001$). Results are visualized in Figure 5.

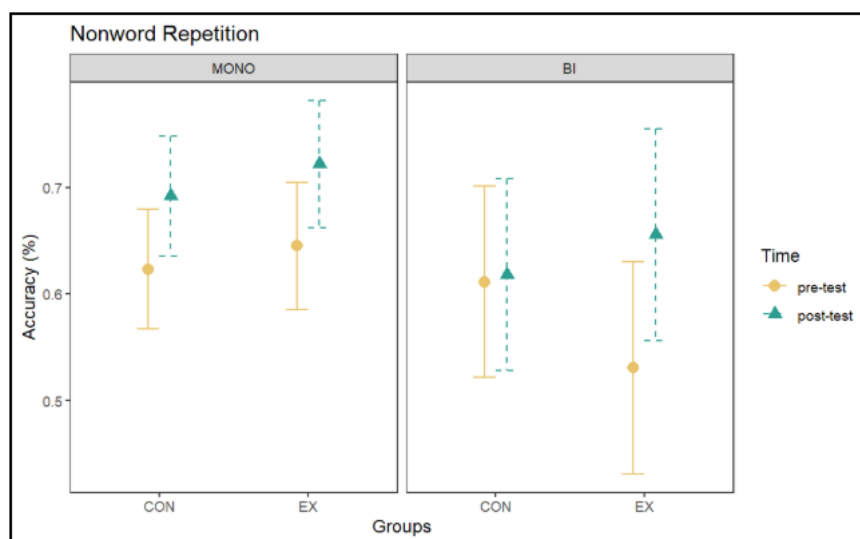


Figure 5. Model summary for the effect of the interaction between Time, Group and Language on Nonword Repetition accuracy.

The final model for Rhyme Detection only included main effects of Time and Language. Fixed effects of Time ($F(1, 72) = 18.43$, $p < .001$) and Language ($F(1, 71) = 18.81$, $p < .001$) were significant. Post-hoc analyses revealed a significant improvement for the whole sample, irrespective of intervention (Estimate = 0.11, SE = 0.03, $t(72) = 4.29$, $p < .001$), and an overall better performance of the MONO group (Estimate = 0.26, SE = 0.06, $t(71) = 4.34$, $p < .001$).

As in Nonword Repetition, the final model for Syllable Blending also included the interaction between Time, Group and Language. Analysis of fixed effects reported a significant effect of Time $\times$ Language $\times$ Group interaction ($F(1, 69) = 6.60$, $p < .05$). However, post-hoc analyses revealed a significant improvement in Syllable Blending accuracy limited to the BI sample of the EX group (Estimate = 0.15, SE = 0.04, $t(69) = 3.96$, $p < .001$). Results are displayed in Figure 6.

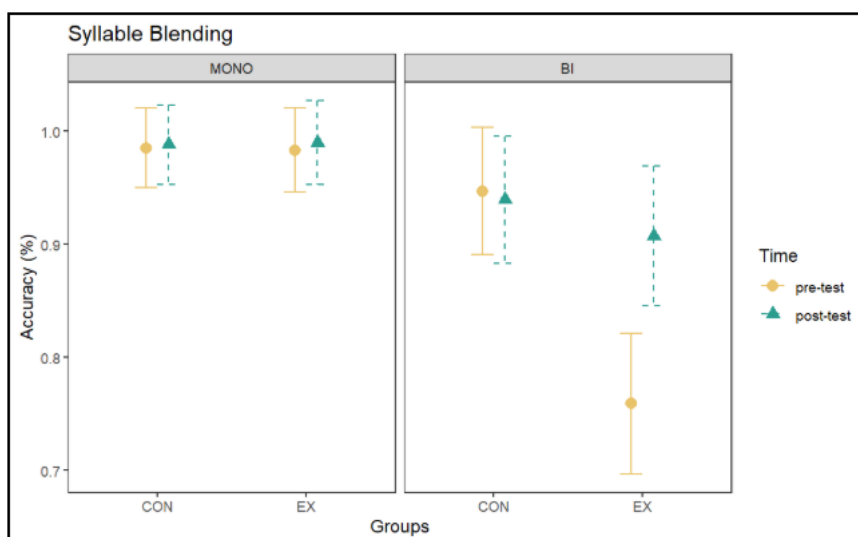


Figure 6. Model summary for the effect of the interaction between Time, Group and Language on Syllable Blending accuracy.

The final model for Syllable Deletion included Time and Group main effects and their interaction. Time $\times$ Group interaction was significant ($F(1, 71) = 33.21, p < .001$). Post-hoc analysis confirmed a significant improvement in the EX group at post-test (Estimate = 0.27, SE = 0.03, $t(71) = 7.59, p < .001$). Results are summarized in Figure 7.

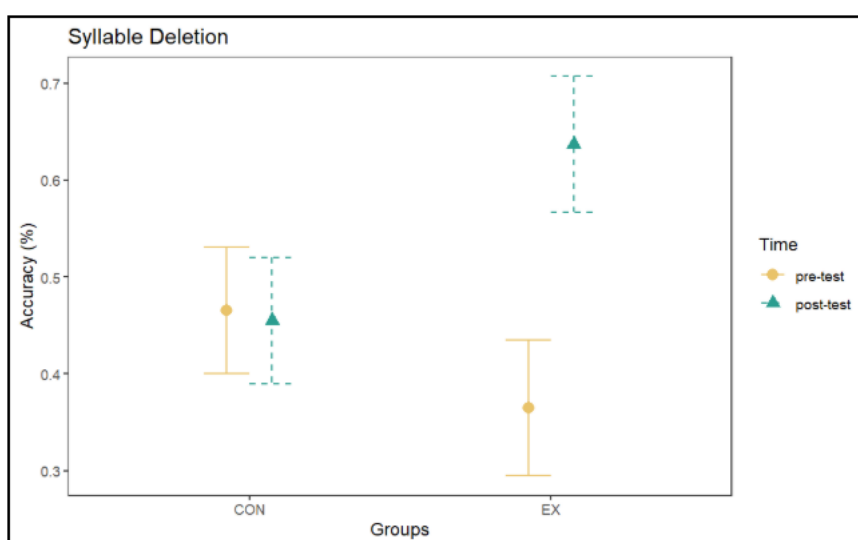


Figure 7. Model summary for the effect of the interaction between Time and Group on Syllable Deletion accuracy.

Final model for Phoneme Blending only included Time and Language main effects. Both Time ($F(1, 72) = 4.43, p < .05$) and Language ($F(1, 71) = 12.13, p < .001$) main effects were significant. Post-hoc analyses revealed a significant improvement in Phoneme Blending accuracy at post-test for the whole sample, irrespective of intervention (Estimate = 0.04, SE = 0.02, $t(72) = 2.11, p < .05$), and an overall better performance of the MONO group (Estimate = 0.24, SE = 0.07, $t(71) = 3.48, p < .001$).

Finally, the same final model was obtained for Phoneme Deletion as well. Main effects of Time ($F(1, 72) = 20.29, p < .001$) and Language ($F(1, 71) = 14.07, p < .001$) were significant. Post-hoc analyses confirmed a significant improvement for the whole sample at post-test, irrespective of intervention (Estimate = 0.12, SE = 0.03, $t(72) = 4.50, p < .001$), and a general poorer performance of the BI group (Estimate = 0.25, SE = 0.07, $t(71) = 3.75, p < .001$).

To summarize, the phonological training proposed to a sample of monolingual and bilingual children attending the first year of primary school was effective on Nonword Repetition, Syllable Blending (but limited to the BI group), and Syllable Deletion. Results of the intervention's effectiveness on reading components are presented in the following paragraph.

Reading skills

The final model for Word reading accuracy included main effects of Time ($F(1, 68.30) = 21.49, p < .001$) and Language ($F(1, 67.66) = 9.73, p < .01$), but no interactions between variables. A significant improvement of Word reading accuracy emerged from post-hoc analysis for the whole sample, irrespective of intervention (Estimate = 0.08, SE = 0.02, $t(68.4) = 4.63, p < .001$). Also, monolinguals' performance was overall significantly better than bilinguals' (Estimate = 0.12, SE = 0.04, $t(67.7) = 3.12, p < .01$).

As for Nonwords accuracy, the final model included Time and Group main effects, besides their interaction. Time $\times$ Group interaction resulted significant ($F(1, 66.25) = 17.82, p < .001$). Post-hoc analysis revealed a significant improvement in accuracy for the experimental group (Estimate = 0.13, SE = 0.02, $t(66.5) = 5.07, p < .001$), which was not observed for the control group. Results are displayed in Figure 8.

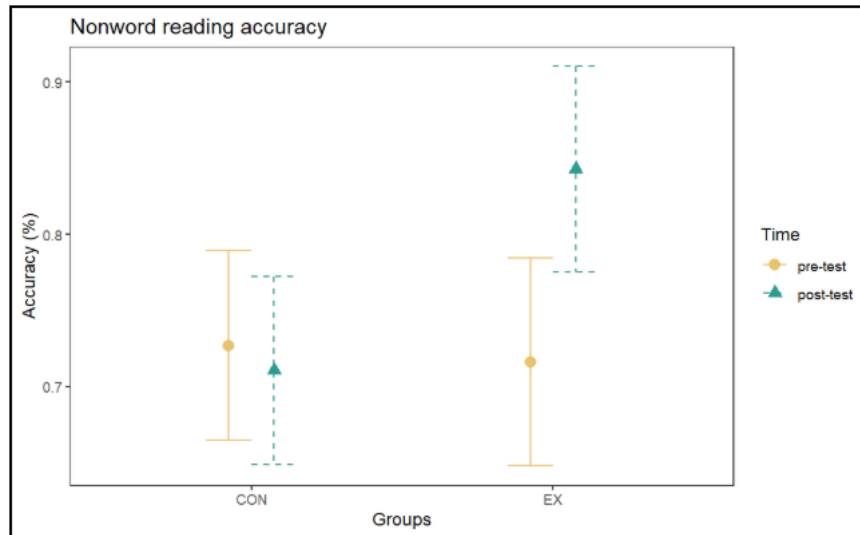


Figure 8. Model summary for the effect of the interaction between Time and Group on Nonword reading accuracy.

The final model for Text reading accuracy was identical to the one obtained for Word reading accuracy. Only main effects of Time and Language were included in the model, both resulting significant (Time: $F(1, 57.39) = 32.36, p < .001$; Language: $F(1, 61.99) = 4.41, p < .05$). Post-hoc analyses confirmed an improvement for the whole sample, irrespective of intervention (Estimate = 0.05, SE = 0.01, $t(63.2) = 5.69, p < .001$) and an overall poorer performance of bilingual children (Estimate = 0.06, SE = 0.03, $t(67.9) = 2.10, p < .05$).

Considering then reading speed, an overall improvement for the whole sample was observed across all Items, irrespective of intervention.

More precisely, the final model for Word reading speed included the interaction between Time, Group and Language, whose effect resulted significant ($F(1, 3952.4) = 10.33, p < .01$). Post-hoc comparisons with emmeans were conducted using asymptotic z-tests ($df = \infty$), as the model did not provide finite denominator degrees of freedom. As a result, all groups displayed significant improvements at post-test phase: MONO from CON group (Estimate = -1.37, SE = 0.12, $z = -11.08, p < .001$), BI from CON group (Estimate = -2.00, SE = 0.19, $z = -10.24, p < .001$), MONO from EX group (Estimate = -1.04, SE = 0.13, $z = -8.24, p < .001$), and BI from EX group (Estimate = -0.59, SE = 0.21, $z = -2.88, p < .01$).

The final model for Nonword reading speed included main effects of Time, Group and Language, and interactions of Time $\times$ Group and Time $\times$ Language. Time $\times$ Group interaction resulted

significant ($F(1, 3813.9) = 32.12, p < .001$), as well as Time $\times$ Language ($F(1, 3818.2) = 12.63, p < .001$). Post-hoc analyses revealed a significant improvement for both experimental and control group at post-test, irrespective of intervention (EX: Estimate = -0.88, SE = 0.11, $z = -7.78, p < .001$; CON: Estimate = -1.70, SE = 0.10, $z = -16.25, p < .001$). The same results were observed for the interaction between Time and Language, with both monolingual and bilingual participants displaying significantly faster reading times at post-test (MONO: Estimate = -1.00, SE = 0.08, $z = -12.05, p < .001$; BI: Estimate = -1.58, SE = 0.14, $z = -11.16, p < .001$).

Results for Text reading speed replicated those obtained from Word reading speed. The final model included the effect of the interaction between Time, Group and Language, which resulted significant ($F(1, 17215) = 20.08, p < .001$). Post-hoc analyses confirmed the significant improvement for all groups at post-test: MONO from CON group (Estimate = -0.75, SE = 0.05, $z = -15.80, p < .001$), BI from CON group (Estimate = -1.39, SE = 0.08, $z = -17.48, p < .001$), MONO from EX group (Estimate = -0.56, SE = 0.05, $z = -11.36, p < .001$), and BI from EX group (Estimate = -0.55, SE = 0.10, $z = -5.56, p < .001$).

Effects of the intervention were measured also for reading comprehension. The final model for reading comprehension included main effects of Time and Language, but no interactions. Both effects of Time ($F(1, 200.35) = 5.28, p < .05$) and Language ($F(1, 64.61) = 6.54, p < .05$) resulted significant. Post-hoc analyses confirmed a general improvement for the whole sample, irrespective of intervention (Estimate = 0.10, SE = 0.04, $t(204) = 2.30, p < .05$), and an overall poorer performance of the bilingual group (Estimate = 0.15, SE = 0.06, $t(68.6) = 2.56, p < .05$).

To summarize, positive effects attributable to the didactic intervention proposed were limited to accuracy in Nonword reading. Instead, Word and Text accuracy and reading speed across all Items, as well as reading comprehension, underwent an overall improvement for the whole sample, irrespective of intervention.

General considerations on the effectiveness of the phonological training, both on phonological skills and on reading components, will be provided in the following paragraph. Reading and reading-related abilities profiles of monolingual and bilingual emergent readers with a migration background will also be discussed.

5.6. Discussion

The aim of the present study was to obtain the profile of reading and reading-related skills in monolingual and bilingual first graders acquiring literacy in Italian. Additionally, we aimed to verify the effectiveness of a phonological training both on phonological skills and on reading components.

