frontiers | Frontiers in Education

TYPE Original Research
PUBLISHED 09 January 2023
DOI 10.3389/feduc.2022.1076630

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

RECEIVED 21 October 2022
ACCEPTED 12 December 2022
PUBLISHED 09 January 2023

CITATION
Sucena A, Silva AF and Marques C (2023) Reading skills promotion: Results on the impact of a preschool intervention. *Front. Educ.* 7:1076630. doi: 10.3389/feduc.2022.1076630

Reading skills promotion: Results on the impact of a preschool intervention

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There is a strong correlation between preschool education skills such as phonological awareness and language and success in reading and spelling acquisition. Even though, this is still not the focus of the early intervention. This study presents the preliminary results of the impact of an intervention program developed to promote reading foundation skills. The study was conducted with 627 children in the last year of preschool education (54.2% boys), ages between 4years and 10months and 6years and 1month. Participants were divided into intervention (n=242) and comparative (n=385) group. Language, implicit, and explicit phonological awareness, and rime implicit awareness were assessed. The intervention group reached statistically higher values in all dimensions at the post-test, a higher magnitude effect and 80% of these children entered the first-grade overpassing cut-off criteria for reading acquisition difficulties. These results support the impact of the program.

KEYWORDS

reading skills, phonologic awareness, language, intervention program, assessment

1. Introduction

Difficulties in reading and spelling acquisition can seriously limit personal aspirations (Jamshidifarsani et al., 2019). It is known that how children start formal schooling influences their school path (Stanovich, 1991). Specifically with a tendency toward those who begin without difficulties to build successful paths and, conversely, those whose beginning is characterized by difficulties to see these difficulties increase throughout schooling. These difficulties have consequences in terms of motivation concerning school and school learning (Lyytinen and Erskine, 2006). Thus, creating the best conditions for children to start formal schooling well-prepared for future requirements is important.

In Portugal, more than 10% of children are retained in grade 2 mainly because of reading difficulties (e.g., Ferreira et al., 2015). This scenario is also found in other countries such as Belgium (Francophone and German-speaking), Luxemburg, and Spain (PISA, 2018). In this sense, Portugal, as well as international research, has invested in the development and assessment of the impact of intervention projects. These projects focus on promoting reading skills as early as possible once it is well-known that the way children begin formal schooling influences their posterior school path (Stanovich, 1991).

Preschool education is a privileged context for preparation for future requirements, specifically regarding skills that facilitate reading and spelling acquisition (Cruz et al., 2014a; Suortti and Lipponen, 2016; Albuquerque and Martins, 2018; León et al., 2019). Several studies have focused on isolating the key variables that effectively contribute to reading and spelling acquisition, concluding that there is a strong relationship between children's previous knowledge, namely regarding phonological awareness and language, and success in reading and spelling acquisition (Lyytinen and Erskine, 2006; McCoy et al., 2019).

Phonological awareness is a fundamental skill for reading acquisition (Carrol et al., 2011; Kyle et al., 2013; Viana and Sucena, 2014; Sucena et al., 2015) and one of the most powerful predictors of reading and spelling success (Eloranta et al., 2017; Gordon et al., 2020; Guaraldo et al., 2020; Snowling et al., 2021; Landerl et al., 2022). Poor phonological awareness development is frequently considered the main cause of reading and spelling difficulties (Pfost, 2015; Hulme and Snowling, 2016; Volkmer et al., 2019). Concurrently, the promotion of phonological awareness development in preschool education profoundly impacts reading and spelling acquisition in grade 1 (Porta and Ramirez, 2019). Children that start formal education (6 years old in Portugal) without phonemic awareness might struggle to understand the letter-sound correspondences (Sucena et al., 2021), which are the basis of the decoding process to be acquired in Grade 1 [Direção Geral da Educação (DGE), 2018]. Thus, this skill should be the main focus of early intervention (Foorman et al., 2016). Even though the literature has shown long ago that it is possible to develop phonemic awareness before reading acquisition (Lundberg et al., 1988), this is still usually developed in the context of reading acquisition during the first grade (Landerl et al., 2018).

