http://dx.doi.org/10.1590/2175-35392019019961

Paper

Phonological Awareness Skills Improved by the Teaching of Reading and Writing

Pauliana do Nascimento Rodrigues[1]; https://orcid.org/0000-0002-6050-0272

Lidia Maria Marson Postalli[1]; https://orcid.org/0000-0001-7560-697X

Abtract

The objective of the study was to verify the development of phonological awareness skills duringthe process of children learning reading and writing by means of a computer program.Three students with learning difficulties, enrolled in the second year of elementary school, took part in this research. Pre and post-test were employed by means of the Phonological Awareness Test and the Reading and Writing Diagnostic Test before and after the realization of Module 1 of the program named Learning to Read and Write by Small Steps, or "Aprendendo a Ler e a Escrever em Pequenos Passos." Results show that the three participants reached the end of the learning program and demonstrated improvement in their reading and writing repertoire. On the Phonological Awareness Test, participants presented improvement in their performance at rhyme, alliteration, and syllabic skills but did not present consistent improvement in their phonemic skills. Results point at the necessity to develop and enhance procedures for the teaching of phonological awareness, especially phonemic skills.

Keywords: phonological awareness; reading; writing.

Habilidades de consciencia fonológica promovidas por la enseñanza de lectura y escritura

Resumen

El objetivo del estudio fue verificar el desarrollo de habilidades de consciencia fonológica a partir de la adquisición de lectura y escritura en niños empleándose un programa informatizado de enseñanza de lectura y escritura. Tres alumnos con dificultad de aprendizaje, matriculados en el segundo curso de la Enseñanza Primaria participaron de la investigación. Se utilizó un delineamiento de pre y post-test, empleando la Prueba de Consciencia Fonológica (PCF) y el Diagnóstico de Lectura y Escritura (DLE) antes y tras la realización del Módulo 1 del currículo Aprendiendo a Leer y a Escribir en Pequeños Pasos. Los resultados mostraron que los tres participantes completaron el programa de enseñanza, demostrando mejora en el repertorio de lectura y de escritura. En la PCF, los participantes presentaron mejora en el desempeño de rima, aliteración y en las habilidades silábicas; pero no presentaron mejora consistente en las habilidades fonémicas. A partir de los resultados se verifica la necesidad del desarrollo y perfeccionamiento de procedimientos para la enseñanza de las habilidades de consciencia fonológica, principalmente, las habilidades fonémicas.

Palabras clave: Consciencia Fonológica; lectura; escritura.

Habilidades de consciência fonológica promovidas pelo ensino de leitura e escrita

Resumo

O objetivo do estudo foi verificar o desenvolvimento de habilidades de consciência fonológica a partir da aquisição de leitura e escrita em crianças empregando um programa informatizado de ensino de leitura e escrita. Três alunos com dificuldade de aprendizagem, matriculados no segundo ano do Ensino Fundamental, participaram da pesquisa. Foi utilizado um delineamento de pré e pós-teste, empregando a Prova de Consciência Fonológica (PCF) e o Diagnóstico de Leitura e Escrita (DLE) antes e após a realização do Módulo 1 do currículo Aprendendo a Ler e a Escrever em Pequenos Passos. Os resultados mostraram que os três participantes completaram o programa de ensino, demonstrando melhora no repertório de leitura e de escrita. Na PCF, os participantes apresentaram melhora no desempenho de rima, aliteração e nas habilidades silábicas; mas não apresentaram melhora consistente nas habilidades fonêmicas. A partir dos resultados verifica-se a necessidade do desenvolvimento e aprimoramento de procedimentos para o ensino das habilidades de consciência fonológica, principalmente, as habilidades fonêmicas.

Palavras-chave: Consciência fonológica; leitura; escrita.