5.6.1. Monolingual and bilingual profile of reading and reading-related skills

As expected, bilingual children performed more poorly on most phonological measures (Rhyme Detection, Syllable Blending, Phoneme Blending, Phoneme Deletion). This is in line with Casani (2021) who also reported that bilinguals were weaker in phonological awareness tasks. Similarly, both Casani's and our samples did not differ in Nonword Repetition, in contrast with our findings from Study 1. As previously suggested, this result could be explained by an effect of age and reading acquisition. Vender et al. (2020) and Vender and Melloni (2021), in fact, found an effect of dyslexia on nonword repetition, but not of bilingualism, suggesting that this skill may be particularly suitable for distinguishing the effects of the two conditions. Our results confirm this hypothesis, but it is likely that the effects of the poor language competence characterizing BCMB cease to be significant once some orthographic knowledge is acquired. As shown by Gathercole (1995, 2006), performance in nonword repetition is closely linked to word learning, as the latter has been shown to predict subsequent nonword repetition in young children. According to the author, oral word learning and, as demonstrated by Nation and Hulme (2011), growth in orthographic knowledge allow for a more fine-grained representation of phonological units, which can be exploited in nonword repetition tasks. BCMB could particularly benefit from initial reading instruction, as for this population it often represents the first exposure to high-quality language input, given the poor home literacy environment that typically characterizes migrant families (Eisenwort et al., 2018; Luo et al., 2021; Novita and Kluczniok, 2022; Valcárcel Jiménez et al., 2024). The months of reading instruction that occurred before the administration of our testing protocol might therefore have enabled children to benefit sufficiently from reading and word acquisition to reach the same level as their monolingual peers in Nonword Repetition.

The fact that the two groups did not differ in the Syllable Deletion task could be attributed to the elevated difficulty of this task. While syllabic awareness emerges quite early in children (Stanovich, 1992), deletion is one of the most cognitively demanding phonological operations (Adams, 1998). As observed informally by the experimenter, children were already able to

perform deletion operations (as shown by results from Phoneme Deletion task), but they particularly struggled with the identification of specific initial syllables, i.e., closed ones (such as *mon-* in *montagna*). Since in this task points were awarded only if both the initial syllable was identified correctly and the remaining word portion was uttered as expected, all children obtained lower scores (see Table 11).

As for reading skills, results from the *ReadLet* protocol almost entirely matched our expectations. Specifically, the two groups reached the same accuracy in the Nonword and Text conditions, while bilinguals were more accurate in Word reading. This last finding could be explained by monolinguals' overall language skills, vocabulary in particular, which might have supported them in the accurate identification of words in isolation. This result is in line with previous research observing poorer accuracy in word reading in bilinguals, both in opaque (Bellocchi and Bonifacci, 2024; Bignon et al., 2025) and transparent languages (Droop and Verhoeven, 2003; Melloni et al., 2022; Murineddu et al., 2006; Verhoeven, 1990, 2000). It must be specified that differences in accuracy were often observed for orthographically complex or irregular words; this is something that we did not specifically look into in the present study, but since our Word stimuli did include different syllable structures, future analyses could verify the effect of this variable on reading accuracy. Nonword reading, instead, relies solely on the grapheme-phoneme conversion route, which is adequately exploited also by bilingual readers. Studies mentioned above consistently found either comparable accuracy for nonword reading in bilinguals and monolinguals, or even a bilingual advantage in this respect (August et al., 2009; Lesaux and Siegel, 2003). This provides further evidence of the ease with which children reading in a transparent orthography acquire orthographic mapping, even in the presence of weaker phonological skills. As for the Text condition, the comparable results could be also explained by the narrative context factor, which clearly helps even beginning readers to predict upcoming text and thus to be more accurate in word identification (despite mixed previous findings: Ehri and Roberts, 1979; Ehri and Wilce, 1980; Goodman, 1965; Nemko, 1984).

Our monolingual sample outperformed the bilingual sample across all reading speed conditions (Word, Nonword, Text). Previous findings are rather mixed in this respect, sometimes showing equal outcomes (Bonifacci and Tobia, 2016; Melloni et al., 2022; Murineddu et al., 2006; Persici et al., 2022), sometimes a bilingual disadvantage, as in our case (Bonifacci and Tobia, 2016; Duzy et al., 2014; Mazzarino and Marzi, 2023; Marzi et al., 2023; Murineddu et al., 2006) across different testing conditions. The fact that more difficulties have merged in the speed component is consistent with previous findings on transparent orthographies showing that reading speed is

more affected in atypical contexts (Wimmer, 1993, for German; Holopainen et al., 2001, for Finnish; Tressoldi et al., 2001, for Italian; Serrano and Defior, 2008, for Spanish). Crucially, bilingual children still lag behind their monolingual peers in this component even after several months of reading instruction. This finding adds to previous evidence showing that BCMB can display difficulties comparable to those of dyslexic readers (Duzy et al., 2014; Melloni et al., 2022; Persici et al., 2022; Verhoeven, 1990). However, the discussion of the results from the effectiveness of the didactic intervention will help us gain further insight into the bilingual reading acquisition trajectory.

Considering briefly reading comprehension, as already mentioned in the results section of this study, bilinguals and monolinguals did not differ, in contrast with much previous research (August et al., 2009; Bonifacci and Tobia, 2016; Bonifacci et al., 2020; Kovelman et al., 2008; Lervåg and Aukrust, 2010; Melby-Lervåg and Lervåg, 2014; Verhoeven 1990, 2000). This result could be attributed to the high level of Text decoding accuracy reached by both linguistic groups; however, it could also be an effect of insufficient data measuring this component. The choice of including only one question for each narrative text was motivated by the young age of the participants, who might have become tired, and therefore inattentive, when faced with too many questions and answers. Nevertheless, this limitation might have affected our results for this component, for which we would have expected a language effect given the significantly poorer bilingual performance in text reading speed, vocabulary, and morphosyntactic comprehension (two typical predictors of reading comprehension; Ardasheva, 2019; Buil-Legaz et al., 2016; Duff et al., 2015; Muter et al., 2004; Sénéchal et al., 2007).

5.6.2. Effectiveness of phonological training on concurrent phonological and reading skills

Analysis of pre- and post-test data revealed that the phonological training improved experimental children's performance in Nonword Repetition, Syllable Blending, and Syllable Deletion, while a single main effect of Time was found for Rhyme Detection, Phoneme Blending, and Phoneme Deletion, meaning that the whole sample equally improved in these tasks.

Specifically, an increase in accuracy in the Nonword Repetition task was observed for both monolinguals and bilinguals from the experimental group, but also for monolinguals from the control group. This pattern suggests that, at least for monolingual children, the observed improvement may largely reflect the natural maturation of phonological abilities that typically occurs at this developmental stage, with the effects of the training overlapping with this

spontaneous growth (see comparable results from Study 2). For bilingual children, however, the intervention appears to have played a more decisive role: the active reflection on phonological units and operations may have provided the additional support needed to consolidate skills that are usually less robust in children acquiring Italian as an additional language. The fact that this improvement was not matched by a similar one in our study with children from kindergarten suggests that nonword repetition is somewhat dependent on reading experience and the development of literacy-related phonological processing, as previously observed (Gathercole, 1995, 2006; Nation and Hulme, 2011).

The model for Syllable Blending yielded a significant effect of the intervention, but limited to bilingual children. This effect can be easily explained by the fact that monolingual children from both groups already performed at near-ceiling levels even in pre-test phase (see Figure 2). This is expected, considering both that syllable sensitivity is acquired rather early (Stanovich, 1992) and that the blending operation is located at the third out of five levels of phonological operations complexity, according to Adams (1998). However, since bilinguals started from a significantly poorer level in this skill at pre-test, they might have particularly benefitted from active implementation of this operation.

Finally, the clearest effect of the intervention was observed for Syllable Deletion. As mentioned above, this task was particularly challenging for both monolinguals and bilinguals. The fact that the Language variable did not result significant in the final model clearly shows that the experimental group as a whole equally benefitted from the intervention. As previously discussed, children particularly struggled with the correct identification of closed initial syllables. However, as several activities specifically revolved around this kind of syllable, which was gradually introduced (see Paragraph 5.4.2.1 and Appendix F), their identification skills improved considerably, leading to an overall better performance.

Rhyme Detection, Phoneme Blending, and Phoneme Deletion appeared not to be affected by phonological training. As discussed in Section 2.4.1, rhyme detection seems to be less dependent from explicit reading proficiency (Lundberg et al., 1988). Results from Phoneme Blending and Deletion are somehow less expected, as several training sessions were dedicated to these unit and operations (and positive effects on phoneme blending were found in previous research on bilingual children; see Engel de Abreu et al., 2020, Stuart, 1999). However, since only a single effect of Time was found, this could be explained by a spontaneous improvement in all our children, who, of course, continued attending regular school classes of formal reading instruction. A natural (and desired) improvement in reading might, in turn, have affected

operations with phonemes, whose sensitivity is expected to increase with reading competence (Perfetti et al., 1984).

This leads us to the final aspect to be discussed – namely the intervention’s effects on reading skills.

The only component that clearly appeared enhanced by the phonological training was Nonword Reading accuracy, where the effect was identical for experimental bilinguals and monolinguals. This result contrasts with previous findings. In our Study 1, training benefits emerged exclusively for Nonword reading speed; in Casani (2021), a metaphonological intervention also yielded positive results only on reading speed of various type of reading stimuli; finally, Engel de Abreu (2020) did not find any improvement in reading in their bilingual sample. The effect observed here in Nonword reading accuracy can be tentatively explained by a general improvement in sublexical skills provided by the intervention. As previously discussed, these skills are necessary to exploit the grapheme-phoneme conversion route – the only mechanism through which non-existent words can be read. Word and Text reading, and clearly comprehension, might have benefitted more from vocabulary or oral skills training (Bowyer-Crane et al., 2008).

The fact that the improvement was visible only for accuracy, and not for speed, was probably due to the initial condition of the two groups: as can be seen in Table 8, the experimental group was already faster than the control group across all reading measures, and this might have limited their room for improvement. Accuracy, instead, was comparable across reading stimuli in isolation (Words and Nonwords), leaving more room for improvement provided by the intervention.

The very limited effect of our intervention on reading components can probably be attributed to the short amount of time allocated for this initiative (10 hours), which was at least doubled in other intervention studies on first graders or bilinguals (Casani, 2021; Defior and Tudela, 1994; Engel de Abreu, 2020; Lie, 1991; Poskiparta et al., 1999; Uhry and Shepherd, 1993). This duration was within the range suggested by the National Reading Panel (2000), but apparently was not sufficient for multilingual beginning readers. Additionally, due to organizational constraints, we had to administer the intervention to whole classes, while the guidelines proposed by the Panel recommend delivering it in small groups, which could have limited the effectiveness of the training itself.

5.7. Limitations and conclusive remarks

Our preliminary explorative analysis revealed that bilingual children with a migration background lag behind their monolingual peers in both reading – albeit limited to the speed component – and in several phonological measures, even after six months of reading instruction. However, post-test results indicated a positive trend toward improvement in both phonological and reading skills across both linguistic subgroups. Indeed, Rhyme Detection, Phoneme Blending and Deletion, and, most importantly, reading speed across all Items, Word and Text reading accuracy, and reading comprehension improved in the whole sample, irrespective of the intervention. Although bilinguals still underperformed monolinguals at post-test (Language always significantly contributed to the regression models), they also showed improvement, presumably attributable to progression in reading acquisition. This is in line with previous findings suggesting that bilinguals simply need more time to catch up with monolinguals (Paradis and Jia, 2017). Of course, this leads to further uncertainties concerning the diagnosis of reading impairments in BCMB populations. This question will be addressed in the concluding Chapter of this dissertation.

Nevertheless, our study provided evidence, albeit limited to a small sample, in favour of phonological training as an effective tool to support early reading development, especially for bilingual children, who tend to be particularly vulnerable in this domain. Although we followed most of the recommendations of the National Reading Panel (2000) – such as the gradual introduction of smaller phonological units and more complex operations, the inclusion of orthographic representations of oral stimuli, and an appropriate overall duration and time distribution – the fact that the intervention was administered to whole classes, including linguistically diverse children at different reading levels, might have affected its effectiveness. Moreover, the two groups (experimental and control) were not perfectly matched in terms of pre-test results, but unfortunately the children's distribution could not be modified due to organizational constraints. Future research should attempt to minimize such initial differences while proposing longer, small-group-oriented intervention protocols.

Chapter 6 - General discussion and conclusion

The aim of the present dissertation was to contribute to the understanding of the reading acquisition trajectories of bilingual children with a migration background, a population still understudied in the Italian literature on the topic. The need for the present research stems from the fact that this specific bilingual population, due to cultural, socioeconomic, and linguistic disadvantages, often exhibits atypical reading acquisition trajectories which may superficially resemble those of reading impaired children (Bedore and Peña, 2008; Geva, 2000; Paradis, 2007a).

As a consequence, bilingual children with a migration background are often subject to misdiagnosis of reading impairments (Deponio et al., 2000; Samson and Lesaux, 2009), a risk that may hamper their academic path in two opposite ways. On the one hand, if reading impairments are diagnosed without considering the complex collateral scenario characterizing BCMB, this may lead to demotivation and school drop-out, as students may develop a negative attitude toward additional support. On the other hand, if a ‘wait-and-see’ approach is adopted, these children may miss the optimal time window to receive adequate and effective support (Catts et al., 2002; Justice, 2006). Developing more inclusive assessment and support protocols is therefore of the utmost importance.