In the same way, language is a crucial preparation skill for reading and spelling acquisition (Hulme et al., 2020; Piasta et al., 2021). Specifically, vocabulary has been linked to reading skills and to reading difficulties in different orthographies (Volkmer et al., 2019). Children who enter first grade with solid language skills are well-positioned for literacy success (National Early Literacy Panel, 2008; Ramsook et al., 2020). On the other hand, children who enter first grade with language impairments are more likely to have long-term implications on their school paths (Lousada et al., 2016; Adlof and Hogan, 2018). The development of language, specific vocabulary is related to reading comprehension (Gaté et al., 2009; Scull, 2013; Swanson et al., 2018; Collazos-Campo et al., 2020; Cadime et al., 2021), and reading comprehension is a mandatory skill to acquire knowledge in any curriculum domain (McGrath and Hughes, 2018; Koponen et al., 2020). These findings highlight the importance of improving oral skills before early reading acquisition. In sum, both phonological awareness and language in preschool are predictors of reading and spelling acquisition in grade 1 (Cruz et al., 2014b; Pazeto et al., 2017; Salvador and Martins, 2017; Hulme et al., 2020; Snowling et al., 2021). Also, difficulties in phonological awareness are common in children who also experience language difficulties (Bickford-Smith et al., 2005; Porta and Ramirez, 2019; Raspin et al., 2019). In Portugal, there are curriculum guidelines for preschool education that focus, among other aspects, on promoting phonological awareness and language (Lopes da Silva et al., 2016). Yet, for various reasons, many children enter first grade without these skills (Chatterji, 2006). For these children, preschool attendance could and should have served as an essential context for primary prevention intervention (Piasta et al., 2021).

These results support the theoretical motivation for developing reading intervention programs that aim to promote early learning success in different languages. These studies show that successful reading interventions programs are those that include phonological awareness training (particularly regarding the phoneme) and language (particularly vocabulary; Santos and Maluf, 2010; Arriaza and Ruiz, 2014; Lousada et al., 2016; Suggate, 2016; Bratsch-Hines et al., 2020; Lingwood et al., 2020). The effect increases when the programs are promoted at preschool ages (Dion et al., 2010; Carrol et al., 2011; Leij, 2013).

Thus several international projects elect preschool for the promotion of phonological awareness (Falth et al., 2017; Milbrum et al., 2017; Gonzalez and Hughes, 2018), and language (Vaklin-Nusbaum and Nevo, 2017; Chacko et al., 2018; Dickinson et al., 2018; Van Kleeck, 2018).

The role of the skills mentioned above has been widely developed in opaque languages such as English (Rao, 2018) or French, as well as for transparent languages such as Finnish, Spanish, Italian, or Greek in children at the reading acquisition phase (Ferroni et al., 2018; Stappen and Van Reybroeck, 2018; Caravolas et al., 2019; Gorgen et al., 2021). As a result of the inconsistencies between graphemes and phonemes English speaking children need a more extended learning period (two times longer) to acquire the reading foundations (Seymour et al., 2003). European Portuguese orthography presents fewer inconsistencies between graphemes and phonemes (Seymour et al., 2003; Sucena et al., 2009) than English. Even if Portuguese-speaking children acquire reading skills earlier and faster than English speakers, some Portuguese children still face difficulties and struggle to develop reading and spelling skills. Regarding the scenario in Portugal with an intermediate orthography such as Portuguese and in agreement with the national guidelines for preschool (Lopes da Silva et al., 2016), several programs focus on language development in preschool education (Viana, 2002; Cruz et al., 2014a; Alves, 2016; Lousada et al., 2016). On the other hand, the focus on phonemic awareness in preschool literacy intervention programs is scarce (Silva and Sarmento, 2017; Abreu et al., 2020). Although recent studies reveal that Portuguese children show poor phonemic awareness upon entering grade 1 (Sim-Sim, 1998; Veloso, 2003; Cadório et al., 2016; Meira, 2017; Batista, 2018). As far as the authors' knowledge goes, this is the first project focusing on both phonemic awareness and language. In this way, this study aims to contribute to the development of scientifically informed reading skills programs in the early stages of learning to read.

