

DEVELOPMENT PROCESS OF AN EMERGENT LITERACY BATTERY FOR BRAZILIAN PRESCHOOL CHILDREN

PROCESSO DE DESENVOLVIMENTO DE UMA BATERIA DE LITERACIA EMERGENTE PARA CRIANÇAS PRÉ-ESCOLARES BRASILEIRAS

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ABSTRACT: *Preschool is an important time for linguistic skills consolidation, so, it is essential to comprehend which skills promote Emergent Literacy (EL) development and, consequently, allow children to read and write proficiently. In Brazil, there is a lack of standardized tools to evaluate these skills. The aim of this study is to present the development of an EL battery for Brazilian preschoolers (Pre-ALFA). The development process was followed by 4 steps: 1) Integrative review of EL assessment and Pre-ALFA tasks' design; 2) Expert's analysis; 3–4) Pilot studies with 4–6-year-old children (N=20). The last three steps were examined through frequency analysis. Integrative review pointed out fundamental abilities to be evaluated in this age range: emergent writing and reading; alphabet knowledge; vocabulary; phonological awareness. A preliminary structure of the battery was designed and used as a reference for the next steps. The results of both experts' analysis and pilot studies showed that the items were relevant to preschoolers' evaluation (>75% agreement achieved; no significant floor/ceiling effect), although a few adjustments were needed. Pre-ALFA seems to be promising to give an outlook on children's EL skills development and might be helpful in educational and clinical environments.*

KEYWORDS: *emergent literacy; child development; neuropsychological assessment; preschool.*

RESUMO: A pré-escola é um período importante para consolidação das habilidades linguísticas, sendo essencial compreender quais habilidades promovem o desenvolvimento da Literacia Emergente (LE) e, conseqüentemente, permitem às crianças leitura e escrita proficientes. No Brasil, observa-se escassez de instrumentos padronizados para avaliação dessas habilidades. O objetivo deste estudo é apresentar o processo de desenvolvimento de uma bateria de avaliação da LE para pré-escolares brasileiros (Pré-ALFA). Esse processo ocorreu em 4 etapas: 1) Revisão integrativa da avaliação da LE e modelagem das tarefas do Pré-ALFA; 2) Análise de especialistas; 3–4) Estudos piloto com crianças de 4–6 anos (N=20). As três últimas etapas foram examinadas mediante análise de frequência. A revisão integrativa assinalou as habilidades fundamentais a avaliar nessa faixa etária: leitura e escrita emergentes; conhecimentos do alfabeto; vocabulário; consciência fonológica. Uma estrutura preliminar da bateria foi construída e utilizada como referência nas etapas posteriores. Ambos resultados da análise de especialistas e estudos piloto demonstraram itens relevantes para a avaliação de pré-escolares (>75% de concordância alcançada; sem efeitos chão/teto significativos), ainda que poucos ajustes sejam necessários. Pré-ALFA aparenta ser promissor para dar uma perspectiva do desenvolvimento das crianças nas habilidades de LE e pode ser útil nos ambientes educacionais e clínicos.

PALAVRAS-CHAVE: literacia emergente; desenvolvimento infantil; avaliação neuropsicológica; pré-escola.

1 Introduction

During the first years of life, important changes in the brain structure and function promote a gradual specialization of cognitive-linguistic processes and the acquisition of specific knowledge, which is essential for children's oral and written language development (HOROWITZ-KRAUS; HUTTON, 2015; WANG, 2018). It has been acknowledged that language development occurs as a *continuum* throughout childhood, as a result of the neurobiological and cognitive-linguistic development, as well as the linguistic resources and practices provided in the home, school, and social environments (SULZBY; TEALE, 1991; TEALE; SULZBY, 1986; WHITEHURST; LONIGAN, 1998).

Although oral and written language development are interrelated, while the key factors for promoting oral language upgrading are child-environment “natural” verbal interactions, written language growth depends on contextualized learning of a specific writing culture. Thus, in addition to environmental verbal inputs, formal instruction is needed to form neural pathways to support fundamental complex neurocognitive processing for written language functioning, such as the letter-sound correspondence, despite the child's neurobiological structures already

mature since birth involved in oral language acquisition (BROCE *et al.*, 2019; HOROWITZ-KRAUS; HUTTON, 2015; WANG, 2018).

However, even children who have not yet learned the formal rules of alphabetic principles present some knowledge about oral and written language, likely because of their exposure to graphic symbols used to communicate and the uses of certain vocabulary terms in contexts (SULZBY; TEALE, 1991; TEALE; SULZBY, 1986). Therefore, specific models have been designed to describe the development of linguistic abilities prior to formal literacy instruction.