The first two chapters of this dissertation allowed us to address the theoretical background and discuss past findings on reading acquisition in bilingual children with a migration background. Specifically, Chapter 1 presented the mechanisms and the underlying abilities involved in the reading process. By adopting the Simple View of Reading (Gough and Tunmer, 1986; Hoover and Gough, 1990) as theoretical framework, we reviewed the developmental trajectories of decoding and language comprehension acquisition in typical contexts (Ehri, 1995, 2005; Frith, 1986; Lervåg et al., 2018). An analysis of the Italian situation of language and reading outcomes in bilingual children with a migration background and of comparable contexts in other languages has allowed us to confirm that these children often lag behind their monolingual peers, even after several years of formal instruction (Cordin and Vender, 2022; INVALSI, 2025). While decoding difficulties seem to be more limited (August et al., 2009; Bonifacci and Tobia, 2016; Droop and Verhoeven, 2003; Lesaux and Siegel, 2003; Persici et al., 2022; Verhoeven, 2000), BCMB emerge to struggle more with reading comprehension (Bonifacci and Tobia, 2016; Kovelman et al., 2008; Lervåg and Aukrust, 2010; Melby-Lervåg and Lervåg, 2014). These difficulties are mainly due to a limited language proficiency, particularly marked in academic-related contexts (Cummins,

1979a, 2008), which is in turn negatively affected by low socioeconomic and migrant status (Eisenwort et al., 2018; Ginsborg, 2006; Hoff, 2013; Novita and Kluczniok, 2022; Valcárcel Jiménez et al., 2024). According to Cummins (1979b), BCMB's difficulties in the language of instruction can be explained by an interdependence relationship existing between this and the children's family languages: if the latter is not stimulated by rich and heterogeneous stimuli (e.g., including, for instance, exposure to written stimuli, as through shared reading), as it is often the case for low-income families, the former struggles to thrive as well, even if exposed to more variegated input (i.e., school language). As anticipated above, diagnosing reading impairments in BCMB is therefore particularly challenging, especially if it is done by using monolingual norms.

Assessing linguistic predictors of reading skills appears to be a reliable method to identify bilingual children with or at risk for developing reading impairments (Bedore and Peña, 2008; Vender et al., 2020, 2021; Vender and Melloni, 2021). Despite being partially dependent on language and reading acquisition (Kuo and Anderson, 2006; Perfetti et al., 1987; Ricketts et al., 2007), linguistic predictors of literacy are acquired spontaneously as part of the typical language acquisition path. Deficits in these components may therefore indicate at an early stage which children are at risk for developing reading impairments, even before school onset. This was precisely the focus of Chapter 2. By mainly examining studies conducted on children learning to read in English, we described the predictive relationship between a variety of pre-reading skills (or reading predictors), including phonological and morphological awareness, orthographic knowledge, rapid naming, oral language skills, and vocabulary, and later reading outcomes (decoding and comprehension). We observed that, despite difference in orthographies or in reading acquisition trajectories, these abilities measured before reading instruction onset are generally able to predict later performance in reading tasks (see Section 2.2).

The other focus of Chapter 2 was the effects of training on pre-reading skills, particularly phonological awareness. We decided to focus on this skill given its central role in the acquisition of the alphabetic principles (Bryant et al., 1990). Starting from Bradley and Bryant (1983), a consistent body of literature has shown crosslinguistically that phonological training is beneficial for children's phonological skills, even before reading instruction onset (see Section 2.4.1). Such positive effects were found for disadvantaged populations (from Brady et al., 1994; see Section 2.4.2) and for Italian preschoolers as well (Casani, 2021; Goffredo et al., 2016; Majorano et al., 2022, 2023; Zanchi et al., 2012; see Section 2.4.3). Findings on long-term transfers on later reading skills are instead more mixed, as they appear to be more consistent for languages with an opaque orthography, possibly due to the greater effort needed to acquire grapheme-phoneme

mapping in these languages, that may derive larger benefits from enhanced phonological skills (Bus and Van IJzendoorn, 1999; Ehri et al., 2001; Suggate, 2016).

The investigation of the effects of phonological training on Italian preschoolers and beginning readers is limited, especially as far as bilingual children are concerned (Casani, 2021). However, given the positive effects found in this population in other languages (from Stuart, 1999), further research on Italian bilinguals is needed. Together, targeted assessment tools and didactic interventions aimed at enhancing pre-reading skills may be the key to support bilingual children with a migration background in their initial academic path.

Building on these premises, three original studies were presented. The structure and the main findings of each study is described in the following paragraphs.

Study 1: Predicting emerging reading skills: a longitudinal study on monolingual and bilingual preschool children acquiring literacy in Italian

Study 1 aimed to provide a better understanding of the predictive relationship between preschool performance in pre-reading skills and later reading outcomes in bilingual and monolingual Italian children. Specifically, it was guided by the following research questions:

- (RQ1) How do monolingual and bilingual preschoolers with a migration background perform on reading predictors (including phonological and orthographic awareness, morphological awareness, vocabulary, lexical access, and oral language skills) in Italian?
- (RQ2) Can preschool performance in linguistic pre-reading skills predict emergent reading outcomes in bilingual and monolingual preschool children acquiring literacy in Italian?
- (RQ3) How do environmental factors such as SES and language exposure contribute to the development of pre-reading skills in bilingual children with a migration background?

To answer to these questions, a sample of 74 children (44 monolinguals, 30 bilinguals) attending the final year of kindergarten was recruited and tested longitudinally. At T0, corresponding to the final year of kindergarten, a variety of reading predictors was assessed. At T1 and T2 (1st and 2nd Grade), the same group was tested on reading abilities by means of finger-tracking technology. A short summary of the main findings for each research questions is provided.

RQ1

A series of t-tests was used to compare monolinguals and bilinguals' performance on reading predictors, including Nonverbal Intelligence, Nonword Repetition, Rhyme Detection, Phoneme Blending, Letter Knowledge, Receptive and Productive Vocabulary, Rapid Automatized Naming, Listening Comprehension, Narrative Abilities, and Morphological Awareness. Results showed that bilingual children underperformed their monolingual peers across all measures, except for Nonverbal Intelligence. Overall, our results are in line with previous findings obtained for older bilingual children learning to read in Italian (Bellocchi et al., 2017; Casani, 2021; Vernice and Pagliarini, 2018; Vettori et al., 2024). These findings provide further evidence to the fact that bilingual children with a migration background begin formal instruction with a reduced competence in all those language areas that are fundamental to acquire reading skills effectively, putting them at a disadvantage compared to their monolingual peers from very early on. If not adequately addressed, these difficulties may negatively impact their whole academic path (Cordin and Vender, 2022).

RQ2

In order to avoid multicollinearity issues, a cluster analysis was run to group participants based on similarities on kindergarten performance across all language tasks. As a result, this analysis yielded three clusters, each one defined by the following features: (i) a cluster including 11 participants (10 monolinguals, 1 bilingual), all displaying a high performance across all language tasks (HC); (ii) a cluster including 45 participants (31 monolinguals, 14 bilinguals), with an overall intermediate performance across all tasks (IC); (iii) a cluster including 18 participants (3 monolinguals, 15 bilinguals) displaying a low performance across all tasks (LC). Interestingly, even though language group (i.e., bilinguals/monolinguals) was not included as a variable in the cluster analysis, bilingual participants almost entirely fell in the intermediate- or low-performing clusters, confirming the results obtained from the t-tests. Cluster membership was therefore included as independent variable in a series of linear regressions aimed to verify its effect on later reading skills. In other words, we wanted to determine whether having high, intermediate, or low pre-reading scores significantly affected reading outcomes. Separate models were run for reading speed, accuracy, and comprehension, and for 1st and 2nd Grade results. The variable Item (Words, Nonwords, Texts) was also included in the models as independent variable, to examine potential differences in each reading stimuli.

Results showed that the pattern of performance that emerged for kindergarten tasks was replicated for reading outcomes as well, even though not all differences were significant. Specifically, HC consistently displayed the highest accuracy and shortest reading times,

followed by IC and then LC. The same occurred for comprehension. Looking at within-cluster contrasts, we observed that cluster membership appeared to affect the reading strategies employed to approach Words and Nonwords. In fact, whereas HC children read both Items with comparable high accuracy, LC displayed instead comparable low accuracy for the two Items. At the same time, HC and IC showed lexicality effects, as Words were read faster than Nonwords, while LC did not, as both Items were read at a comparable speed. We hypothesised that Cluster membership affects progress in reading strategies: at the end of 1st Grade, HC was already able to apply both reading routes (lexical and sublexical; Coltheart et al., 2001) appropriately, while LC still struggled with both; IC, instead, represented a middle ground between the two. Considering then between-clusters confronts it emerged that, while reading accuracy was comparable across the three Clusters for all Items, LC significantly lagged behind in Text reading speed and comprehension until the end of 2nd Grade.

Even though, to our knowledge, no previous studies had used cluster analysis to determine patterns of performance in pre-reading skills and then verify the predictive power of overall preschool performance on later reading, we can conclude that our results supported the hypothesis that linguistic pre-reading skills can determine reading outcomes, even in a transparent orthography and after two years of reading instruction. Our aim was also determining whether patterns of performance in pre-reading skills can predict later reading comparably in monolinguals and bilinguals, so that both populations could equally benefit from early support of weaker skills. Crucially, most of the children included in the low-performing cluster were bilinguals, although three monolinguals fell into this cluster too. Of course, we cannot rule out the possibility that this division originates from sample characteristics, given its limited size; however, this result represents further evidence for the difficulties that bilingual children with a migration background experience with reading acquisition, adding up to a consistent body of research summarized above.

Nevertheless, assessing pre-reading skills can still be an effective method to identify bilingual children who are more at risk of displaying atypical reading acquisition trajectories: as we have seen, bilingual children from our sample were equally divided between the intermediate-performing cluster, where most of the monolinguals fell, and the low-performing cluster. In the next paragraph, we will see that language experience and socioeconomic status play a central role in determining pre-reading outcomes, showing that assessment protocols targeting bilinguals should always consider these external parameters.

RQ3

For our third research question, answers from the *Q-BEx* questionnaire (De Cat et al., 2023) were put into relation with bilingual children performance in kindergarten. Specifically, we wanted to verify whether falling into the intermediate- or the low-performing cluster could be predicted by language experience and socioeconomic status. To do so, we ran an additional cluster analysis considering answers from the *Q-BEx* questionnaire tapping family and community language exposure and use, age of kindergarten onset, everyday habits, family composition and parental education. After obtaining two distinct clusters, we observed that children belonging to the *Q-BEx* cluster characterized by a larger exposure to the community language, whose members had started kindergarten earlier, and whose parents had a higher level of education in the community language, were also more likely to fall in the kindergarten intermediate-performing cluster, while children with the opposite language and SES profile were more closely linked to the low-performing cluster.

As discussed in this dissertation, children from a disadvantaged socioeconomic background typically receive a less rich language input (Ginsborg, 2006). Therefore, it is likely that the picture we observed aligns with this fact: presumably, since those children who were more largely exposed to the family language were also those whose parents had lower levels of education, considered as indicative of SES, it may be the case that they were exposed to poorer language input, in any of the languages spoken in the family. Since the questionnaire was administered to parents only when children were attending the 2nd Grade, we could not collect a measure of shared reading in the two languages, a parameter typically informative of home language environment, during kindergarten years; this detail would have allowed us to draw a stronger link between richness of the input and preschool performance. The fact that the age of kindergarten onset (before or after 3) also played a role in determining cluster membership is also indicative of the benefits that a richer language input can yield. In kindergartens, in fact, although no activities targeting explicit reading instruction are usually proposed, shared readings are typically common, and children who had been exposed to similar activities from early on may have derived greater benefits.

As already anticipated in Chapter 3, this should not be taken as a suggestion to limit the use of the family language in favour of the community language. Conversely, as will be discussed below, parents should be informed about the benefits that a richer language input may yield, and should be encouraged to provide such heterogeneous inputs to their children also in the family language, as a means to facilitate the acquisition of a higher level of the community language as well.

Taken together, findings from Study 1 have added up to previous research highlighting the difficulties that bilingual children with a migration background encounter at formal reading instruction onset. Although on a small sample, we have shown that children who are particularly at-risk to lag behind in reading acquisition can already be detected at kindergarten, and that such difficulties are linked to children's language experience and socioeconomic background. Besides being assessed and identified, children with linguistic vulnerabilities should also be supported in their reading acquisition process. This was precisely the focus of our Studies 2 and 3.

Study 2: Phonological awareness in monolingual and bilingual preschool children: short- and long-term effects of a didactic intervention

The aim of Study 2 was to verify the effectiveness of a didactic intervention administered in preschool as a way to support concurrent phonological awareness and later reading. As summarized above, a large body of literature has proven that explicit phonological training is beneficial for children's phonological skills, and, in specific circumstances, also for reading outcomes. The research questions guiding our investigation were the following:

(RQ1) What is the effectiveness of a didactic intervention focused on phonological awareness on concurrent phonological skills and later decoding abilities in preschool children?

(RQ2) Does the effectiveness of the phonological training differ between Italian monolingual and bilingual preschoolers with a migration background?

The population involved in this study was identical to that of Study 1. After being assessed on phonological awareness (Nonword Repetition, Rhyme Detection, Phoneme Blending) in the middle of the final year of kindergarten, a selected group of our sample (38 children, 27 monolinguals, 11 bilinguals) was delivered a 9-hour didactic intervention on this skill, participating in activities presented as games. Following the guidelines of the National Reading Panel (2000), children attended the training in small groups, and activities focused on progressively less salient units (words, rhymes, syllables, phonemes) and more demanding operations (identification, segmentation, blending). After this phase, an immediate post-test followed, to evaluate potential effects on phonological skills; then, training effects on decoding outcomes were explored at the end of 1st Grade.

Answers to RQ1 and RQ2 were provided by running a series of linear regression including Group (Experimental vs. Control), Language (Monolinguals vs. Bilinguals) and Time (pre- vs. post-test) as independent variables and verifying their effects on Nonword Repetition, Rhyme Detection, and Phoneme Blending scores. Effects of Group and Language were also measured for first-grade decoding components (speed and accuracy). Results revealed that the phonological training was effective on Phoneme Blending for the whole Experimental group, and on Nonword reading speed, but limited to monolinguals of this group.

As emerged from previous studies, the limited effect on later reading outcomes was expected, since our children were learning to read in a transparent orthography (Bus and Van IJzendoorn, 1999; Ehri et al., 2001; Suggate, 2016). However, the gains obtained in Phoneme Blending may have contributed to enhance sublexical reading speed in monolinguals. The absence of improvement for Rhyme Detection and Nonword Repetition could be attributed to two (possibly concurrent) causes. The first concerns the nature of the abilities: as proposed by Lundberg et al. (1988), rhyme sensitivity does not involve direct manipulation of phonological units, but it is rather dependent on sensitivity to sound similarity, and possibly less affected by explicit training. Nonword Repetition, instead, relates more to phonological memory, rather than awareness, and this was not specifically trained. Also, this skill has been found to be correlated with vocabulary growth (Metsala and Walley, 1998) which would allow children to obtain more fine-grained phonological representations, enhancing in turn operations such as nonword repetition. As a result, children's spontaneous vocabulary growth may have exerted a greater (and generalised to the whole group) effect on this task rather than the training itself. The second possible cause lies in the reduced hours that were dedicated to the training of these skills (3 hours for both Nonword Repetition and Rhyme Detection together).