This study adopted a quasi-experimental design, with two independent groups (intervention and comparative) and repeated measures (pre and post-test). Two factors were assessed: Time and Group. The effect of Time (pre and post-test) was assessed regarding

phonological awareness (rime implicit awareness, phoneme implicit awareness, phoneme explicit awareness, phoneme segmentation), and language (oral verbal expression and listening comprehension). The effect of Group (intervention or comparative) was assessed regarding explicit phonemic awareness and phonemic segmentation. If the intervention has a positive impact on foundation skills (H1), in that case, there should be an interaction between the two factors (Time and Group; H2), indicating that at the end of preschool education, children who were subject to the intervention perform better than those who were in the comparison group.

To have a more thorough understanding of the impact of the preschool education intervention, the authors followed up on the participants' reading and spelling skills at the beginning of their grade 1. It is expected that the children that enter grade 1 with higher phonological skills and language present fewer reading acquisition difficulties (H3).

2. Materials and methods

2.1. Participants

Participants include 627 children, 287 girls (45.8%), and 340 boys (54.2%) aged between 4 years and 10 months and 6 years and 1 month (age at first assessment). Children were enrolled in 28 schools in the north of the Portuguese coast. Children were divided between the Intervention Group ($n = 242$), and the Comparative Group ($n = 385$). For all measures, participants from the IG were assessed before and after the intervention (pre and post-test). The CG was assessed in the pre-test and post-test on phoneme explicit awareness and phoneme segmentation. Of the 242 students in the intervention group, 197 were reassessed regarding phonemic explicit awareness at the beginning of first grade. Participants were classified according to their socioeconomic background, 45% of students from medium-high SES and 55% from medium-low SES. The SES was assumed regarding the type of school context. Public schools in Portugal are integrated into or not in "Priority Intervention Educational Territories (TEIP/NTEIP)." [1] So, regarding this differentiation, we classified as medium-low SES the TEIP type of schools and as medium-high SES the children from NTEIP type schools.

2.2. Instruments

2.2.1. Promotion of reading skills program PRS

The motivation for developing the PRS Program is based on the poor levels of phonemic awareness of Portuguese children upon entering first grade (Cadório et al., 2016; Meira, 2017; Batista, 2018), along with the growing concern regarding early prevention of reading difficulties.

PRS aims to promote the foundation skills for future reading skills in the last year of preschool education. It was conducted in 28 schools in a municipality on the northern coast of Portugal. The PRS focus on the development of phonological awareness (rime and phoneme—epiphoneme, metaphoneme, and phonemic segmentation) and language (expressive and comprehensive). The intervention occurred in the classroom context, conducted by a researcher with the collaboration of the kindergarten teacher, who was invited to replicate each session on his/her own. There were two sessions per week, with duration of 45 min each, between November and May. The intervention was divided into 41 sessions through playful materials (Sucena and Nadalim, 2021): 12 sessions dedicated to the development of phonological awareness (supra phonemic units—rime) and language and 29 sessions dedicated to the development of phonemic awareness (epiphoneme, metaphoneme, and phonemic segmentation).

An example of these materials regarding language promotion is the "magic bag." This activity, it is worked both expressive and comprehensive language. In this activity, a child is asked to take a card with a picture (of jobs, transports, fruit/vegetables, furniture, clothing, toys, animals, or musical instruments). The other children are asked to guess the image on the card through semantic categorization. Previous to this activity there is an explanation of the semantic categories in which each child is invited to describe what they know about one category. It is explained, for example, that the banana, the pear, and the apple belong to the fruits category. Another example of activities to promote expressive language is the "know-it-all." In this activity, it is explained to the children that a story is going to be tolled and they must pay a lot of attention because they will have to complete some of the sentences of the story. For example, "yesterday Pedro went to visit some friends and before going to their house he bought a melon [in Portuguese one melon], but if he knew it was so good instead of buying one, he would have bought two…" and one of the children must answer "two melons [in Portuguese—dois melões]." An example of an activity to promote comprehensive language is the "fast, slow," in which is told a story, and then questions about the story are asked. In this activity, the child needs to pay attention and understand to the story in order to answer the questions.