For instance, the Emergent Literacy (EL) model (ROHDE, 2015; SÉNÉCHAL *et al.*, 2001; SULZBY; TEALE, 1991; WHITEHURST; LONIGAN, 1998), which is commonly associated with preschool analyses of cognitive-linguistic abilities, describes reading and writing learning from a developmental perspective. Children's experiences in family, culture, and school environments maximize the learning of such abilities. For this reason, variations in children's development are expected, as a result of individual differences in child-environment relationships (LONIGAN, 2015; TEALE; SULZBY, 1986).

Whitehurst and Lonigan (1998) propose that the EL construct, regarding individual abilities (such as grapheme-phoneme knowledge and semantic units), can be organized into two interrelated components. The first component (*outside-in*), which includes vocabulary, narrative comprehension, and emergent reading (in its contextual level), tends to be more susceptible to home linguistic environment influence. The second component (*inside-out*), which includes phonological awareness and emergent writing (print units) abilities, tends to be more susceptible to early educational environment influence (LONIGAN, 2015; WHITEHURST; LONIGAN, 1998).

Alternatively, Sénéchal and colleagues (2001) suggest that the EL construct refers to code-related abilities (emergent writing and reading, as well as alphabet knowledge) which are processed as a complement, but independently, to oral language abilities (narrative comprehension and vocabulary) and to metalinguistic abilities (syntactic and phonological awareness). The authors also propose the oral language and metalinguistic abilities as separate components. Rohde (2015) understands that the EL abilities are organized in those same three components, but considers that some abilities, such as phonics and comprehension, are not specifically (or predominantly) processed by only one component, which serves as "gaps" to the EL subcomponents process (e.g., phonics can help improve oral and written language). This

perspective highlights cultural and sociodemographic aspects as crucial to individual development within the modeling design, differently from other authors.

Later in the academic path, when children are in the initial steps of formal literacy instruction, other models are suggested to analyze reading and writing development. Similarly to the EL models, the integrative model of Four Processors (ADAMS, 1990; 2013), for example, considers the interactions of different linguistic components (orthographic, phonologic, semantic, and contextual). This model starts from the orthographic (reading and writing) and phonological (expressive and receptive oral language) components, which allow children to do the grapheme-phoneme conversion, to distinguish orthographic patterns, as well as other linguistic analyses. For instance, their inter-relations with other processors might help in tasks such as comprehension of different text genres and analysis of word meaning (ADAMS, 2013).

Notably, there is a lack of standardized tools to evaluate Emergent Literacy in preschoolers in Brazil (CARIM *et al.*, 2018; FERREIRA *et al.*, 2010), in both theoretical and psychometric parameters. To address this limitation, the main goal of this study is to present the development of a battery for preschoolers' assessment of Emergent Literacy abilities, which was based on a dynamic comprehension of the theoretical models previously presented (ADAMS, 1990; 2013; LONIGAN, 2015; ROHDE, 2015; SÉNÉCHAL *et al.*, 2001; WHITEHURST; LONIGAN, 1998). The instruments' development steps include *Pre-ALFA* tasks' design (including literature review), experts' analysis, and pilot study. The instrument has two parts: *Pre-ALFA* Part A is composed by Emergent Written Language tasks, and Part B refers to Oral Language tasks.

2 Method

The development of *Pre-ALFA* — parts A and B — followed four successive steps recommended by educational and psychological standards (AERA; APA; NCME, 2014; PACICO, 2015):

- *Step 1 – Literature review and Pre-ALFA tasks' design:* To address content specifications of *Pre-ALFA* (A and B) instrument and help in the construction of tasks, comprehending which items would be evaluated in each task, an integrative literature review was designed (SOUZA; SILVA; CARVALHO, 2010). For this step, first, theoretical and meta-analytic studies in international databases were considered

(Pubmed, PsycInfo and ERIC). Specific keywords were combined to refine the search process (early literacy / emergent literacy / preliteracy + development / assessment / evaluation + kindergarten / preschool), which were useful to specify Emergent Literacy concepts and determine related cognitive abilities. In order to increase the knowledge of the characteristics of preschool assessment tools, we also considered international instruments published or under development until March, 2019 designed to evaluate Emergent Literacy components by using the same keywords to refine search. Data collection for Step 1 was performed in the second semester of 2018 (database research) and in the first semester of 2019 (analysis of international instruments).