The fact that the whole Experimental group improved in Phoneme Blending answers to our second research question by confirming that monolingual and bilingual children can equally take advantage of phonological trainings. This is in line with previous findings from other languages on bilingual populations (Bodé and Content, 2011; Herrera et al., 2011; Patscheke et al., 2016; Stuart, 1999, 2004). Additionally, past research has evidenced that the largest effect sizes are obtained for phoneme-level operations, as these are the less salient phonological units and probably benefit the most from explicit training (Cunningham, 1990). As for the absence of benefit transfer on reading for bilinguals, it may be explained by an interplay between the limited duration of the intervention (Gunn et al, 2000), the considerable amount of time between the

intervention and the follow-up post-test, and the limited language competence of these participants.

Taken together, these findings preliminarily support, on a very small sample, the benefits of administering didactic interventions to monolingual and bilingual preschoolers, a population still understudied in the Italian context (Casani, 2021). Programs such as this could be implemented in traditional kindergarten curricula to promote early phonological awareness as a first step for aiding children with language vulnerabilities to close the initial gap with their monolingual peers.

Study 3: Supporting emerging reading skills: effectiveness of phonological training in multilingual primary school classes

On the same line of the study just described, the aim of this final study was verifying the effectiveness of a didactic intervention focused on phonological awareness on concurrent phonological skills and reading outcomes in a population of first graders. Given the reciprocal relationship between phonological awareness and literacy (Perfetti et al., 1987), active reflection on and manipulation of phonological units can be beneficial also for beginning readers, as extensively demonstrated (from Cunningham, 1990; see Section 2.4.4). However, to our knowledge, only one study examined the effects of a phonological training on bilingual Italian children (Casani, 2021); additionally, little is known about the reading profile of monolingual and bilingual first graders learning to read in Italian (Desimoni et al., 2012; Pinto et al., 2016; Majorano et al., 2021 for reading assessment in monolinguals), as most research focuses on second graders or older children.

Building on these premises, we elaborated the following research questions:

- (RQ1) What is the profile of reading and reading-related (phonological) skills in Italian monolingual and bilingual first graders with a migration background?
- (RQ2) What is the effectiveness of a didactic intervention focused on phonological awareness on concurrent phonological skills and decoding in first graders learning to read in a transparent orthography?
- (RQ3) Does the effectiveness of the phonological training differ between Italian monolingual and bilingual first-graders with a migration background?

A new sample of 73 first graders (52 monolinguals, 21 bilinguals) was recruited for this study. Additionally, participants were divided into an Experimental group (34 children, 25 monolinguals, 9 bilinguals) and a Control group (39 children, 27 monolinguals, 12 bilinguals) based on whether or not they took part in the intervention. In Phase 1, the whole sample was tested on measures of phonological awareness (Nonword Repetition, Rhyme Detection, Syllable and Phoneme Blending and Deletion) and reading (speed, accuracy, and comprehension for Words, Nonwords, and Texts) by means of finger-tracking technology. After the intervention, that consisted in playful activities focused on units and operations of increasing complexity and included orthographic representations of stimuli, the whole sample was re-tested on the same measures.

RQ1

A series of t-tests allowed us to compare monolinguals and bilinguals' performance on phonological and reading measures. Monolingual children outperformed bilinguals on all phonological measures, except for Nonword Repetition and Syllable Deletion, which were comparable across groups. As for reading, monolinguals were significantly better at Word reading accuracy, and at Word, Nonword and Text speed. No difference emerged for Nonword and Text accuracy and for comprehension.

The poorer bilingual performance on more demanding phonological tasks is in line with previous studies (Casani, 2021). Interestingly, compared to Study 1, bilinguals did not differ from monolinguals on Nonword Repetition. An improvement in this component may have been influenced by a growth in vocabulary, as proposed by Gathercole (1995, 2006). Nonword Repetition is confirmed to be less affected by bilingual contexts (Casani, 2021; Taha et al., 2022; Vender et al., 2020; Vender and Melloni, 2021), but only in older children. The results for Syllable Deletion, instead, could be attributed to the complexity of the task, that resulted as equal across groups.

The results for reading measures were in line with our expectations. The poorer bilingual accuracy for Words can be explained by the smaller vocabulary, whose effect appears to be mitigated by the textual dimension. When only sublexical reading is involved, the two groups are equal, supporting the rapid acquisition of grapheme-phoneme mapping in transparent orthographies (Melloni et al., 2022; Murineddu et al., 2006). Reading speed, instead, appears to be more problematic for bilinguals. Past findings in this respect are mixed, but this component has been consistently shown to be more affected by reading difficulties in transparent

orthographies (Serrano and Defior, 2008). The fact that differences in comprehension were only marginally significant could be an effect of the limited data collected.

RQ2 and 3

A series of linear regressions was run to verify the effects of Group (Experimental vs. Control), Language (Monolinguals vs. Bilinguals) and Time (pre- vs. post-test) on phonological awareness and reading outcomes. This served to explore the effects of the intervention and potential differences between bilinguals and monolinguals.

An improvement in Nonword Repetition, Syllable Blending, and Syllable Deletion was observed for the Experimental group, but limited to Bilingual participants for the first two skills. Instead, the whole sample improved on the remaining tasks at post-test, irrespective of intervention. We can hypothesise that, for monolinguals, the improvement observed mainly coincides with the spontaneous growth of phonological skills. Bilinguals, instead, who displayed initial lower phonological skills, could benefit more from explicit instruction on those components that are at the foundation of effective reading. The general improvement observed for phoneme-based operations, instead, might have been attributable to an effect of reading instruction, delivered by teachers on a daily basis, rather than to the intervention.

Finally, a transfer of the intervention gains on reading was found exclusively for Nonword reading accuracy, for both Monolinguals and Bilinguals. The fact that, as in Study 2, the benefits were limited to Nonword Reading is not surprising, as the trained skills were precisely those needed to read through the sublexical route. We hypothesise that the effect did not extend to reading speed because the Experimental group was already significantly faster compared to the Control group at pre-test, thus limiting the margin of improvement for the former. All the other components improved spontaneously.

Taken together, these findings confirm that bilingual children with a migration background lag behind their monolingual peers in phonological and specific reading abilities even after a few months of reading instruction, as already shown for older children (see Paragraph 1.3.2.1). Nevertheless, these children are also those who appear to benefit the most from explicit phonological training, even though the transfer on reading skill is limited. It is possible that a longer training, delivered to smaller groups of children, may have had a greater impact on all skills.

Some general conclusions can be drawn from our studies. First, the longitudinal investigation allowed us to observe that bilingual children at risk to develop reading difficulties can be detected even before school onset, provided that both language and contextual factors are taken into account. Second, even though direct benefits on reading are limited, phonological awareness interventions can be an effective way to allow children, above all those with language vulnerabilities, to get familiar with a set of skills and concepts that are at the core of the reading mechanism. Without an effective decoding, there cannot be adequate reading comprehension.

A crucial point of the present dissertation was the design and implementation of original screening and assessment protocols. Many of the linguistic tests were specifically designed for these studies (Phoneme Blending for Study 1, 2, 3; Syllable Blending and Deletion and Phoneme Deletion for Study 3), and, most importantly, an original protocol for first graders was elaborated for the finger-tracking application *ReadLet* (Taxitari et al., 2020). All these tools have proven reliable for capturing fine-grained differences between skilled and poor readers, and between monolinguals and bilinguals. Administering these tests on a wider scale would allow for their validation.

Similar conclusions can be reached for the intervention protocols, which were completely original. Anecdotally, the experimenter perceived that children were at ease and engaged with the proposed activities, and this aspect was crucial for the effectiveness of the intervention. As widely documented, motivation plays a central role in learning mechanisms (Martin and Dowson, 2009), and this is precisely the reason why all our intervention activities were structured as entertaining games. Further research should verify the effectiveness of the kindergarten training on a greater variety of phonological skills, to evaluate the impact also on more salient phonological units.

Limitations and future directions

As previously stated, the samples on which our experiments were run were particularly small, allowing only preliminary and exploratory conclusions. Future studies should involve larger and more balanced samples, particularly with regard to bilingual children. On the same line, studies based on experimental and control groups should always assign participants to either group randomly. This is something that was not possible for us, due to organizational matters, but it would have ensured a less biased context for the administration of our training programs. On the other hand, this allowed us to apply our protocols in real-life contexts, namely existing classes,

and this enabled us to test the feasibility of similar projects in a plausible scenario. Finally, to obtain a more complete picture of our participants and rule out potential interplays between migrant status and low SES, information on the latter should have been collected for our monolingual sample as well. However, given the very limited research on Italian bilingual preschoolers and emergent readers, we believe that this contribution can serve, together with other studies, as a starting point for the investigation of these children's unique reading acquisition trajectory.

The main motivation behind this research was the promotion of a more inclusive education system. As discussed in the initial chapter of this dissertation, the reading and educational outcomes of bilingual children with a migration background are strongly linked to their cultural, socioeconomic, and linguistic circumstances. Their family languages are generally not promoted in official contexts, and the disadvantaged family conditions they often come from do not always allow them to develop the prerequisites needed for effective reading acquisition. We believe that integrating screening and support protocols in standard school programs would not impact the current curricular structures excessively, but it would make a considerable difference for children with language vulnerabilities. As we proposed in our studies, these activities should be presented as playful games and take into account the age and the competence of children at every developmental stage. In kindergarten, for instance, shared nursery rhymes reading could include active reflection on the concept of rhyme or sound similarity. In early grades, children's attention could be drawn to the compositional nature of syllables and phonemes.

Early screening and support for these populations can certainly contribute to addressing this issue, but for migrant children to feel truly included, school institutions must make a radical change in their attitudes toward them. Some attempts have been made in recent years: for instance, the pedagogical practice of translanguaging (see Cummins, 2019, for a review), which consists in the use of children's family languages in everyday classroom activities and crosslinguistic comparisons, aims to make them feel more included and at ease when expressing themselves. This attitude toward children's home languages would also contribute to enhancing their perception of these languages as a competence to pursue, and not as something to be hidden or disregarded (Garraffa et al., 2023). Unfortunately, however, teachers and educators are often not completely aware of the importance for children of maintaining their home languages and of the benefits that this can bring to the acquisition of the community language (Cunningham, 2020). Therefore, as discussed at several points, families should be educated on the importance and the benefits that providing a richer linguistic input in their family

languages has on their children's general linguistic development. A variegated use of family languages should be promoted, and not discouraged as it often still occurs.

Of course, this cannot be left to individual initiative; similar programs should be promoted at a national level. Most importantly, synergistic collaboration among educational institutions, teachers, researchers, and practitioners should be fostered, as it is only through such collaboration that we will be able to ensure an equitable and bright future for all children, irrespective of their backgrounds.

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Appendix A – Study 1: T0 assessment materials

Phonological awareness

Nonword repetition (Vender et al., 2020)

Number of syllables	Complexity level	Stimuli
2	simple	<i>diso, buna, cabo</i>
	intermediate	<i>girvo, delsa, parce</i>
	complex	<i>prambio, sparfie, sculvia, breldia</i>
3	simple	<i>nosime, tesulo, pubaro</i>
	intermediate	<i>lacombre, plecarvo, menstari</i>
	complex	<i>flasterdi, gramblefo, brispange, blasturno</i>
4	simple	<i>dusevopi, zidotule, gopeluma</i>
	intermediate	<i>sencutroma, valdobresi, precaldupo</i>
	complex	<i>maspurvendio, tresculpiogna, fespulgiacro, biostermulva</i>
5	simple	<i>remifaludo, dumicefona, mularisove</i>
	intermediate	<i>fulestorinca, zigrupensola, blitacunorze</i>
	complex	<i>chestangutoldri, postencuvimbla, dignaschermunflo, chestangutoldri</i>

Rhyme Detection (Vender and Melloni, 2021)

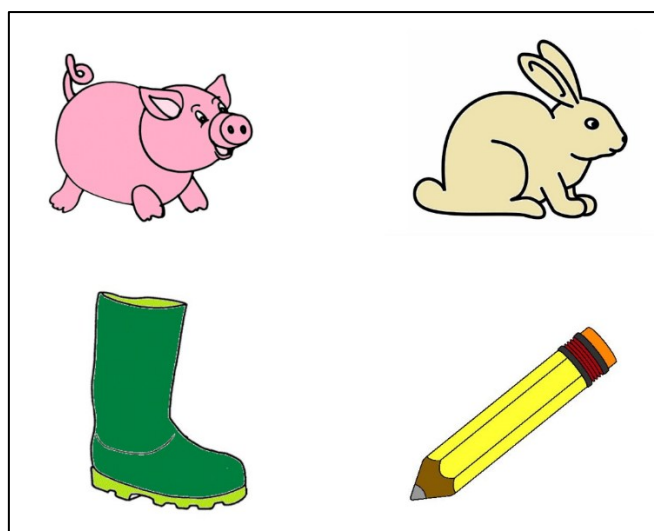


Figure 1. Visual example from the Rhyme Detection task.