1 The NTEIP/TEIP program is a Portuguese government initiative, currently implemented in schools located in economically and socially disadvantaged territories, marked by poverty and social exclusion, where violence, indiscipline, abandonment and school failure are most evident (TEIP schools). The main goal of the program is to prevent and to reduce early school leaving and the indiscipline (Direção-Geral da Educação (DGE), 2021; Centro de Investigação e Estudos de Sociologia (CIES) & Instituto Universitário de Lisboa (ISCTE), 2011) and improving school grades of the students in the TEIP schools. This is a positive discrimination program aimed at supporting schools located in socioeconomically disadvantaged areas. The strategy of the TEIP program is based on a decentralizing model, focusing on the local, with the school as a central element in supporting the resolution of community problems (CIES & ISCTE, 2011).

An example of an activity to promote rime awareness is "rime and find the match." In this activity, some children will be selected to be the line leaders. A large card with an image (e.g., lemon in Portuguese – limão (/limɐ̃w̃/]) is distributed to each leader. Subsequently, each child picks a smaller card that rimes with one of the big ones. The child must identify which of the big cards his/her card rimes with and join the corresponding leader (e.g., lion, heart, plane [in Portuguese] – leão (/ljɐ̃w̃/), coração (/kurɐsɐ̃w̃/), and avião (/ɐvjɐ̃w̃/]). An example of an activity to promote implicit phonemic awareness is "listen and find out the sound." In this activity, (at least) two circles are formed that represent different sounds through images that start with that sound (e.g., seal [foca (/fɔkɐ/)] starts with / f). Children are told different words and are asked to move into the circle that represents the sound by which the word begins. An example of an activity to promote explicit phonemic awareness is "I spy with my little eye." In this activity, the child is told "I spy with my little eye something beginning with the sound… (phoneme)." The child is expected to continue the activity by producing words that begin with the same phoneme.

An example of an activity to promote phoneme segmentation is "Snack time" In this activity, there are three animals: frog, emu, and seal [in Portuguese – rã (/ʁɐ̃/), ema (/emɐ/), foca (/fɔkɐ/)] with two, three, and four phonemes, respectively. The child is given a set of cards with food images and is asked to choose the animal with the matching number of phonemes.

2.2.2. Assessed variables

Sociodemographic variables, language, and phonological awareness were assessed with all participants. Sociodemographic variables were assessed through a questionnaire developed for that purpose, assessing age, sex, and type of school (TEIP—Educational Territory of Priority Intervention, or NTEIP—Non-Educational Territory of Priority Intervention). The language was assessed with the Language Test, ALPE—Preschool Language Assessment (Sucena and Castro, 2011). This test assesses language, specifically Listening Comprehension, Oral Verbal Expression (in the semantic and morphosyntactic domains), and Metalanguage (in the semantic, morphosyntactic, and phonological domains). In this study, the dimension of the Metalanguage was not evaluated. Each correct answer is quoted with one and incorrect answers with zero. The result corresponds to the total of correct answers obtained in the various subtests (semantics, morphosyntactic, or metalinguistic). The raw data are converted into standardized data provided in the test manual, according to sex and age. The range of standardized results between 77.5 and 122.5 is considered within the limits of the normal variation.

Regarding phonological awareness, the rime implicit awareness was assessed through a "Same-Different" detection test (Vale, 1999). Children should answer "yes" or "no" according to whether there is a common rime in a pair of words. The task consists of six training items and 12 experimental items. "Yes" and "no" pairs of words appear randomly. All items share the same syllabic structure—Consonant-Vowel-Consonant (CVC). The result corresponds to the total of correct answers.

Implicit and explicit phonemic awareness was assessed with ALEPE—European Portuguese Reading Assessment (Avaliação da Leitura em Português Europeu; Sucena and Castro, 2011). The phonemic implicit awareness task consists of affirming whether or not a pair of words starts with the same phoneme. In this subtest consists of five training items and 20 experimental items. Each item is constituted of a pair of words, with two syllabic structures, simple, CV (Consoant–Vowel) or complex, CVC. The result corresponds to the total of correct answers. The phonemic explicit awareness task consists of identifying the common phoneme in a pair of words. In this subtest there are three training items and 12 experimental items. Each item consists of a pair of words, with two syllabic structures, simple, CV and complex, CVC. The result corresponds to the total of correct answers.