1 Universidade Federal de São Carlos – São Carlos – São Paulo – Brasil; paulinanr@gmail.com; lidiapostalli@ufscar.br

Introduction

Official Brazilian statistics show that the rate of illiteracy in Brazil is 8,0%, 12.9 million people, among Brazilians older than 15 (IBGE, 2015). According to the Functional Illiteracy Index, or "Indicador de AnalfabetismoFuncional (INAF)" of the Paulo Montenegro Institute, despite being considered literate by official indices, millions of individuals can only read and interpret small texts with explicit information and a reduced number of words. According to research realized by the Paulo Montenegro Institute (2016), most respondents (42%) were ranked in the elementary group, which means they can read one or two pieces of information in diverse texts of medium-sized extension while realizing small inferences, and solve problems involving small basic operations and some degree of control and planning. Most importantly, only 8% of the repondents are in the last group of literacy, which reveals their command of skills that set them free from restrictions in order to understand and interpret texts in normal situations involving multiple phases, operations and types of information.

Regarding this problem, many studies have been realized so that the acquisition of reading and writing skills can be better understood and, as a consequence, more efficient teaching techiniques will be designed. Studies that seek the development of procedures for the teaching of reading and writing, based on the teaching of a network of relations between stimulus and stimulus and reponse (cf. de Rose, 2005; de Souza & de Rose, 2006; Sidman, 1994; Sidman &Tailby, 1982), have produced a solid body of knowledge, which hints at the existence of basic requisites for the acquisition of the reading behavior, and therefore allowing for the efficient programming of teaching activities.

Aiming at investigating the effects of the teaching of reading and writing skills on the development of phonological awareness skills, the present study has employed Module 1 of the program for the teaching of reading and writing entitled Learning to Read and Write in Small Steps, or "Aprendendo a Ler e a Escrever em Pequenos Passos", developed by de Rose and collaborators (de Souza, de Rose, Hanna, Calcagno, & Galvão, 2004; de Souza & de Rose, 2006).The teaching program is composed by three modules. Module 1 aims at teaching regular words of the consonant-vowel type. The objective of Module 2 is to teach words composed by consonant clusters, digraphs, and graphemes whose corresponding phoneme depends on context. Lastly, Module 3 is based on storybooks. Procedures were planned in small steps in order to allow learners to realize activities without difficulty and at their own pace. The first Module was applied widely and on different populations and their results demonstrate the efficacy of the teaching of reading and writing for children with learning difficulties (cf. de Souza & de Rose, 2006; de Souza et al., 2009; de Rose, de Souza, & Hanna, 1996; Reis, de Souza, de Rose, 2009).

Since its initial proposal in the 1980s, the teaching program has been improved (cf. de Souza & de Rose, 2006). The control on stimulus by means of smaller word units is relevant for generalization, that is, the reading of new words composed by syllables from words directly taught. The teaching of the relation between dictated syllables and printed syllables of the taught words (de Souza et al., 2009), and the employment of Constructed Response Matching to Sample (CRMTS) for the task of constructing printed words with movable letters (de Rose et al., 1996) were employed together with teaching strategies conducive to the discrimination of units that compose words, which increased the indices regarding the reading of taught words and generalization words (the reading of new words, formed by letters and syllables from words already taught).

Studies indicate that the development of phonological awareness (awareness of the sounds that constitute speech) is related to successful learning of reading and writing (Barrera & Maluf, 2003; Capovilla, Gütschow, &Capovilla, 2004; Justino & Barrera, 2012; Moreschi & Barrera, 2017; Nunes, Frota, & Mousinho 2009; Puliezi & Maluf, 2012; Santos & Maluf, 2010; Santos & Barrera, 2017).

Considering the importance of and the interest in investigating the acquisition of a repertoire of discriminating and manipulating skills related to sounds (phonological awareness) by the acquisition of reading and writing skills, the present study intended to verify the development of phonological awareness skills by means of the acquisition of reading and writing skills by children with learning difficulties while employing Module 1 of the program for the teaching of reading and writing. The module is entitled Learning to Read and Write in Small Steps, or "*Aprendendo a ler e a escrever em pequenos passos*" (cf. de Souza & de Rose, 2006; de Souza et al., 2004).

Method

Participants

Three children took part in the research, two boys andone girl, ages seven to nine, with a low reading repertoire (reading of, at most, two out of 15 words assessed in the initial Reading and Writing Diagnosis) and little Phonological Awareness (scores between 12 and 15 out of 40 in the Phonological Awareness Test). All participants were enrolled in the second year of Elementary School at a public institution in a city in the countryside of São Paulo.The participants were given fictitious names in order to protect the identities of all those involved in the research. This research project was approved by the Research Ethics Committee, or "Comitê de Ética em Pesquisa" (CAEE 34223314.4.0000.5504).