Given word	Target word	Phonological distractor	Semantic distractor
<i>bidone</i> _(practice item)	<i>sapone</i>	<i>bilancia</i>	<i>cestino</i>
<i>panino</i> _(practice item)	<i>delfino</i>	<i>paletta</i>	<i>gelato</i>
<i>maiale</i>	<i>stivale</i>	<i>matita</i>	<i>coniglio</i>
<i>forchetta</i>	<i>molletta</i>	<i>formaggio</i>	<i>coltello</i>
<i>badile</i>	<i>fucile</i>	<i>banana</i>	<i>rastrello</i>
<i>patata</i>	<i>pirata</i>	<i>padella</i>	<i>zucchini</i>
<i>cancello</i>	<i>martello</i>	<i>canguro</i>	<i>lucchetto</i>
<i>piscina</i>	<i>bambina</i>	<i>pilota</i>	<i>costume</i>
<i>melone</i>	<i>pallone</i>	<i>medaglia</i>	<i>anguria</i>
<i>cavallo</i>	<i>cristallo</i>	<i>carota</i>	<i>gallina</i>
<i>castagna</i>	<i>lavagna</i>	<i>castello</i>	<i>nocciola</i>
<i>cuscino</i>	<i>bambino</i>	<i>cucina</i>	<i>divano</i>

Phoneme Blending

Number of syllables	Structure	Stimuli
-	-	<i>pane, cane</i> _(practice items)
2	CVCV	<i>riso, mela, nave</i>
2	CCVCV	<i>treno, scale, frigo</i>
2	CVCCV	<i>mondo, torta, denti</i>
3	CVCVCV	<i>matita, tavolo, regalo</i>

Lexical access

Rapid Automated Naming (Vender and Delfitto, 2024)

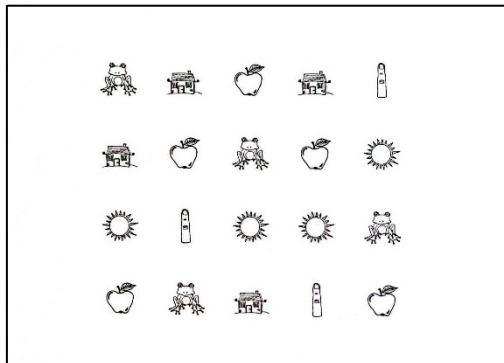


Figure 2. Practice items for the Rapid Automatized Naming task.

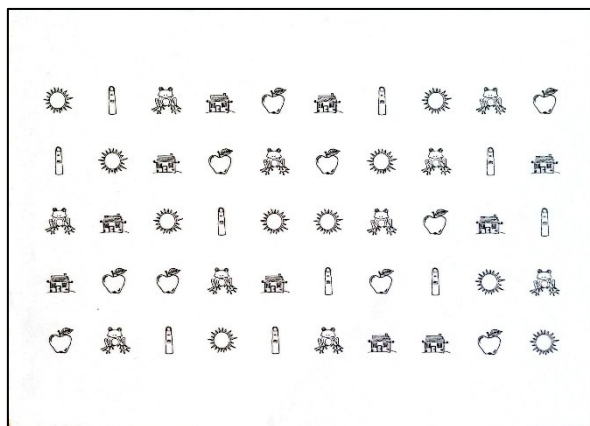


Figure 3. Stimuli for the Rapid Automatized Naming task.

Morphological awareness

Nonword inflection (Vender et al., 2017)

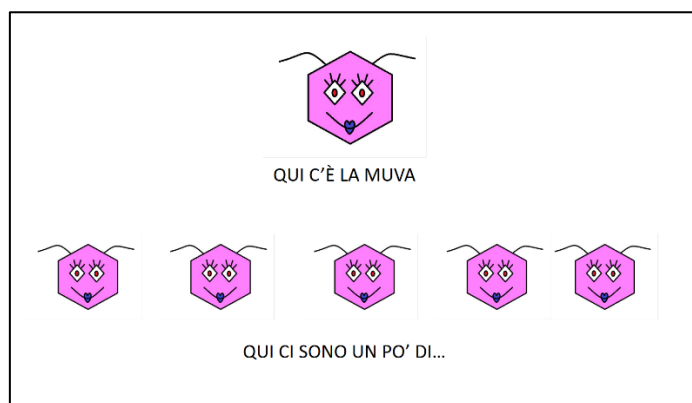


Figure 4. Visual example from the Nonword inflection task.

Condition	Stimuli
Practice item (words)	<i>gallo, scala</i>
Practice items (nonwords)	<i>saro, muva</i>
Feminine sing. <i>a</i> > pl. <i>e</i>	<i>gora, zurla, trima</i>
Masculine sing. <i>o</i> > pl. <i>i</i>	<i>folo, tarno, prebo</i>
Masculine sing. <i>e</i> > pl. <i>i</i>	<i>corze, trape, lone</i>
Masculine sing. <i>a</i> > pl. <i>i</i>	<i>treda, voma, bolfa</i>
Feminine sing. <i>e</i> > pl. <i>i</i>	<i>mose, forde, stabe</i>

Nonword derivation (Melloni and Vender, 2022)



Figure 5. Visual example from the Nonword derivation task.

Stimuli: *Gatto* (practice item), *filpo* (practice item), *gabo*, *fespo*, *cumbo*, *daffo*, *bilo*

Appendix B – Study 1: T1 assessment materials

ReadLet (Taxitari et al., 2020)

Words

Length	Syllabic structure	Stimuli
Short (2 syllables)	CV	<i>mito, vita, fumo, sede</i>
	CC	<i>gesso</i>
	C+C	<i>crisi, preda</i>
	CVC	<i>nervo, campo</i>
	VV	<i>zaino</i>
Long (3/4 syllables)	CV	<i>pericolo, domenica, semaforo, telefono</i>
	CC	<i>cavallo</i>
	C+C	<i>gradino, scatola</i>
	CVC	<i>pulcino, benzina</i>
	VV	<i>notizia</i>
Long + suffix	CV	<i>movimento, musicista, muratore, turismo</i>
	CC	<i>attività</i>
	C+C	<i>scultura, tradizione</i>
	CVC	<i>fornaio, altezza</i>
	VV	<i>divisione</i>

Nonwords

Length	Syllabic structure	Stimuli
Short (2 syllables)	CV	<i>nuse, bita, muvo, zalo</i>
	CC	<i>maffi</i>
	C+C	<i>spobo, bremono</i>
	CVC	<i>parno, gante</i>
	VV	<i>daima</i>
Long (3/4 syllables)	CV	<i>selafime, mesabune, varipifo, telidobo</i>
	CC	<i>tegalla</i>
	C+C	<i>scapide, trevuso</i>
	CVC	<i>banteco, cartomo</i>
	VV	<i>feliasi</i>

Long + suffix	CV	<i>selabista, mesazione, varipismo, telidione</i>
	CC	<i>tegallore</i>
	C+C	<i>scapità, trevaio</i>
	CVC	<i>bantemento, cartura</i>
	VV	<i>feliezza</i>

Texts

Text	Questions	Answers
Il coniglietto <i>Un coniglietto vuole regalare le uova di Pasqua a tutti i bambini. Per fare una sorpresa, cerca un posto dove nasconderle. Durante la notte trova un bel prato e decide di mettere le uova di cioccolato in mezzo ai fiori. Il mattino dopo, sul prato si vedono tante uova colorate. Tutti i bambini corrono verso il prato per raccogliere le uova. Il coniglietto sorride, felice di aver fatto una bella sorpresa ai bambini.</i>	Chi trova le uova?	*I bambini Il coniglietto Le galline
	Quando nasconde le uova il coniglietto?	*Di notte Di mattina Di pomeriggio
	Perché il coniglietto mette le uova in mezzo ai fiori?	*Per nasconderle Perché sembrano fiori Per proteggerle
Il riccio <i>Per tornare a casa da scuola, Luca passa sempre vicino a un parco. Un giorno, trova un piccolo riccio tutto solo. "Povero riccio, sicuramente si è perso". Luca prende il riccio con attenzione e lo porta a casa. Alcuni giorni dopo, Luca va a fare una gita nel bosco e decide di liberare il riccio. Piano piano, posa il riccio sulle foglie del</i>	Dove porta il riccio Luca?	*Nel bosco A scuola In giardino
	Dove passa Luca per tornare a casa?	*Accanto a un parco Accanto al bosco Accanto a un lago

*bosco, felice di aver aiutato il
suo piccolo amico.*

*Perché Luca dice che il riccio si
è perso?*

**Perché il riccio è solo
Perché il riccio è piccolo
Perché il riccio è spaventato*

Appendix C – Study 1: T2 assessment materials

Words and Nonwords

See Appendix B

Texts⁷

Text	Questions	Answers
Zigghi e Gianni – Episode 1 <i>Zigghi è un alieno da un pianeta lontano. È tondo come un pallone da calcio. Ha due grandi occhi verdi e il pelo è blu e giallo. Gli piace molto volare con la sua nave spaziale rossa. Zigghi vuole visitare tutti i pianeti. Un giorno decide di andare sul pianeta più bello di tutti: la Terra. Al tramonto, Zigghi arriva nel cielo di una grande città. Osserva le case e i tetti rossi. Vola sopra un fiume blu e su grandi parchi con alberi verdi e fiori colorati. Decide di andare a vedere la città più da vicino. Si nasconde quindi tra le foglie di un albero. Da lì guarda le macchine che passano veloci sulla strada. Ad un tratto il semaforo diventa rosso e le macchine si fermano. Zigghi è molto sorpreso perché nel suo pianeta le macchine possono volare.</i>	<i>La storia racconta...</i> <i>Zigghi viaggia con...</i>	<i>*di un alieno che visita la Terra delle macchine che non si fermano al semaforo di una partita di calcio di un umano che visita la Luna</i> <i>*una nave spaziale le sue ali la macchina l'aereo</i>

⁷ The Texts adopted for T2 assessment were elaborated by the research team of the *ComPhys Lab* in the context of the *ReadLet* project (Ferro et al., 2018).

Zigghi e Gianni – Episode 2

Zigghi continua ad osservare le macchine.
Un uccellino che vola veloce come la sua
nave spaziale cattura la sua attenzione.
Decide allora di seguirlo come in una gara.

Ma l'uccellino all'improvviso cambia
direzione e Zigghi, che non vuole perderlo di
vista, perde il controllo della sua nave.

Atterra allora sul balcone della casa di
Gianni, che in quel momento era già a letto
e stava leggendo un libro prima di dormire.

Sentendo strani rumori provenienti dal
balcone, Gianni va a vedere cosa sta
succedendo. Sul balcone trova Zigghi e la
sua nave spaziale. Il suo cuore alla vista
dell'alieno inizia a battere all'impazzata. Ma

Gianni, dopo aver visto Zigghi tremare
anche lui di paura, pensa a quello che gli
dice sempre sua mamma sugli insetti:
“Forse lui ha più paura di me, per quanto
strano possa sembrare”. Prende così
coraggio e lo saluta con la mano. Zigghi lo
imita.

La storia racconta...

Zigghi atterra sul
balcone di Gianni
perché...

*il primo incontro tra Zigghi e
Gianni
un bambino che non vuole
andare a scuola
un uccellino che si nasconde
dietro a un albero
la gara tra Zigghi e una
macchina

*ha perso il controllo della sua
nave
non sa che cosa sia un balcone
vuole incontrare Gianni
l'uccellino è andato sul balcone

Il nonno e Darwin – Episode 1

Mio nonno Andrea è molto bravo a
raccontare le storie. Non racconta le storie
della buonanotte. Il nonno Andrea non
legge quelle dei libri. Racconta storie che si
inventa al momento. Mi piace molto
ascoltarlo. Con la sua voce dolce, nonno
Andrea riesce a dare vita ad ogni parola. Mi
sembra di vivere le storie che mi racconta.
Le sue mani sono grandi e mentre parla si
muovono veloci. Sembra un ballerino o un

Nonno Andrea è
molto bravo a...

*raccontare le storie
giocare con il nipote
ballare
viaggiare

*attore in un teatro. Sono molto felice di
passare del tempo con lui. Prima di andare
a dormire, io mi siedo per terra accanto al
letto e il nonno sulla sedia. Poi lui mi
sorride e io so che sta per cominciare. Per
alcuni secondi chiude gli occhi e fa un
grande respiro. E così cominciano tutti i
viaggi con la grande fantasia del nonno alla
guida.*

*Dove trova le storie il
nonno Andrea?*

**Le inventa
In un libro
Da un attore
Da un ballerino*

Il nonno e Darwin – Episode 2

*Tra tutte le storie che mi ha raccontato il
nonno, la mia preferita è quella del vecchio
Giustino e della pianta rara. Giustino
abitava nell'ultima casa del paese, non
lontano dalla casa del nonno. Era un tipo
strano, usciva poco e non parlava quasi
mai. Giustino, per quanto fosse conosciuto
da tutti in paese, stava sempre da solo.
Preferiva la compagnia degli animali a
quella degli altri abitanti del paese. Aveva
un cane, due gatti e sei tartarughe. Al lato
della casa aveva un giardino incolto con*

*Il tesoro di Giustino
era...*

**una pianta
due gatti
sei tartarughe
un cane*

*una vecchia serra al centro. Nella serra, si
diceva Giustino nascondeva il suo tesoro,
una pianta rarissima che veniva da chissà
dove. Mio nonno, che allora era un giovane
curioso con la passione per le piante, era
ossessionato dal segreto di Giustino.
Avrebbe fatto di tutto per dare uno sguardo
all'interno della serra. Ma il vecchio non
lasciava che nessuno si potesse avvicinare.*

*Giustino era un
uomo...*

**solitario
piacevole
contento
socievole*

Appendix D – Study 2: Phase 2 phonological training materials

Words and rhymes

Word sound-meaning discrimination

Condition	Stimuli
Word length – referent match (short word – small-sized referent)	<i>topo, mano, pane, mela, ape, fiore, penna, naso, pera, noce</i>
Word length – referent match (long word – large-sized referent)	<i>grattacielo, elefante, automobile, rinoceronte, elicottero, frigorifero, dinosauro, unicorno, ippopotamo, aeroplano</i>
Word length – referent mismatch (long word – small-sized referent)	<i>coccinella, pomodoro, uccellino, lucertola, albicocca, fotografia, cappellino, fazzoletto, saponetta, quadrifoglio</i>
Word length – referent mismatch (short word – large-sized referent)	<i>nave, treno, mare, panda, monte, palma, drago, torre, moto, razzo</i>

Long and short words production

Condition	Stimuli
Long word	<i>cioccolato, palloncino, telefono, pennarello</i>
Short word	<i>lago, vaso, luna, casa</i>

Nonword repetition ('Whispers')

Number of syllables	Word/nonword	Stimuli
2	Word	<i>sole, nave, mare, rete, pace</i>
	Nonword	<i>sote, coti, dila, rine, deto</i>
3	Word	<i>cucina, corona, matita, parola, domani</i>
	Nonword	<i>denora, calado, sutena, potili, monale</i>