- *Step 2 – Experts’ analysis (Pre-ALFA, A and B):* A preliminary version was analyzed by four professionals with doctoral degrees, specialized in Developmental Psychology and/or Language Development, with expertise in reading, writing and phonological awareness during childhood. They examined the relevance and adequacy of each item evaluating the Emergent Literacy construct and suggesting changes in stimuli or task instructions, if necessary. The level of agreement was verified by frequency analysis for each item, considering 75% of agreement as a reference to maintaining items and applying reformulations suggested (HAIR *et al.*, 2009). After this analysis, two pilot studies were conducted with the latest version of *Pre-ALFA*: the first one specifically for the Emergent Writing Language component (Part A), described in the next step, and the second for the Oral Language component (Part B), which is still ongoing and, thus, is partially presented in this study.

- *Step 3 – Pilot study 1 (Pre-ALFA Part A – Emergent Writing and Reading, and Alphabet Knowledge):* Ten children between 4 and 6 years of age ($M=5.24$; $SD=0.65$) participated in this phase. Participants were regularly enrolled in two public schools in Porto Alegre, RS (southern Brazil), and were selected by convenience. Only children with no parent-reported complaints of development/learning disorders (APA, 2014) or any sensory impairment, except for treated conditions, such as the use of eyeglasses for visual problems, were taken as participants. A frequency analysis of children’s performance on each item was performed in which items were reviewed based on children’s responses (e.g., reformulation of the writing instruction, so that it could be clear to 4–6-year-olds). Depending on their familiarity with the questions asked, children spent approximately fifteen to thirty minutes answering the tasks in this phase.

Tasks were administered individually by a trained researcher, in a quiet room at the

child's school in the following order: 1) Emergent Writing; 2) Emergent Reading; 3) Alphabet Knowledge.

- *Step 4 – Pilot study 2 (Pre-ALFA Part B – Expressive Vocabulary and Phonological Awareness):* Ten children between 4 and 6 years of age ($M = 5.60$; $SD = 1.17$) with typical development participated in this phase. Participants were regularly enrolled in public and private schools in Porto Alegre, RS (southern Brazil), and were selected by convenience following the same criteria presented in Step 3. A frequency analysis of children's performance in each item was carried out. The items were reviewed based on the children's responses (e.g., picture design rearrangement, so that it could be clear to 4–6-year-olds). Expressive vocabulary and phonological awareness were evaluated in two different samples (except for one child who answered both tasks) and at two different times. Children spent five to ten minutes, approximately, answering each task in this phase, depending on their familiarity with the stimuli presented. In an online video call, they were individually evaluated by a trained researcher, due to COVID-19 pandemic restrictions. All pictures were created specifically for this study by an illustrator.

Data analyzed in Steps 2 and 3 were collected from October to November 2019, and Step 4 from September to November 2020 (Expressive Vocabulary) / May 2021 (Phonological Awareness). This study was approved by the Research Ethics Committee of a Federal University in Brazil (CAAE 08980919.2.0000.5334). For the assessments of the pilot study 1, the local early childhood education department allowed the examiners to contact the participant schools. Families were invited to join the research in a meeting with target classes and invitations were released by teachers at the school bulletin board. Risks and benefits were explained to each family before parents signed the consent form to allow the child's participation in the study. Pilot study 2 was conducted remotely (through video calls) due to COVID-19 pandemic restrictions preventing in-person assessment, following the same ethical conditions used in Pilot study 1.

3 Results

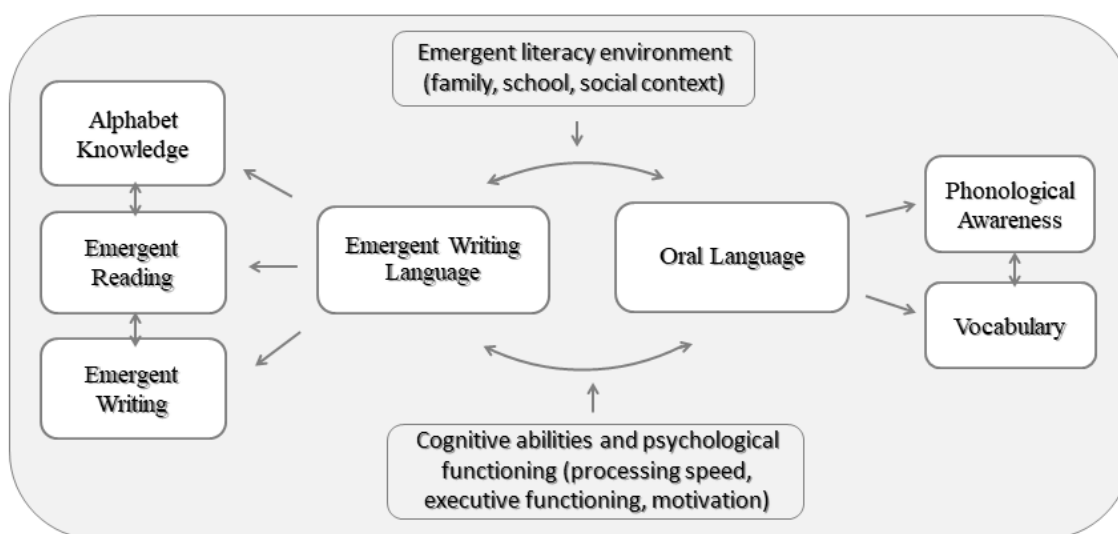
3.1 Step 1 – Literature review and *Pre-ALFA* tasks' design (*Pre-ALFA*, A and B)