Settting

Data collection took place in a research laboratory in a public university in the courtyside of the State of São Paulo. Participants were transported to the research site every

weekday in opposite time of class schedule. The average duration of each session for the realization of the day's activities was from 45 to 60 minutes.

Reasearch Material and Equipment

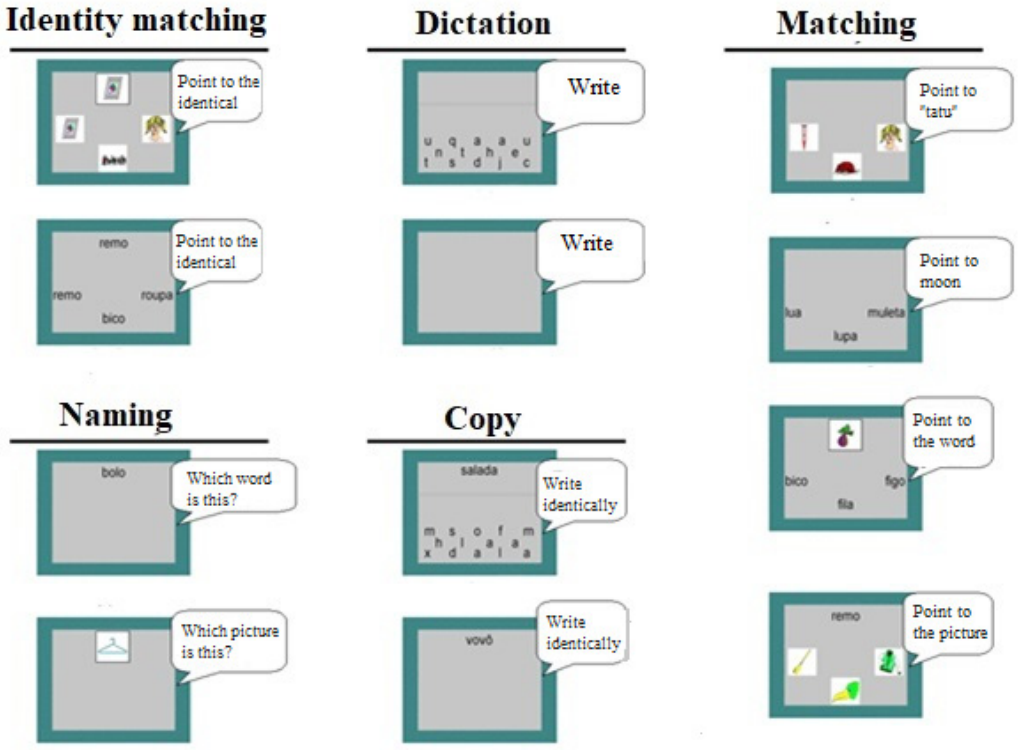
For the teaching of reading and writing the material employed was the 2.1 version of Module 1 of a computer program for the teaching of reading and writing entitled Learning to Read and Write in Small Steps, or "*Aprendendo a Ler e a Escrever em Pequenos Passos"* (cf. de Souza & de Rose, 2006). The application of teaching procedures occurred by means of the Computer-individualized Teaching Manager, or "*Gerenciador de Ensino Individualizado por Computador"* (GEIC). It is a platform that allows for the remote application of teaching programs. For the application of the teaching program, computers and headphones were used in order to ensure the quality of employed sound stimulus. The teaching program itself realized a record of the responses.

Instruments

Test of Phonological awareness by oral production (Capovilla & Capovilla, 1998).The objective of this test is to assess skills related to discriminating and manipulating the sounds of speech. The test is devided into 10 subtests (rhyme, alliteration, syllabic synthesis, phonemic synthesis, syllabic segmentation, phonemic segmentation, syllabic manipulation, phonemic manipulation, syllabic transposition, phonemic transposition) and each subtest contains four attempts. For each right attempt one point is added and participants might obtain a maximum of 40 points.