Rhyme detection

Given word	Target word	Phonological distractor	Unrelated distractor
Children's names and surnames	<i>sfida</i>	<i>cane</i>	<i>aereo</i>
	<i>capriola</i>	<i>giacca</i>	<i>pappagallo</i>
	<i>tram</i>	<i>ippopotamo</i>	<i>zebra</i>

<i>letti</i>	<i>casa</i>	<i>mela</i>
<i>castello</i>	<i>dono</i>	<i>spiaggia</i>
<i>biscotti</i>	<i>camicia</i>	<i>cigno</i>
<i>sapone</i>	<i>balena</i>	<i>patatine</i>
<i>prato</i>	<i>neve</i>	<i>torta</i>
<i>mani</i>	<i>zucca</i>	<i>libri</i>
<i>altalena</i>	<i>giacca</i>	<i>macchina</i>
<i>pesco</i>	<i>luna</i>	<i>verdura</i>
<i>pane</i>	<i>marmotta</i>	<i>casa</i>
<i>cioccolato</i>	<i>imbuto</i>	<i>gatto</i>
<i>cuori</i>	<i>pino</i>	<i>caffè</i>
<i>biglie</i>	<i>isola</i>	<i>cane</i>
<i>Pippo</i>	<i>finestra</i>	<i>pesci</i>
<i>anelli</i>	<i>gallo</i>	<i>famiglia</i>
<i>piscina</i>	<i>adesivi</i>	<i>fuoco</i>
<i>città</i>	<i>gelato</i>	<i>fiore</i>
<i>acquari</i>	<i>giugno</i>	<i>pomodoro</i>
<i>faro</i>	<i>lombrico</i>	<i>casa</i>
<i>sveglia</i>	<i>denti</i>	<i>gelato</i>
<i>cucchiaino</i>	<i>mano</i>	<i>pizza</i>
<i>cartoni</i>	<i>pesci</i>	<i>albero</i>
<i>faro</i>	<i>cane</i>	<i>peperone</i>
<i>naso</i>	<i>topo</i>	<i>acqua</i>
<i>carrozza</i>	<i>costume</i>	<i>aereo</i>
<i>macedonia</i>	<i>anno</i>	<i>zebra</i>
<i>giaguaro</i>	<i>mucca</i>	<i>mela</i>
<i>trottola</i>	<i>dado</i>	<i>uccello</i>
<i>pallone</i>	<i>grano</i>	<i>torta</i>
<i>piatti</i>	<i>mela</i>	<i>libro</i>
<i>camino</i>	<i>cibo</i>	<i>macchina</i>
<i>burattini</i>	<i>rospo</i>	<i>gatto</i>
<i>cioccolatini</i>	<i>zampa</i>	<i>caffè</i>
<i>treno</i>	<i>cestino</i>	<i>acqua</i>
<i>braccialetti</i>	<i>bocca</i>	<i>fuoco</i>
<i>gattini</i>	<i>mare</i>	<i>pesci</i>
<i>Italia</i>	<i>amaca</i>	<i>fiore</i>

Rhyme production

Stimuli: pane, mare, mano, montagna, pallone, pulcino, maestra, canale, pera, campana

Syllables

Syllable identification

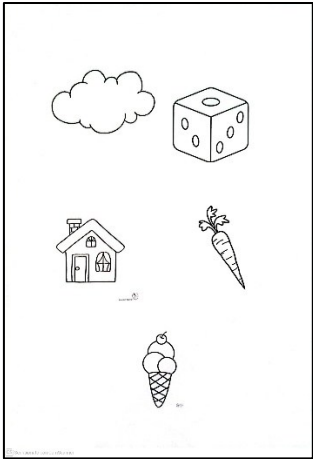


Figure 6. Materials for the Syllable identification training activity.

Syllable identification (‘Handkerchief game’)

Length	First-syllable structure	Stimuli
2 syllables	CV	<i>lupo – luce</i>
		<i>lana – lago</i>
		<i>lino – libro</i>
		<i>fata – fame</i>
		<i>fico – filo</i>
		<i>foto – foglio</i>
	CVC	<i>torta – torno</i>
		<i>forno – forma</i>
		<i>corta – corno</i>
		<i>mondo – monte</i>
<i>calza – calma</i>		
<i>campo – cambio</i>		

3 syllables	CV	<i>pilota – pirata</i>
		<i>catena – canale</i>
		<i>sapone – salame</i>
		<i>balena – banane</i>
		<i>pecora – petalo</i>
		<i>divano – ditale</i>
	CVC	<i>campana – cambiare</i>
		<i>salmone – saltare</i>
		<i>pulcino – pulsante</i>
		<i>soldato – soldino</i>
		<i>lampada – lampone</i>
		<i>fortuna – forbici</i>

Syllable identification and segmentation ('Memory game')

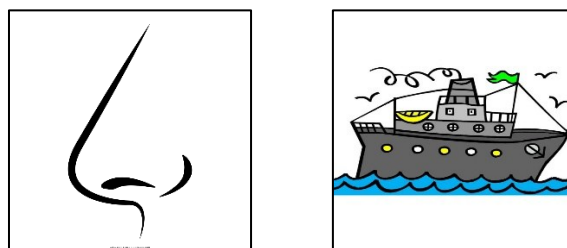


Figure 7. Visual example from the Memory game.

Condition	Stimuli
Initial-syllable matching	<i>banana – bastone</i>
	<i>dito – divano</i>
	<i>lumaca – luna</i>
	<i>mano – matita</i>
	<i>medaglia – mela</i>
	<i>naso – nave</i>
	<i>ramo – rana</i>
	<i>sedia – semaforo</i>
	<i>telefono – tesoro</i>
Final-syllable matching	<i>bambola – candela</i>
	<i>cioccolata – polenta</i>
	<i>elefante – prete</i>
	<i>pomodoro – tesoro</i>
	<i>regalo – tavolo</i>
	<i>sorriso – vaso</i>
	<i>budino – camino</i>
	<i>cane – limone</i>

Syllable identification and segmentation

Stimuli: bacio, cane, dado, fata, gara, lato, mano, naso, pane, rana

Syllable segmentation ('Hopscotch')

Length	First-syllable structure	Stimuli
2 syllables	CV	<i>Sara, tana, rana, cara, sala, moto, topo, poco, dopo, foto</i>
	CVC	<i>caldo, mondo, campo, lampo, tenda, torta, carta, soldo, porto, forte</i>
3 syllables	CV	<i>banana, limone, melone, balena, farina, divano, salame, patata, colore, sapone</i>
4 syllables	CV	<i>telefono, pomodoro, topolino, caramella, pericolo</i>
	CVC	<i>cartolina, tamburello, fortunato, mercoledì, verdurina</i>

Syllable segmentation and blending ('Syllabic chain')

Stimuli: *salame, fortuna, mare, parco, gelato, cortile, pera, forma*

Phonemes

Phoneme identification

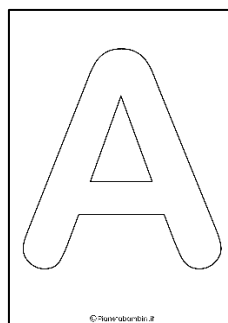


Figure 8. Materials for the Phoneme identification training activity.

Phoneme identification ('Handkerchief game')

Stimuli: oca – oro, ape – amo, ufo – uno

orologio – ombrello, elefante – elicottero, armadio – anatra

vaso – vela, neve – naso, casa – coro

pera – pila, bolla – bacio, dado – dito

faro – foto, vino – voto, sole – seme

mano – mela, nano – nome, buio – ballo

sera – Sara, zero – zuppa, scena – scimmia

cena – cielo, giacca – giorno, cane – cosa

Phoneme identification ('The Alien')

Condition	Stimuli
Correct	Avete visto che bello il fiocco che ho sulla testa? Mi sto divertendo molto a fare questo gioco con voi! Siete proprio dei bambini simpatici! Vi piace il mio vestito arcobaleno? Avrei proprio voglia di un bel gelato al cioccolato! Grazie per avermi aiutato con la vostra lingua! Ho imparato tante cose con voi
	Che freddo! Chiudete la <u>dorta</u> ! Chi ha bevuto dalla mia <u>forracia</u> ? Ieri mia mamma mi ha letto un bellissimo libro di <u>ravole</u> Chi vuole giocare con me a <u>tascondino</u> ? Il mio piatto preferito è la <u>binestra</u> di verdure Tutti i giorni mio papà mi porta a scuola in <u>lacchina</u> A casa ho un bellissimo peluche a forma di <u>nattino</u>
Nonword	Ieri ho giocato a <u>gialla</u> con mio cugino Mia mamma per il compleanno mi fa sempre la <u>porta</u> con la panna Oggi il <u>telo</u> è grigio, ma domani ci sarà il sole! Una volta quando ero piccola mi sono fatta male alla <u>nano</u> Sapete che soffro di vertigini? Ho un po' paura a guardare giù dalla <u>minestra</u>
Minimal pair	

*Domani vado alla testa di compleanno della mia
amica Sofia
La mia merenda preferita è cane e Nutella*

Phoneme identification ('Minimal pairs')

Condition	Stimuli
Vowel change	<i>sole – sale, nave – neve, casa – cosa, topo – tipo, ramo – remo</i>
Consonant change	<i>cane – pane, sera – seta, foto – moto, naso – vaso, fico – filo, freno – treno, dritto – fritto, crema – trema</i>
Consonant doubling	<i>pala – palla, casa – cassa, copia – coppia</i>
Nonword	<i>coti – cati, deto – reto, dila – dima</i>
Identical word pair	<i>mela, fata, pera, luna, tetto, rana, penna</i>
Identical nonword pair	<i>sote, dano, rine</i>

Phoneme identification and segmentation ('The Ship')

Stimuli: *bambini, cani, patate, rinoceronti, mucche, tappeti, finestre, serpenti, lamponi, nasi*

Phoneme blending

Stimuli: *ape, oca, ora, uno, ufo*

casa, cane, cosa, caso, caro

vera, sera, pera, nera, cera

noce, rana, faro, dito, toro

Appendix E – Study 3: Phase 1 and 3 assessment materials

Additional measures

Lexical access

Rapid Automatized naming with objects: see Appendix A

Rapid Automatized Naming with letters

S	M	S	B
M	D	M	A
B	A	A	D
D	S	B	M
A	B	D	S

Figure 9. Practice items for the Rapid Automatized Naming task with Letters.

A	B	D	S	M	S	B	A	D	M
B	A	S	M	D	M	A	D	B	S
D	S	A	B	A	A	D	M	S	B
S	M	M	D	S	B	M	B	A	D
M	D	B	A	B	D	S	S	M	A

Figure 10. Stimuli for the Rapid Automatized Naming with letters.

Phonological awareness

Nonword Repetition

See stimuli from Appendix A

Rhyme Detection

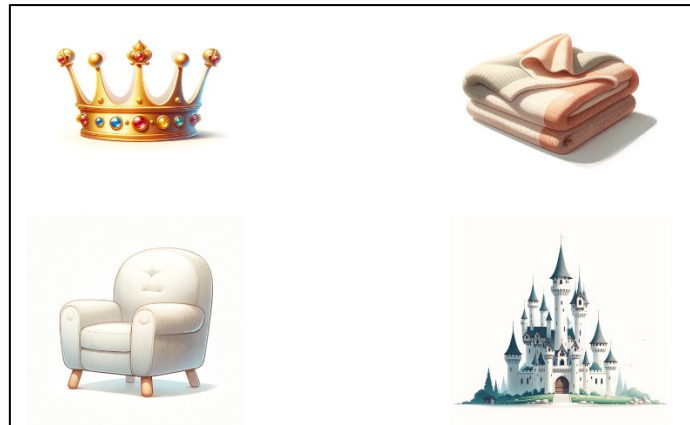


Figure 11. Visual example from the Rhyme Detection task.

Version 1: see stimuli from Appendix A

Version 2

Given word	Target word	Phonological distractor	Semantic distractor
<i>bidone</i> _(practice item)	<i>sapone</i>	<i>bilancia</i>	<i>cestino</i>
<i>panino</i> _(practice item)	<i>delfino</i>	<i>paletta</i>	<i>gelato</i>
<i>divano</i>	<i>indiano</i>	<i>disegno</i>	<i>tappeto</i>
<i>collana</i>	<i>fontana</i>	<i>coltello</i>	<i>vestito</i>
<i>biglietto</i>	<i>insetto</i>	<i>bicchiere</i>	<i>regalo</i>
<i>cartella</i>	<i>ciambella</i>	<i>cartone</i>	<i>diario</i>
<i>corona</i>	<i>poltrona</i>	<i>coperta</i>	<i>castello</i>
<i>bottiglia</i>	<i>conchiglia</i>	<i>bottone</i>	<i>caraffa</i>
<i>pantera</i>	<i>bandiera</i>	<i>panchina</i>	<i>giraffa</i>
<i>colore</i>	<i>dottore</i>	<i>coperchio</i>	<i>pennello</i>
<i>balena</i>	<i>catena</i>	<i>bastone</i>	<i>medusa</i>
<i>canguro</i>	<i>tamburo</i>	<i>candela</i>	<i>koala</i>

Syllable Blending

Version 1

Length	Syllabic structure	Stimuli
-	-	dado, mare _(practice items)
2 syllables	CV	sole
	CVC	gamba
	CCV	festa
3 syllables	CV	carota
	CVC	cortile

4 syllables	CCV	<i>segreto</i>
	CV	<i>calamita</i>
	CVC	<i>detersivo</i>
	CCV	<i>fotografo</i>
5 syllables	CV	<i>paracadute</i>
	CVC	<i>rinoceronte</i>
	CCV	<i>pipistrello</i>

Version 2

Length	Syllabic structure	Stimuli
-	-	<i>dado, mare</i> (practice items)
2 syllables	CV	<i>noce</i>
	CVC	<i>corda</i>
	CCV	<i>bosco</i>
3 syllables	CV	<i>budino</i>
	CVC	<i>canzone</i>
	CCV	<i>costume</i>
4 syllables	CV	<i>genitore</i>
	CVC	<i>davanzale</i>
	CCV	<i>lavatrice</i>
5 syllables	CV	<i>matematica</i>
	CVC	<i>peperoncino</i>
	CCV	<i>frigorifero</i>