The theoretical and meta-analytic literature review published indicated that besides words, reading, writing and alphabet knowledge, emergent written language in preschool requires another developing skill. The way children write their own names and letters, for example, observing and discriminating writing and reading patterns, is different over time (and that is why a qualitative scheme for evaluation is needed, as well as quantitative scores, to analyze children's growth process). For oral language, the phonological awareness assessment task considered the first steps in word/syllable identification and manipulation (JUSTICE; INVERNIZZI; MEIER, 2002; NATIONAL EARLY LITERACY PANEL – NELP, 2008; LONIGAN, 2015; PHILLIPS *et al.*, 2012; PURANIK; LONIGAN, 2014; SPENCER *et al.*, 2013).

International instruments for Emergent Literacy assessment and tasks aiming to capture children's abilities through different components, including listening and manipulating the information, observing visual characteristics, recalling the information, and responding orally or by writing, were analyzed in order to refine the understanding of the construct. Tasks were then organized considering multiple ways to assess children's understanding of Emergent Literacy skills (except for oral language), from simple identification to discrimination. Some of the tasks requested that children only point to the right answer (multiple-choice tasks), whereas others, due to the complexity of the tasks, required verbal answers and manipulation of different information at the same time (CHAN, 2015; INVERNIZZI *et al.*, 2009; INVERNIZZI *et al.*, 2004; IYER *et al.*, 2019; LONIGAN *et al.*, 2007; NATIONAL CENTER FOR LEARNING DISABILITIES – NCLD, 2009).

In order to address these findings in the instrument composition, we propose an assessment model for Emergent Literacy abilities organized into two components: 1) Emergent Written Language (Emergent Reading and Writing, and Alphabet Knowledge tasks); 2) Oral Language (Vocabulary and Phonological Awareness). The conceptual model of these components' relationship is shown in Figure 1.

Figure 1 – Structural Model of Assessment Components of Emergent Literacy – *Pre-ALFA*