A phoneme segmentation task was developed for this study. The participant is asked to split the word "into its constituent sounds." The task consists of two training items and five experimental items. Each item has the same syllabic structure—VCV. The result corresponds to the total of correct answers. Both phoneme explicit awareness and phoneme segmentation tests were administered only when the child scored more than 15 points on an implicit test (corresponding to 75% of correct answers). The 75% criteria were set to avoid the results due to the chance associated with a "yes/ no" task.

2.3. Procedures of data collection

Authorizations for participation in this study were obtained from the school boards and the children's guardians. The assessment goals were presented to both school directors and children's guardians. Confidentiality in the data processing was guaranteed. Children were assessed individually, T1 before the intervention (October 2020), T2 after the intervention (June 2021), and T3 at the beginning of first grade (October 2021). The assessment team was constituted by eight reading and spelling training experts. The experts' team also implemented the intervention program. All elements of the expert team worked in close collaboration, as well as with the principal researcher. The role of the expert team was to implement the intervention program previously designed.

All children from preschools included in the project were allocated to the intervention group. Children in the comparative group belong to a different municipality and followed the regular classes provided by the preschool teacher, whereas the intervention group benefited from the PPRS intervention along with the regular classes. There are no age differences between the intervention and the comparative groups. The proportion of students per SES was roughly equivalent: *ca.* 50% of the participants in both the intervention and the comparative group

came from medium-high SES (specifically, 45 and 55%). Both groups were exposed to the (same) Portuguese educational program. After the intervention, the preschool teachers of the comparative group benefited from specific training on phonological skills and language promotion.

2.4. Procedures of data analyses

Regarding the data analysis procedures, the following assumptions, necessary to conduct parametric tests were verified: interval dependent variable, normal distribution of the dependent variable for each group defined by the independent variable, and homogeneity of the variances. The normality tests indicated that this assumption was not met for all dimensions evaluated. As a way of dealing with non-compliance with all the assumptions, parametric and non-parametric tests were conducted to compare their results. Whenever the results of the parametric and non-parametric tests converge toward the rejection of the null hypothesis, the results of the parametric tests are reported (Martins, 2011). To compare the magnitude of the effect between groups, d Cohen with correction Hedges and Olkin (Hedges and Olkin, 1985) was used.

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS IBM) for Windows, version 26.0. Tests of parametric differences between subjects were performed (independent samples *t*-test) to test the effect of the group on phonemic explicit awareness measures and phonemic segmentation. Tests of parametric differences between subjects were also carried out (paired-samples *t*-test) to verify the effect of time on measures of language (OVE and LC) and phonological awareness (rime implicit awareness, phoneme implicit awareness, phoneme explicit awareness, and phoneme segmentation in the intervention group, as well as, the effect of time on phonological awareness; phoneme explicit awareness, phoneme segmentation) in the comparative group (Supplementary Table 1). In brief, in pre (T1) and post-test (T2), the intervention group was assessed regarding language (OVE and LC) and phonological awareness (rime implicit awareness, phoneme implicit awareness, phoneme explicit awareness, and phoneme segmentation). On the other hand, in pre (T1) and post-test (T2), the comparative group was assessed regarding phoneme explicit awareness and phonemic segmentation. Of the 242 children that belong to the intervention group, 197 were reassessed at the beginning of first grade (T3), regarding phonemic explicit awareness.

3. Results

Descriptive results may be inspected in Supplementary Table 2. Regarding language (assessed with the intervention group) results are within the limits of the normal variation, and there was a small increase (four percentual points) from the pre-test to the post-test (respectively, 69–73% in oral verbal expression and 72–76% in listening comprehension). Regarding phonological awareness, the intervention group had a sharp increase between the pre and post-test. In rime implicit awareness and phoneme implicit awareness, the increase was of about 20 percentual points (respectively, 64–88 and 57–82%). As for the phoneme explicit awareness and the phoneme segmentation the increase was at or above 50 percentual points (respectively, 10–81 and 6–54%), an increase larger than that observed for the comparative group, ranging from 40 to 25 percentual points for both the phoneme explicit awareness and the phoneme segmentation (respectively, from 11 to 48% and from 5 to 31%).