Syllable Deletion

Version 1

First-syllable structure	Stimuli
-	<i>melone, banana</i> (practice items)
CV	<i>balena, farina, lavoro</i>
CVC	<i>cancello, lampone, calzino</i>
(C)CCV(C)	<i>profumo, strumento, francese</i>
V	<i>arancia, esame, oliva</i>

Version 2

First-syllable structure	Stimuli
-	<i>melone, banana</i> (practice items)

CV	<i>regina, gelato, limone</i>
CVC	<i>cartello, fantasma, montagna</i>
(C)CCV(C)	<i>tramonto, spremuta, grembiule</i>
V	<i>orecchio, anello, amico</i>

Phoneme Blending

Version 1: see stimuli from Appendix A

Version 2

Number of syllables	Structure	Stimuli
-	-	<i>pane, cane</i> (practice items)
2	CVCV	<i>buco, dito, neve</i>
2	CCVCV	<i>croce, scopa, drago</i>
2	CVCCV	<i>barca, calze, tempo</i>
3	CVCVCV	<i>pecora, salame, moneta</i>

Phoneme Deletion

Version 1

Condition	Stimuli
Practice items	<i>nome, luce</i>
Continuous C + V	<i>faro, lana, mare</i>
Stop C + V	<i>bacio, torre, carta</i>
Stop/sibilant C + C	<i>grano, prete, stella</i>
Sibilant + CC	<i>strada, struzzo, scritta</i>

Version 2

Condition	Stimuli
Practice items	<i>nome, luce</i>
Continuous C + V	<i>vino, rete, naso</i>
Stop C + V	<i>porta, doccia, gufo</i>
Stop/sibilant C + C	<i>bruco, scarpa, crema</i>
Sibilant + CC	<i>strega, striscia, straccio</i>

ReadLet (Taxitari et al., 2020)

Words and Nonwords

See stimuli from Appendix B

Texts

Version 1: see stimuli from Appendix B

Version 2

Text	Questions	Answers
La Befana		
<i>La Befana vola di notte sulla sua scopa. Si ferma davanti alle case dei bambini e cerca un modo per lasciare i regali. Prova a entrare dalle finestre, ma sono tutte chiuse. Decide allora di scendere dai camini. Entra silenziosamente nelle case e riempie le calze appese con dolcetti, giocattoli e tante caramelle. La Befana continua il suo viaggio e porta felicità a tutti i bambini.</i>	Cosa trova chiuso la Befana?	*le finestre i camini le porte
L'uccellino		
<i>Marta gioca spesso a palla con il papà. Un giorno, mentre giocano in giardino, vede un uccellino che è caduto dal nido. "Povero uccellino, deve essere ferito! Portiamolo a casa."</i> <i>Dopo qualche giorno, l'uccellino sta meglio ed è pronto a tornare a volare. Marta allora lo porta in giardino per farlo volare verso il nido.</i> <i>Da quel giorno, Marta e l'uccellino diventano amici inseparabili e vivono insieme tante avventure.</i>	Dove trova Marta l'uccellino?	*in giardino a casa a scuola

Appendix F – Study 3: Phase 2 phonological training materials

Rhymes

Rhyme detection/production

Version 1: rhyme detection



Figure 12. Visual example from the Rhyme detection training activity.

Given word	Target word	Phonological distractor	Semantic distractor
<i>Anello</i> (practice item)	<i>Fratello</i>	<i>Arancia</i>	<i>Collana</i>
<i>Binario</i>	<i>Acquario</i>	<i>Biglietto</i>	<i>Stazione</i>
<i>Medaglia</i>	<i>Tovaglia</i>	<i>Merenda</i>	<i>Trofeo</i>
<i>Cintura</i>	<i>Verdura</i>	<i>Cinghiale</i>	<i>Camicia</i>
<i>Gelato</i>	<i>Mercato</i>	<i>Gemelli</i>	<i>Budino</i>
<i>Palazzo</i>	<i>Ragazzo</i>	<i>Pavone</i>	<i>Finestra</i>
<i>Aceto</i>	<i>Tappeto</i>	<i>Agnello</i>	<i>Oliva</i>
<i>Palestra</i>	<i>Minestra</i>	<i>Patata</i>	<i>Piscina</i>
<i>Moneta</i>	<i>Pianeta</i>	<i>Modella</i>	<i>Cassiera</i>
<i>Canestro</i>	<i>Maestro</i>	<i>Capelli</i>	<i>Pallone</i>
<i>Castoro</i>	<i>Tesoro</i>	<i>Cassetto</i>	<i>Criceto</i>
<i>Biscotto</i>	<i>Cerotto</i>	<i>Bisnonno</i>	<i>Farina</i>
<i>Campeggio</i>	<i>Parcheggio</i>	<i>Campana</i>	<i>Albergo</i>
<i>Coniglio</i>	<i>Sbadiglio</i>	<i>Corallo</i>	<i>Tacchino</i>
<i>Formaggio</i>	<i>Villaggio</i>	<i>Fornaio</i>	<i>Salame</i>

<i>Foresta</i>	<i>Tempesta</i>	<i>Focaccia</i>	<i>Montagna</i>
<i>Racconto</i>	<i>Tramonto</i>	<i>Racchetta</i>	<i>Fumetto</i>
<i>Pompiere</i>	<i>Bicchiere</i>	<i>Pompelmo</i>	<i>Soldato</i>

Version 2: rhyme production

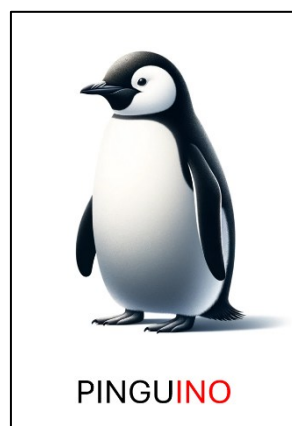


Figure 13. Visual example from the Rhyme production training activity.

Condition	Stimuli
Animals	cane (practice item) , gatto, pinguino, cammello, leone, gallina, criceto, cinghiale, coccodrillo, giaguaro, ragno, cavalletta, rana, gabbiano
Food	crostata, pomodoro, lasagna, cioccolato, torta, arancia, mozzarella, cipolla, pera

Syllables

Syllable identification

Version 1

Context	Target syllable	Condition	Stimuli
Word in isolation	pa	Target	<i>Pane</i> (practice item) , <i>papera</i> , <i>pace</i> , <i>sciarpa</i> , <i>zampa</i> , <i>campana</i>
		Distractor	<i>Ciliegia</i> , <i>lumaca</i> , <i>pigiama</i> , <i>sapone</i> , <i>panda</i>
Word in sentence	ra	Target	<i>C'è una rana che nuota nello stagno</i> <i>Le lasagne al ragù mi piacciono tantissimo</i>

				Da un po' di tempo è iniziata la primavera
				Mia mamma cucina un passato di verdura
				molto buono
Distractor				Mi piace molto giocare con la nave dei pirati
				Mia mamma mi legge spesso le favole della
				buonanotte
				Quest'estate vado in vacanza in montagna
				Allo zoo ho visto un rinoceronte
				Mio nonno coltiva le carote e le patate in
				campagna
				Tutte le mattine bevo il succo d'arancia
Word in text	ma	Target	Distractor	Maria è una bambina molto allegra e
				simpatica. Le piace tanto andare al mare per
				raccogliere le conchiglie. Quando è in
				spiaggia, osserva l'acqua che brilla come un
				<u>diamante</u> sotto il sole. Poi, entra con i piedi
				nell'acqua e lascia che la schiuma delle onde
				la bagni appena appena. Ogni tanto vorrebbe
				diventare leggera come una piuma e volare su
				quella immensa distesa d'acqua che la
				incuriosisce così tanto. Uno dei giorni più belli
				della sua vita è stato quello in cui è andata a
				fare una gita in <u>motoscafo</u> per vedere i delfini.
				Quel giorno c'erano tutti i suoi <u>amici</u> : Andrea,
				Carolina, e anche Giulia. Il cuore le batteva
				forte forte quando è riuscita a vedere uno di
				questi animali , i suoi preferiti, vicinissimo alla
				loro barca.
Word in text	ba	Target	Distractor	Tito è un piccolo topolino molto curioso. Vive
				nel bagno della casa dei Rossi, una famiglia
				allegra e divertente. Proprio dietro la vasca, il
				topolino ha scavato un piccolo <u>buco</u> che è
				diventato una tana perfetta. Ogni volta che ha
				fame, Tito va in cucina e prende qualcosina da
				mangiare: la sua cosa preferita sono le
				banane . Quando il tempo è bello, esce in
				giardino e gioca nell' erba fresca con altri

topolini: insieme corrono e si arrampicano sugli alberi. Un'altra cosa che ama fare è uscire dopo un temporale sul balcone della camera dei Rossi: da lì riesce sempre ad ammirare un bellissimo **arcobaleno**. La sera, poi, si nasconde nella cameretta di Alice, la figlia dei Rossi, e ascolta la mamma mentre le legge una **fiaba**. Quando è stanco, Tito torna nella sua tana per andare a dormire.

Version 2

Context	Target syllable	Condition	Stimuli
Word in isolation	con	Target	conchiglia, secondo, confetto, contadino, incontro
		Distractor	pennarello, felpa, coniglio, balcone, bancone
Word in sentence	per	Target	Michela è una persona molto gentile e vivace Mia mamma oggi indossa una collana di perle bellissima La gara di ieri si è svolta lungo un percorso molto complicato Mio papà mi rimbecca sempre le coperte prima di andare a dormire Se si mette il coperchio sulla pentola, l'acqua bolle più in fretta
		Distractor	Mio fratello una volta è stato quasi morso da una vipera La mia verdura preferita sono i peperoni Mia nonna fa una torta pere e cioccolato deliziosa Una tartaruga può vivere anche più di cento anni Ieri mia nonna mi ha insegnato a cucire i bottoni

		<i>Per non farsi male è meglio usare le forbici con la punta arrotondata</i> <i>Quando apparecchio metto sempre la forchetta a destra e il coltello a sinistra</i> Target <i>Quando mangio la pasta ci metto sempre tantissimo formaggio sopra</i> <i>L'anno prossimo inizierò a prendere lezioni di pianoforte</i> <i>Mio cugino a scuola deve indossare l'uniforme</i>
Word in sentence	<i>for</i>	<i>Quando il semaforo è rosso bisogna fermarsi</i> <i>Camminare in una foresta di notte può essere molto pericoloso di notte</i> Distractor <i>Mio papà ieri ha fatto un foro nel muro per appendere un quadro</i> <i>Da grande vorrei fare il fotografo</i> <i>Sabato andrò all'osservatorio per guardare la luna</i>

Syllable identification and segmentation ('The Ship')

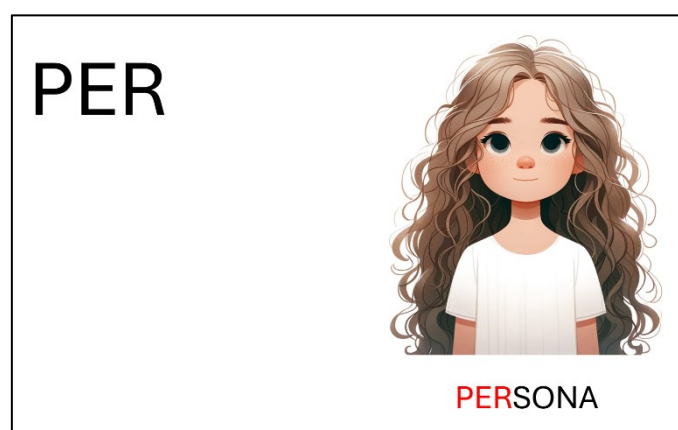


Figure 14. Visual example from the Syllable identification and segmentation training activity.

Condition	Stimuli	Prompt
Open syllable	co-	colore

Closed or complex-onset syllable	<i>ri-</i>	<i>ricotta</i>
	<i>so-</i>	<i>sogno</i>
	<i>di-</i>	<i>dinosauro</i>
	<i>ca-</i>	<i>caramella</i>
	<i>re-</i>	<i>remo</i>
	<i>po-</i>	<i>polipo</i>
	<i>con-</i>	<i>confettura</i>
	<i>pro-</i>	<i>profilo</i>
	<i>per-</i>	<i>persona</i>
	<i>com-</i>	<i>compagno</i>
	<i>sta-</i>	<i>stagioni</i>
	<i>par-</i>	<i>parmigiano</i>
	<i>pri-</i>	<i>prigione</i>

Syllable segmentation and blending ('Syllabic chain')

Condition	Stimuli
Words ending with a CV syllable	<i>nodo, cognome, sciarpa, ippopotamo, maionese</i>
Words ending with a CCV syllable	<i>pietra, tempesta, lepre, agosto</i>

Syllable deletion

Condition	Initial syllable structure	Stimuli
Real word after first-syllable deletion	-	<i>bilancia, capanna, cemento, cucina, salame, trifoglio, amore, formaggio</i>
	CV	<i>patata, vocale, veleno, timone, tesoro, sapone, regalo, pirata, pavone, nipote, motore, bevanda, canale, dicembre, finocchio</i>
Nonword after first-syllable deletion	CCV	<i>trofeo, presepe, problema, criniera, bretelle, granaio, programma, brigante, fratello</i>
	CVC	<i>vernice, tartufo, serpente, pompelmo</i>
	V	<i>adulto, inizio, odore, umore</i>

Phonemes

Phoneme identification and nonword repetition ('The Alien')

Version 1: phoneme identification



Figure 15. Visual example from the Phoneme identification training activity.