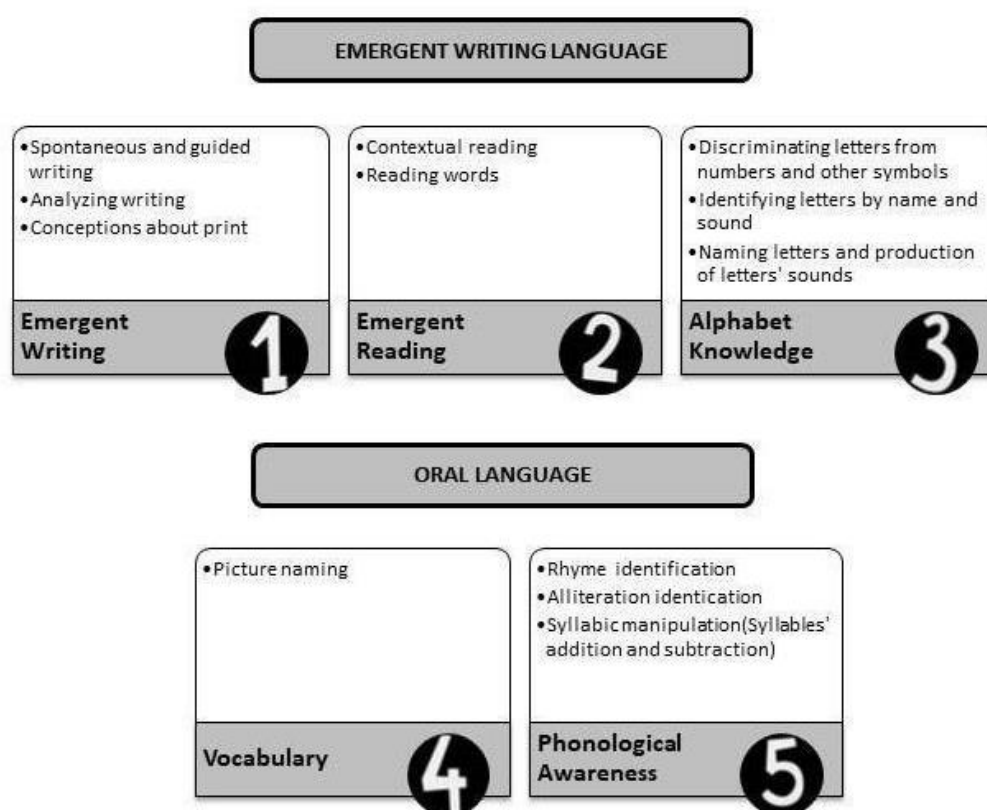


Source: Author's own elaboration (based on ADAMS, 1990; 2013; LONIGAN, 2015; ROHDE, 2015; SÉNÉCHAL *et al.*, 2001; WHITEHURST; LONIGAN, 1998).

The five abilities regarding Emergent Literacy receive support from other cognitive-linguistic abilities (e.g., processing speed, usually measured by rapid automatized naming tasks, and verbal work memory) (JUSTICE; INVERNIZZI; MEIER, 2002; LONIGAN, 2015; NELP, 2008). The interaction between Emergent Literacy components and other cognitive-linguistic abilities are influenced by home, culture, and school environments (e.g., socioeconomic status, income, shared reading activities and educational practices) in early childhood (INVERNIZZI *et al.*, 2010; JUSTICE; INVERNIZZI; MEYER, 2002; LONIGAN, 2015; PHILLIPS; LONIGAN, 2005).

Based on the conceptual model of *Pre-ALFA* (Figure 1) and both integrative literature review search processes, a preliminary version of the battery was developed. It was composed of 15 tasks created by the authors to evaluate Emergent Reading and Writing, Alphabet Knowledge, Vocabulary, and Phonological Awareness (Figure 2).

Figure 2 – Preliminary components of *Pre-ALFA* battery



Source: Author's own elaboration.

The search and selection criteria of each item for Guided Writing, Analyzing Writing (word level), and Reading Words tasks were: a) words with up to eight characters within three syllables; b) high frequency words in Brazilian Portuguese – over 100.000 in a million registers (SARDINHA, n.d.); c) words commonly found in children's vocabulary.

For Conceptions about print, a storybook was written by the first author (*"Little witch, the novice witch"*, originally in Portuguese as *"Bruxa picorrucha, a aprendiz de bruxa"*), using rhymes to compose the story plot. Items such as Writing direction, Title/End of story Location and other contextual parameters of the book were selected in this level of children's EL assessment.

In Alphabet knowledge tasks' development, Identification level items were selected based on the criteria of frequency in Brazilian Portuguese (QUARESMA; PINHO, 2007), electing one item for each level for both names and sounds of letters (high frequency – "A" – 14% / "O" – 11%; medium frequency – "M" – 5% / "R" – 6%; low frequency – "G" and "F" – 1%). For the Naming letters task, all 26 letters of the alphabet were included. For Production of letters' sounds, only 22 stimuli were included ("H" is not represented by any phoneme in

Brazilian Portuguese and “K”, “W” and “Y” are presented only in proper names and foreign words – CEGALLA, 2008). In these tasks, words were randomly arranged.

Finally, in Phonological Awareness tasks, the selection criteria for the items in the Expressive Vocabulary Assessment were words commonly found in children’s vocabulary and simply represented by drawing, to make it easy for children to identify. This preliminary version of *Pre-ALFA* went through an expert’s analysis to improve tasks’ relevance and content, and instruction’s written form.

3.2 Step 2 – Experts’ analysis (*Pre-ALFA*, A and B)

In the experts’ analysis of the relevance and adequacy of *Pre-ALFA* tasks, none of the items showed levels of agreement below 75% (Table 1), and those that needed changes in their stimuli or instruction were reformulated based on the experts’ suggestions. Items with exclusion suggestions were kept for pilot study analysis since most experts agreed with the proposed items (75% of agreement). The results for each component are presented below.