Regarding phoneme explicit awareness both the intervention and the comparative group start (pre-test) with very similar results close to 10% but have a very different progression, as the intervention group reaches an accuracy of 81%, whereas the comparative group does not reach the 50% hallmark. As for the phonemic segmentation, the same pattern is observed: at the pre-test results range between 5 and 6% (intervention and comparative group, respectively), whereas at the post-test the intervention group attained results close to 54%, whereas the comparative group did not overcome 30%. In general, at the post-test, the intervention group reaches results above 75% for phonological awareness (except for phonemic segmentation, with an accuracy of 54%). In sharp contrast, the results of the comparative group (phoneme explicit awareness and phonemic segmentation) did not reach 50%.

Regarding the Group effect at the pre-intervention results of the paired-samples *t*-test indicate the absence of statistically significant differences regarding phoneme explicit awareness and phonemic segmentation (see Supplementary Table 2). At the post-intervention moment, the results of the Independent Sample T-Test indicate a statistically significant advantage for the intervention group in comparison with the comparative group for both phoneme explicit awareness, $t\ (625) = 14.17$, $p < 0.001$ and phonemic segmentation $t\ (625) = 7.35$, $p < 0.001$ (Graph 1).

Regarding the time effect results of a Paired-Samples *t*-test indicate a statistically significant effect for the intervention group for both language—oral verbal expression $t\ (241) = -9.43$, $p < 0.001$, and listening comprehension $t\ (241) = -9.34$, $p < 0.001$— and phonological awareness rime implicit awareness $t\ (241) = -12.84$, $p < 0.001$, phoneme implicit awareness, $t(241) = -19.57$, $p < 0.001$, phoneme explicit awareness $t\ (241) = -34.20$, $p < 0.001$, as well as phoneme segmentation $t\ (241) = -19.47$, $p < 0.001$. Even if there is a statistically significant effect for the comparative group as well, for both phoneme explicit awareness $t\ (384) = -2956.19$, $p < 0.001$ and phoneme segmentation $t\ (384) = -599.72$, $p < 0.001$, the Hedges and Olkin (1985) and Chacko et al. (2018) shows a strong variation in the intervention group. The Hedges and Olkin (1985) and Chacko et al. (2018)) vary between 2.64 (phoneme explicit awareness) and 1.53 (phonemic segmentation) in the intervention group, and 1.14

(phoneme explicit awareness), and 0.93 (phonemic segmentation), in the comparative group.

At the beginning of first grade, 80.2% of the participants in the IG were classified as not at risk of developing reading difficulties—based on the criteria of Mean −1.5SD, corresponding to two or fewer correct answers (out of 12) in phoneme explicit awareness. Over 50% performed at or above 11 correct answers (out of 12) in phoneme explicit awareness.

4. Discussion and conclusion

This study aims to present the preliminary results of the impact of PPRS. PPRS was developed to promote language and phonological awareness at preschool, with an important focus on phonemic awareness. Even though the Portuguese Preschool Curriculum Guidelines include phonological awareness training, these guidelines are not obligatory or trained systematically by all kindergarten teachers, so regular preschool education does still not address phonemic awareness sufficiently, as it can be shown by the low level of phonemic awareness the students start the grade 1 (Sucena et al., 2021). In this way, it is the authors' expectation that PRS will help prevent early reading acquisition failure by promoting reading skills and preparing children for early reading acquisition.

In this study, a quasi-experimental design was adopted, with two independent groups (intervention and comparative without intervention) and repeated measures (pre and post-test). The study hypothesis assumes that if the PPRS has a positive impact on pre-reading skills, there should be an interaction between the two factors, indicating that at the end of preschool education, children who were subject to the PPRS intervention perform better than those in the comparison group. Results indeed have confirmed a more positive impact of time for the intervention group. The differences between pre and post-intervention moments are statistically significant for all assessed skills: Language (Listening Comprehension and Oral Verbal Expression) and Phonological Awareness (Rime Implicit Awareness, Phoneme Explicit awareness, and Phoneme Segmentation). Specifically, Listening Comprehension and Oral Verbal Expression increased by around 4% from pre to post-test. There was a strong increase in rime implicit awareness and phoneme implicit awareness between the pre-test and post-test (respectively, 64–88 and 57–82%). A stronger increase between the pre-test and post-test was observed for the phonemic unit in the intervention group, corresponding to 70 percentual points for explicit awareness (10–81%) and to 50 percentual points for phonemic segmentation (6–57%).