Condition	Stimuli	Real words
Phoneme omission	<i>stazone, caicia, inghiale, plazzo, aceo, gabbiao</i>	<i>stazione, camicia, cinghiale, palazzo, aceto, gabbiano</i>
Phoneme addition	<i>monieta, mapestra, crinceto, ciassetto, giaguardo, soldateo</i>	<i>moneta, maestra, criceto, cassetto, giaguaro, soldato</i>
Phoneme inversion	<i>albrege, forseta, tarmonto, moppiere, finestar, dentisat</i>	<i>albergo, foresta, tramonto, pompiere, finestra, dentista</i>
Correctly spelled words	<i>arancia, verdura, finestra, capelli, biscotto, tesoro</i>	-

Version 2: nonword repetition

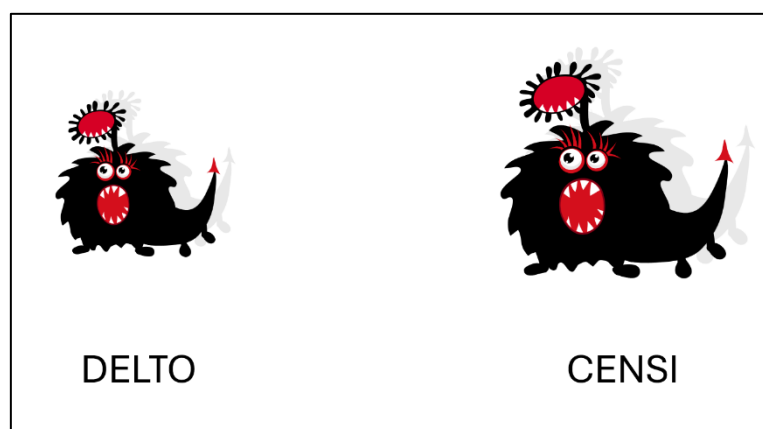


Figure 16. Visual example from the Nonword repetition training activity.

Length	Condition	Stimuli
2 syllables	CV syllables	<i>supe, geza</i>
	Complex syllables	<i>delto, censi, prinzio, grencia</i>
3 syllables	CV syllables	<i>colani, dunase</i>
	Complex syllables	<i>somentri, moverchi, prastante, stusciano</i>
4 syllables	CV syllables	<i>rinatule, lituvame</i>
	Complex syllables	<i>contigrela, nelmastori, migliadencio, beltrodanza</i>
5 syllables	CV syllables	<i>viporetuca, potudinase</i>
	Complex syllables	<i>facustidenzo, lugosceranti, prestindaghismo, stoprendugliche</i>

Phoneme identification and segmentation ('The Ship')



Figure 17. Visual example from the Phoneme identification and segmentation training activity.

Initial and final phonemes	Prompt
<i>f – a</i>	<i>forchetta</i>
<i>n – o</i>	<i>naso</i>
<i>l – a</i>	<i>luna</i>
<i>d – o</i>	<i>dono</i>
<i>c – o</i>	<i>cono</i>
<i>t – a</i>	<i>talpa</i>

Phoneme blending and inversion

Version 1: phoneme inversion

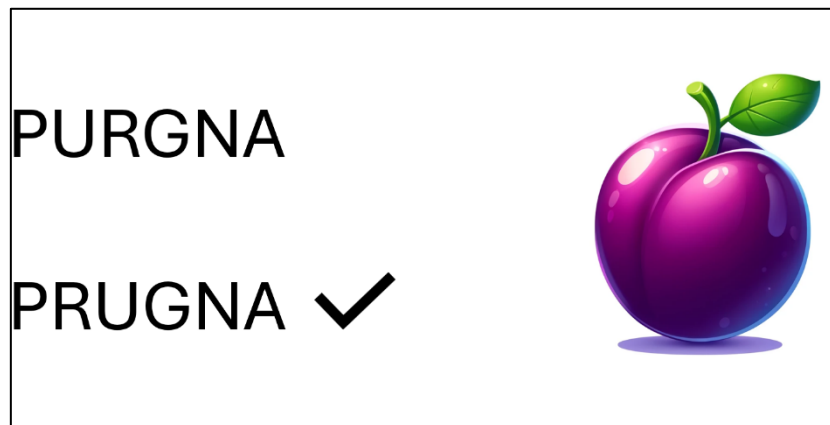


Figure 18. Visual example from the Phoneme inversion training activity.

Stimuli with phoneme inversion	Correct words
<i>braca</i>	<i>barca</i>
<i>sefra</i>	<i>sfera</i>
<i>crane</i>	<i>carne</i>
<i>sucdo</i>	<i>scudo</i>
<i>prela</i>	<i>perla</i>
<i>plama</i>	<i>palma</i>
<i>girdo</i>	<i>grido</i>
<i>flepa</i>	<i>felpa</i>
<i>burco</i>	<i>bruco</i>
<i>purgna</i>	<i>prugna</i>
<i>trota</i>	<i>torta</i>
<i>sipga</i>	<i>spiga</i>

Version 2: phoneme blending



Figure 19. Visual example from the Phoneme blending training activity.

Stimuli (underlined syllables were omitted): *scarpa, specchio, scena, smalto, strada, stanza, sciarpa, slitta, scimmia, striscia, spalla, strega*

Phoneme blending

Length (in letters)	Stimuli
4	<i>casa, foca, lago, muro, sale, topo, vaso, pala, giro</i>
5	<i>spada, prato, frase, spina, trono, spesa, zampa, vento, porta, marzo, ponte, talpa, palla, gnomo, gioco, ghio, cassa, gallo</i>
6	<i>veleno, sapone, pirata, lumaca, divano, cucina, quadro, chiodo, ciuffo, gnocco, strato, giallo</i>
7	<i>spruzzo</i>
8	<i>capitano, quaderno, gomito, quadrato, medicina</i>
9	<i>scrivania</i>

Phoneme deletion

Phoneme to be deleted	Stimuli
Initial	<i>bagno, capra, forno, cena, fame, lupo</i>
Central	<i>mente, corpo, pulce, fungo, cervo, polso, danza, verme, banca, panca, monte, merlo</i>
Final	<i>nido, pepe, rosa, tenda, sogno, pasta</i>

Review of previously learned concepts – ‘Goose game’

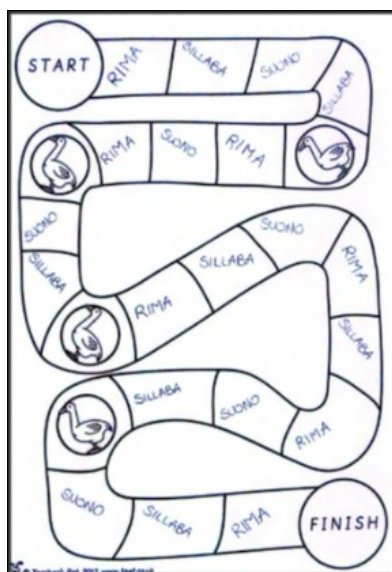


Figure 20. Board of the Goose game used to revise phonological units and operations during the intervention.

Version 1

Phonological unit	Phonological operation	Questions	Translation
Rhymes	Identification	<i>Limone fa rima con balcone?</i> <i>Tonno fa rima con nonno?</i> <i>Gennaio fa rima con febbraio?</i> <i>Bagno fa rima con balena?</i> <i>Camino fa rima con capanna?</i> <i>Profumo fa rima con prosciutto?</i> <i>Gatto fa rima con cane?</i> <i>Arancia fa rima con banana?</i> <i>Quaderno fa rima con matita?</i> <i>Frittata fa rima con insalata?</i> <i>Nocciola fa rima con parola?</i> <i>Cantante fa rima con diamante?</i>	‘Does ... rhyme with ...?’
	Production	<i>Dimmi una parola che fa rima con castello</i> <i>Dimmi una parola che fa rima con pacchetto</i> <i>Dimmi una parola che fa rima con rumore</i> <i>Dimmi una parola che fa rima con regina</i> <i>Dimmi una parola che fa rima con sorriso</i> <i>Dimmi una parola che fa rima con scodella</i> <i>Dimmi una parola che fa rima con polpetta</i> <i>Dimmi una parola che fa rima con mulino</i> <i>Dimmi una parola che fa rima con merenda</i>	‘Tell me a word that rhymes with ...’
Syllables	Identification	<i>In gelato c’è la sillaba la?</i> <i>In aquilone c’è la sillaba lo?</i> <i>In colomba c’è la sillaba lom?</i> <i>In vento c’è la sillaba fen?</i> <i>In cuscino c’è la sillaba mo?</i> <i>In giraffa c’è la sillaba gir?</i>	‘Is the syllable ... present in the word ...?’

	Identification and blending	<i>Dimmi tre parole che iniziano con la sillaba co</i> <i>Dimmi tre parole che iniziano con la sillaba pe</i> <i>Dimmi tre parole che iniziano con la sillaba vi</i> <i>Dimmi tre parole che iniziano con la sillaba fa</i> <i>Dimmi tre parole che iniziano con la sillaba sa</i> <i>Dimmi tre parole che iniziano con la sillaba mi</i>	‘Tell me three words that begin with the syllable ...’
	Blending	<i>Che parola è do-man-da?</i> <i>Che parola è for-tu-na?</i> <i>Che parola è te-le-co-man-do?</i>	‘What word is ...?’
	Deletion	<i>Cosa rimane se tolgo la prima sillaba a forchetta?</i> <i>Cosa rimane se tolgo la prima sillaba a maiale?</i> <i>Cosa rimane se tolgo la prima sillaba a criceto?</i> <i>Cosa rimane se tolgo la prima sillaba a fratello?</i> <i>Cosa rimane se tolgo la prima sillaba a cornice?</i> <i>Cosa rimane se tolgo la prima sillaba a lavagna?</i>	‘What is left if I remove the first syllable from the word ...?’
	Identification	<i>In mandarino c’è il suono m?</i> <i>In lucertola c’è il suono r?</i> <i>In topo c’è il suono d?</i>	‘Is the sound ... present in the word ...?’
	Identification and blending	<i>Dimmi tre parole che iniziano con il suono r</i> <i>Dimmi tre parole che iniziano con il suono n</i> <i>Dimmi tre parole che iniziano con il suono f</i> <i>Dimmi tre parole che iniziano con il suono p</i> <i>Dimmi tre parole che iniziano con il suono d</i> <i>Dimmi tre parole che iniziano con il suono g</i>	‘Tell me three words that begin with the sound ...’
Phonemes	Blending	<i>Che parola è c-i-n-e-m-a?</i> <i>Che parola è s-u-g-o?</i> <i>Che parola è p-r-a-t-o?</i> <i>Che parola è t-a-s-c-a?</i> <i>Che parole è p-a-v-o-n-e?</i> <i>Che parola è s-t-u-f-a?</i>	‘What word is ...?’
	Deletion	<i>Cosa rimane se tolgo il primo suono a fata?</i> <i>Cosa rimane se tolgo il primo suono a gallo?</i> <i>Cosa rimane se tolgo il primo suono a pranzo?</i>	‘What is left if I remove the first sound from the word ...?’

Version 2

Phonological unit	Phonological operation	Questions	Translation
Rhymes	Identification	<i>Uccello fa rima con mantello?</i> <i>Cappotto fa rima con salotto?</i> <i>Caviglia fa rima con pastiglia?</i> <i>Canzone fa rima con candela?</i> <i>Melone fa rima con metallo?</i> <i>Vacanza fa rima con vapore?</i> <i>Farfalla fa rima con zanzara?</i> <i>Carota fa rima con zucchini?</i> <i>Chitarra fa rima con violino?</i>	‘Does ... rhyme with ...?’
	Production	<i>Dimmi una parola che fa rima con tastiera</i> <i>Dimmi una parola che fa rima con lavoro</i> <i>Dimmi una parola che fa rima con montagna</i> <i>Dimmi una parola che fa rima con quadrato</i> <i>Dimmi una parola che fa rima con capitano</i> <i>Dimmi una parola che fa rima con persona</i> <i>Dimmi una parola che fa rima con natura</i>	‘Tell me a word that rhymes with ...’

		<i>Dimmi una parola che fa rima con giornale</i> <i>Dimmi una parola che fa rima con mattone</i>	
Syllables	Identification	<i>In melanzana c'è la sillaba za?</i> <i>In nuvola c'è la sillaba nu?</i> <i>In poltrona c'è la sillaba tro?</i> <i>In torta c'è la sillaba dor?</i> <i>In serpente c'è la sillaba de?</i> <i>In pomodoro c'è la sillaba pom?</i>	'Is the syllable ... present in the word ...?'
	Identification and blending	<i>Dimmi tre parole che iniziano con la sillaba ri</i> <i>Dimmi tre parole che iniziano con la sillaba so</i> <i>Dimmi tre parole che iniziano con la sillaba di</i> <i>Dimmi tre parole che iniziano con la sillaba ca</i> <i>Dimmi tre parole che iniziano con la sillaba re</i> <i>Dimmi tre parole che iniziano con la sillaba po</i>	'Tell me three words that begin with the syllable ...'
	Blending	<i>Che parola è ca-mi-no?</i> <i>Che parola è pul-ce?</i> <i>Che parola è la-van-di-no?</i>	'What word is ...?'
	Deletion	<i>Cosa rimane se tolgo la prima sillaba a minestra?</i> <i>Cosa rimane se tolgo la prima sillaba a prigionie?</i> <i>Cosa rimane se tolgo la prima sillaba a ringhiera?</i> <i>Cosa rimane se tolgo la prima sillaba a negozio?</i> <i>Cosa rimane se tolgo la prima sillaba a delfino?</i> <i>Cosa rimane se tolgo la prima sillaba a cravatta?</i>	'What is left if I remove the first syllable from the word ...?'
Phonemes	Identification	<i>In biscotto c'è il suono b?</i> <i>In altalena c'è il suono t?</i> <i>In coperchio c'è il suono c?</i> <i>In primavera c'è il suono f?</i> <i>In pigiama c'è il suono n?</i> <i>In orso c'è il suono z?</i>	'Is the sound ... present in the word ...?'
	Identification and blending	<i>Dimmi tre parole che iniziano con il suono l</i> <i>Dimmi tre parole che iniziano con il suono m</i> <i>Dimmi tre parole che iniziano con il suono v</i> <i>Dimmi tre parole che iniziano con il suono b</i> <i>Dimmi tre parole che iniziano con il suono t</i> <i>Dimmi tre parole che iniziano con il suono c</i>	'Tell me three words that begin with the sound ...'
	Blending	<i>Che parola è f-e-l-p-a?</i> <i>Che parola è m-u-l-i-n-o?</i> <i>Che parola è p-o-s-a-t-e?</i> <i>Che parola è s-a-l-e?</i> <i>Che parola è s-p-a-d-a?</i> <i>Che parola è p-a-n-d-a?</i>	'What word is ...?'
	Deletion	<i>Cosa rimane se tolgo il primo suono a prugna?</i> <i>Cosa rimane se tolgo il primo suono a rosa?</i> <i>Cosa rimane se tolgo il primo suono a schiena?</i>	'What is left if I remove the first sound from the word ...?'