Table 1 – Experts’ agreement levels of *Pre-ALFA* tasks

Emergent Writing Language			
Abilities	Task	Items	Experts’ agreement level
Emergent Writing	Spontaneous and guided writing	Name writing	100%
		Alphabet writing	100%
		Writing words – spontaneous	100%
		Writing words – guided*	----
	Analyzing writing	Grapheme level	75%**
		Word level	75%**
		Textual level	75%**
	Conceptions about print	Books’ content	75%***
		Books’ reading strategies	100%
		Text and picture distinction in the book	75%***
		Book’s title	100%
		Title’s words	100%
		Longer word in the book’s title	75%**
		Equal words in the book’s title	75%**
		Reading direction	100%
		Book’s end reference	75%**
		Children’s story retelling	75%**
Emergent Reading	Contextual reading	----	100%
	Reading words	----	100%
Alphabet Knowledge	Discriminating letters from numbers and other symbols	----	100%
	Identifying letters by name	----	100%
	Identifying letters by sound	----	100%
	Naming letters	----	75%**
	Production of letters’ sounds	----	75%**
Oral Language			
Abilities	Task	Items	Experts’ agreement level
Vocabulary	Picture naming	----	100%
Phonological Awareness	Rhyme identification	Training stimuli 1 and 2	100%
		Test stimuli (a, d, e)	100%
		Test stimuli (b, c)	75%***
	Alliteration identification	Training stimuli 1	75%***
		Training stimuli 2	100%
		Test stimuli (a to d)	100%
	Syllabic manipulation – Syllables’ addition and subtraction	Training stimuli 1 and 2	100%
		Test stimuli (a, b)	100%
		Test stimuli (c, d)	75%***

Source: Author's own elaboration.

*Suggestion: inclusion – **Suggestion: exclusion – ***Suggestion: rearrangement.

3.2.1 Emergent Writing Language component

In *Spontaneous and guided writing* tasks, name writing, writing letters and spontaneous writing items were considered relevant by experts. An item was included based on the suggestion of evaluating both spontaneous and guided writing. Although the experts' suggested using four words and one sentence, five words were required for the guided writing task.

For *Analyzing Writing*, the suggestion was only to extend the number of stimuli per item, to avoid using only one stimulus. However, the same structure was maintained in order to make the battery leaner. As suggested, the word proposed was changed from a first name (*Aline*) to a simple noun (*Corpo*), as suggested, to avoid the association with a relative's name. One expert considered the exclusion of the task, arguing that the items were not appropriate for preschoolers. Considering our criteria of 75% level of agreement, they were maintained in the battery.

In *Conceptions about print*, some items such as "equal words in the title" and "reference to the end of the book" received the indication for dismissal. However, no explanation was mentioned, which led to their maintenance. Other items such as "book's content" and "differentiation text-image" were based on experts' suggestion, to make instruction more clearly arranged.

For *Emergent Reading* tasks, there was a 100% level of agreement. Finally, in *Alphabet Knowledge* tasks, discrimination and identification-like items obtained a 100% level of agreement, while production-like items were highlighted as redundant with other tasks along the component. As previously mentioned, considering the level of agreement (75%), these items were maintained for the pilot study.

3.2.2 Oral Language component

For the *Picture naming* task, there was a 100% level of agreement and no suggestions were made. In *Phonological awareness* tasks, some items obtained 75% level of agreement. All items with appropriateness indicators were redesigned based on experts' suggestions (picture changing or instruction re-writing, for example, to make them clearer). Two training stimuli and four test stimuli on each ability were maintained to homogenize tasks. A summary of both components of *Pre-ALFA* tasks is presented in Table 2. These tasks were used as references for the analyses of Steps 3 and 4 (Pilot studies 1 and 2).