Comparing the results of the intervention group with the comparative group there were no statistically significant differences in the pre-intervention assessment regarding phoneme explicit awareness and phonemic segmentation. Phonemic explicit awareness (*ca.* 10% for IG and 11% for CG), as well as phonemic segmentation (6% for IG and 5% for CG), were poor at the pre-test. These results are expectable and in consonance with previous studies, that found poor levels of phoneme awareness and segmentation at pre-test assessments (Carrol et al., 2011; Leij, 2013; Falth et al., 2017).

Phoneme explicit awareness results between the pre-test (10 and 11% respectively, intervention and comparison group) and the post-test was significantly stronger for the intervention group (which attained results close to 80%) than for the comparative group (that did not overcome 50%). Children in the intervention group benefited from having explicit training in language development and phonological awareness to improve their reading skills (Milbrum et al., 2017; Vaklin-Nusbaum and Nevo, 2017; Chacko et al., 2018; Dickinson et al., 2018; Van Kleeck, 2018; Bratsch-Hines et al., 2020; Lingwood et al., 2020). These results allow us to consider how the intensive, systematic, explicit, and structured way in which these skills are promoted in preschool education contributes to the construction of school success in the scope of reading and spelling acquisition (Lyytinen and Erskine, 2006) both in opaque (Rao, 2018) and in transparent orthographies (Ferroni et al., 2018; Stappen and Van Reybroeck, 2018; Caravolas et al., 2019; Gorgen et al., 2021).

In order to have a more thorough understanding of the impact of the PRS, a follow-up study was conducted regarding reading skills (specifically phoneme explicit awareness) of the subgroup of children that benefited from our intervention at preschool education. Results show that 80% of the students had positive results at the onset of formal education in phonemic awareness. It is important to emphasize that 80% of the students were classified as not at risk of developing reading difficulties. Results reveal that these children were well prepared to face the demands of reading acquisition, revealed by a well-developed phonemic awareness at the beginning of first grade.

These findings mainly contribute to the understanding of the important role of phonemic awareness and language in the early stages of learning to read. They also highlight the importance of early reading intervention as early as kindergarten, with children learning to read in an intermediate orthography such as Portuguese. The authors of this study hope to have contributed to the first of many studies, assessing reading promotion programs in Portuguese, and emphasizing the need to pursue scientifically informed strategies in reading intervention.

Despite the relevance of implementing an early reading intervention program, it is worth mentioning one main limitation, in face of school restrictions, not all skills were assessed with the comparative group. The inexistence of this group for all dimensions limits the possibility of an association between the observed changes and the implementation of the program. It would be of major importance, in future studies, to evaluate a comparative group concerning all skills at pre and post-test. A data collection of a comparative group in all assessed measures and a follow-up of the children in the following years after the completion of the program, as well as an analysis of the evaluation by the team that implements the

program, are aspects to be considered in future studies. Future research should assess the impact of maternal and/or paternal education on reading skills. Two main implications for practice are, therefore, offered. First, this program might be useful for educational practices fostering individual needs. Second, it might contribute to the development of scientifically informed reading skills programs in the early stages of learning to read. Practitioners would be in a better position to early intervene, especially with those children who need them the most, if more accurate information about early reading programs are available.

In sum, after starting the preschool education with similar results for both groups, (i) the intervention group finished the school year with results significantly above the comparative group, revealing a stronger development than children in the comparative group; (ii) the magnitude of the effect was higher for the intervention group than for the comparative group; and (iii) the intervention group presented positive results when assessed at the beginning of the formal school education, with 80% of the children being classified as not at risk of developing reading difficulties.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material; further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

AS designed, supervised, and revised the article critically. AFS collected and inserted the data on SPSS. CM performed literature review, analyzed the data, and wrote the method section. All authors contributed to the article and approved the submitted version.

Funding

This work was supported by European Horizon 2020, under OPERAÇÃO NORTE-08-5266-FSE-000095.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2022.1076630/full#supplementary-material

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