Table 2 – Summary of *Pre-ALFA* abilities, tasks and brief description of items

Emergent Writing Language		
Abilities	Task	Brief description of the items
Emergent Writing	Spontaneous and guided writing	– Name writing (Children had to write their first name). – Letters writing (Writing 26 letters of the alphabet, as recalled). – Writing words – spontaneous writing (Children had to write 5 words chosen by them, including names and/or other known words). – Writing words – guided writing (Children had to write 5 dictated words, with three to seven letters).
	Analyzing writing	Analysis by children of writing stimuli – grapheme, word, and text levels (position and extension).
	Conceptions about print	Analysis of children's knowledge about writing material (e. g., write direction, reference of the end of a story), based on a storybook called "Little witch, the novice witch" (originally in Portuguese as " <i>Bruxa picorrucha, a aprendiz de bruxa</i> ").
Emergent Reading	Contextual reading	Children had to read 6 words, with contextual clues to support – logographic form of brands – 4 original forms and 2 modified versions.
	Reading words	Children had to read 4 isolated words, with three to six letters.
Alphabet Knowledge	Discriminating letters from numbers and other symbols	Graphic stimuli are presented to the child, to differentiate letters, numbers, geometric forms, and other symbols.
	Identifying letters by name	Children's identification of letters dictated by the examiner, within 4 stimuli, analyzing letters of low, medium, and high frequency.
	Identifying letters by sound	Children's identification of letters' sound produced by the examiner, within 4 stimuli, analyzing letters of low, medium, and high frequency.
	Naming letters	Children's naming of 26 letters of the alphabet, disposed randomly on Stimuli Book.
	Production of letters' sounds	Children's phoneme production of 22 letters of the alphabet, disposed randomly on Stimuli Book.
Oral Language		
Abilities	Task	Brief description of the items
Vocabulary	Picture naming	Naming 96 pictures, disposed in 24 strips with 4 pictures each.
Phonological Awareness	Rhyme identification	Picture identification, between 3 options, that contains the same final sound as the target picture. The task has 2 exercise items and 4 test items.
	Alliteration identification	Picture identification, between 3 options, that contains the same initial sound as the target picture. The task has 2 exercise items and 4 test items.
	Syllabic manipulation – Syllables' addition and subtraction	Picture identification, between 3 options that express the target word modified, when a syllable is added or removed in the beginning or the end of the words. The task has 2 exercise items and 4 test items for both types of syllabic manipulation (addition and subtraction).

Source: Author's own elaboration.

3.3 Step 3 – Pilot study 1 (*Pre-ALFA Part A – Emergent Writing Language*)

In this step, the appropriateness of the items for the Emergent Writing Language component was analyzed. The response patterns observed were based on the evaluation of 10 children. In the frequency analysis, most of the items demonstrated appropriate design and instructions. Items “biggest word in the title”, “book content” and letter identification – letter A high-frequency in the language, showed floor (first item) and ceiling (last ones) effects (in other words, they present 100% of wrong and right answers, respectively).

Considering the importance of these items in evaluating possible difficulties in children’s knowledge, they were maintained for further analysis in a larger sample. The item “differentiating words/text and images in the book” was unified with the item “possible reading from a book”, leading to the instructions being re-written. An item was included in the *Conceptions about print* task to help understand if the child can recall most of the storybook parts.

3.4 Step 4 – Pilot study 2 (*Pre-ALFA Part B – Oral Language*)

In this step, the appropriateness of the pictures in the expressive vocabulary Oral Language component was analyzed. The response patterns were observed with the evaluation of 7 children. Based on frequency analysis and children’s responses pattern, 14 of the 96 pictures were drawn again to become clear for children’s stimuli identification and naming.

In Phonological Awareness tasks, 4 children were evaluated. As expected, rhyme and alliteration tasks were more frequently answered correctly than syllabic manipulation ones, and children’s choices of similar sounds (e.g., /x/ instead of /ss/) produced errors in a few items. Based on the frequency analysis and the difficulty level of some pictures named for syllabic manipulation stimuli, two items were exchanged from test to training stimuli. No floor or ceiling effect was observed in both expressive vocabulary and phonological awareness tasks.

4 Discussion and future directions

A consistent body of published research indicates the relevance of early and systematic evaluation of cognitive-linguistic abilities to track and promote literacy-related skills and improve brain structures, especially during preschool age (BROCE *et al.*, 2019; HOROWITZ-

KRAUS; HUTTON, 2015; JUSTICE; INVERNIZZI; MEYER, 2002; LONIGAN, 2015; NELP, 2008; SPENCER *et al.*, 2013; WANG, 2018). As previously mentioned, there is a lack of standardized tools to evaluate Emergent Literacy in Brazilian preschoolers (CARIM *et al.*, 2018; FERREIRA *et al.*, 2010), which motivated *Pre-ALFA*'s development.

The present study described the development of the *Pre-ALFA* Emergent Literacy battery for children's assessment in their initial phases of reading and writing-related abilities, especially to preschoolers. In order to reach standard goals to prepare and turn each task into valid and reliable measures, standardized essential steps were followed (AERA; APA; NCME, 2014; PACICO; HUTZ, 2015; SPENCER *et al.*, 2013; ZANON; HAUCK FILHO, 2015).

Literature review, as part of the first step, demanded the capacity to delimit the most relevant aspects of children's Emergent Literacy, thinking of questions to guide the search in database collection and weighing the information in preexisting international tools. This can help choose the best evidence to guide decisions about the information to include in the test, depending on the abilities to evaluate (AERA; APA; NCME, 2014; SPENCER *et al.*, 2013).

According to Emergent Literacy models, skills such as emergent reading and writing, alphabet knowledge, oral language, and metalinguistic measures, are important precursors of reading and writing development (SULZBY; TEALE, 1991; WHITEHURST; LONIGAN, 1998; SÉNÉCHAL *et al.*, 2001). These abilities presented, in several studies, moderate and strong relations with formal literacy development (AL OTAIBA *et al.*, 2011; CASTRO; BARRERA, 2019; DALE *et al.*, 2018; ECALLE *et al.*, 2015; NELP, 2008; MILBURN *et al.*, 2017).

For *Pre-ALFA* task design, specific abilities were selected: emergent reading and writing (e.g., name writing, analyzing writing patterns, and reading words), alphabet knowledge (in both grapheme and phoneme recognition levels), vocabulary (picture naming), and phonological awareness (e.g., rhymes and alliterations identification). Items via diverse input/output of information, using listening, decoding, coding, and verbalizing competencies to receive, treat and answer each task were included (ADAMS, 2013; AERA; APA; NCME, 2014).

As it is highly recommended by AERA, APA and NCME (2014), for each item, a guideline for test administration was constructed, with instructions for environment accommodations, recommended sessions, materials required, and instructions to apply and monitor children's responses. Scoring procedures were also specified in a guideline. Due to *Pre-ALFA*'s different kinds of items, a diversity of scoring specifications was needed, from one

correct option out of some alternatives and scoring rubrics, with score based on the child's knowledge (using references of theoretical findings to select the rubrics).

The quantitative scores and qualitative parameters used in evaluation recording sheets may support a numeric criterion to observe range differences between children and holistic specifications about the children's linguistic development. For example, if children do not write their own names precisely, although they might have the same score, different types of errors could be related to inaccurate writing, such as letters omissions, repetitions and/or mirroring effects.

Experts' analysis and pretesting in a representative sample similar to the targeted population of the test is endorsed as relevant parts of the elaboration of assessment tools (AERA; APA; NCME, 2014; PACICO, 2015). Thus, the second and third steps of *Pre-ALFA* development process were significant to refine the items to fit children's understanding and their appropriateness to Emergent Literacy model proposed.

The next steps required to accomplish satisfactory psychometric properties in evaluation tools are validity and reliability parameters (AERA; APA; NCME, 2014; JENKINS; HUDSON; JOHNSON, 2007; PACICO; HUTZ, 2015; ZANON; HAUCK FILHO, 2015). Future directions in *Pre-ALFA*'s development refers to analyses of internal consistency, correlations with other neuropsychological tests measuring similar constructs, as well as correlation with individual and environmental factors, such as children's age and sex, and socioeconomic circumstances (e.g., family income and mother's education) of the targeted sample (children of 4 to 6 years of age).

Considering the Brazilian educational background, *Pre-ALFA*'s tasks may help follow initial stages of literacy instruction, which may be investigated in future studies, ideally using longitudinal approaches. Spencer and colleagues (2013) recommended that, in early linguistic development, there must be at least two or three moments during preschool/school years to monitor children's progress.

In addition, factor analyses may allow us to select, within *Pre-ALFA* tasks, a reduced number of items that better correlate with literacy outcomes and propose a screening tool to achieve this goal. This possibility will be investigated once we have a sample size that allows us to conduct factor analysis and potential item reduction.

Lastly, the battery presented in this study has real potential to help identify children's early literacy profile, with its strengths and weaknesses. This is an important step in planning pedagogic or neuropsychological strategies which are imperative for promoting learning

broadly and for designing preventive programs/policies and intervention on learning delays or disabilities. The use for different professionals concerned about learning and schooling (e.g., speech therapist, psychologist, occupational therapist) might be promoted, within educational, clinical, and research settings.

It is important to mention that, although *Pre-ALFA* contains the major abilities considered precursors for literacy development, its aim is to provide a brief evaluation of children's functioning. In this regard, it is important to complement the individual's assessment with language and literacy-related tasks, such as measures of working memory, attention, speed processing, and other fundamental neurocognitive skills (JENKINS; HUDSON; JOHNSON, 2007; SPENCER *et al.*, 2013).

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Artigo submetido em: 08 ago. 2023

Aceito para publicação em: 10 out. 2023

DOI: <https://dx.doi.org/10.22456/2238-8915.134622>