Reading and Writing Diagnosis (Fonseca, 1997; de Souza, de Rose, & Hanna, 1996). This test aims at assessing the skills related to the repertoire of reading and writing. The reading and writing diagnosis is composed by 3 steps and 16 types of tasks.The test consists of matching-to-sample tasks in which the stimuli can be related to each other, for example, identity matching between pictures and the printed words, as well as to arbitrary relation between spoken word and picture, between spoken word and printed word, between picture and printed word, between printed word and picture; and production tasks, for example, oral naming (picture naming, printed word naming, consonants and vowel naming, and syllables naming) and writing (dictation and copy in two models of response - handwritten and by composition). Figure 1 presents the illustrative representation of each type of task that composes the Reading and Writing Diagnosis.

Figure 1. Illustrative representation of each type of task that composes the Reading and Writing Diagnosis. The Balloon presents the instruction given through the headphones. The illustration was taken from the training material named Unit of Reading Initiation, or "Unidade de Inciação à Leitura" for the development of a curriculum in order to teach reading and its immediate requisites.



Computer Program for The Teaching of Reading and Writing - Module 1

The computer program for the teaching of reading and writing – Module 1 – teaches 51 words composed by regular syllables of the Portuguese language (words of the consonant/vowel type).The teaching of words was organized into 4 units. Each unit was composed by four teaching steps (except for the first unit, composed by 5 steps) and the total number of teaching steps was 17. Before and after each unit, tests were given in order to assess the levels of reading, writing, and the relations between words and pictures for all words in the unit. Each step was composed by three words. In each step, trialswere scheduled for words and syllables making up words.

For teaching and testing, dictated words, printed words and pictures, as well as printed syllables, dictated syllables and printed letters were used. The teaching procedure employed: matching to sample procedure for the teaching of relations between dictated and printed words and the relations betweendictated and printed syllables; and constructed-response matching-to-sample procedure for the teaching of relations between the dictated word and the word written by composition (dictation); printed word and the word written by composition (copy). The first strategy involved the selection of a comparison stimulus based on a sample stimulus and the second strategy involved the construction of words by means of syllables and/or isolated words considering a sample stimulus.

The exclusion procedure for the teaching of relations between dictated word and printed word was used. In this condition, when a new word was presented as a sample, the corresponding comparison stimulus was presented along with another printed stimulus with which the participant was already familiar. Thus, the participant could select a new word and exclude the stimulus, which was already known. Baseline trials for the student to identify the familiar word were interspersed with the new word trials, such as novelty control trials (to evaluate the possibility of control by novelty). Correct reponses were followed by messages containing compliments and incorrect responses were followed by a message reporting the mistake and the trial was presented once more.

While the relation between dictated words and printed words was being taught, trialsat copying and dictations were presented as well. The student was requested to write by clicking on the letters displayed on the lower half of the computer screen and composing the new word next to the printed word (copy) or the dictated word (dictation). After writing the word, the student was supposed to click on a neutral picture, which meant the trial was concluded. If the responsewas correct, consequences such as “good job!”, or “great!”, or applause or guitar sounds were presented; if the response was incorrect, the trial was presented again in the copy task or as matching-to-sample task after the dictation task.

After the teaching of words, trials at teaching the syllables of the words were programmed in the same step.The teaching of the syllables composing each word was done separately. In other words, the syllables of a word were taught and only after the obtention of the criterion, the syllables of the next word were taught. When a participant reached 100% of correct responses, the teaching of the syllables of the next word was started. When a student’s performance was under 100% of correct responses, the student would repeat the same step in the next session. After the syllabic training of the three words, an assessment composed of three trials at matching to sample between dictated word and printed version was realized (one trial for each word). Afterwards, the post-test was given. It was composed by thee trials at matching to sample task between dictated word and printed word (one trial for each word). When a participant reached 100% of correct responses a new teaching step would come. When a student did not reach 100% of correct responses the step would be repeated.

At the beginning of each step, the relations between the dictated word and its printed version, and the dictated word and the word written by composition (dictation) were presented along with the words from the previous step in order to assess retention/maintenance of the learned words from the previous step. When a participant did not reach100% of correct responses in the trials at matching to sample task between the dictated word and printed word, the teaching step of these words was realized. When a student reached 100% of correct responses, the step was realized with three new words.

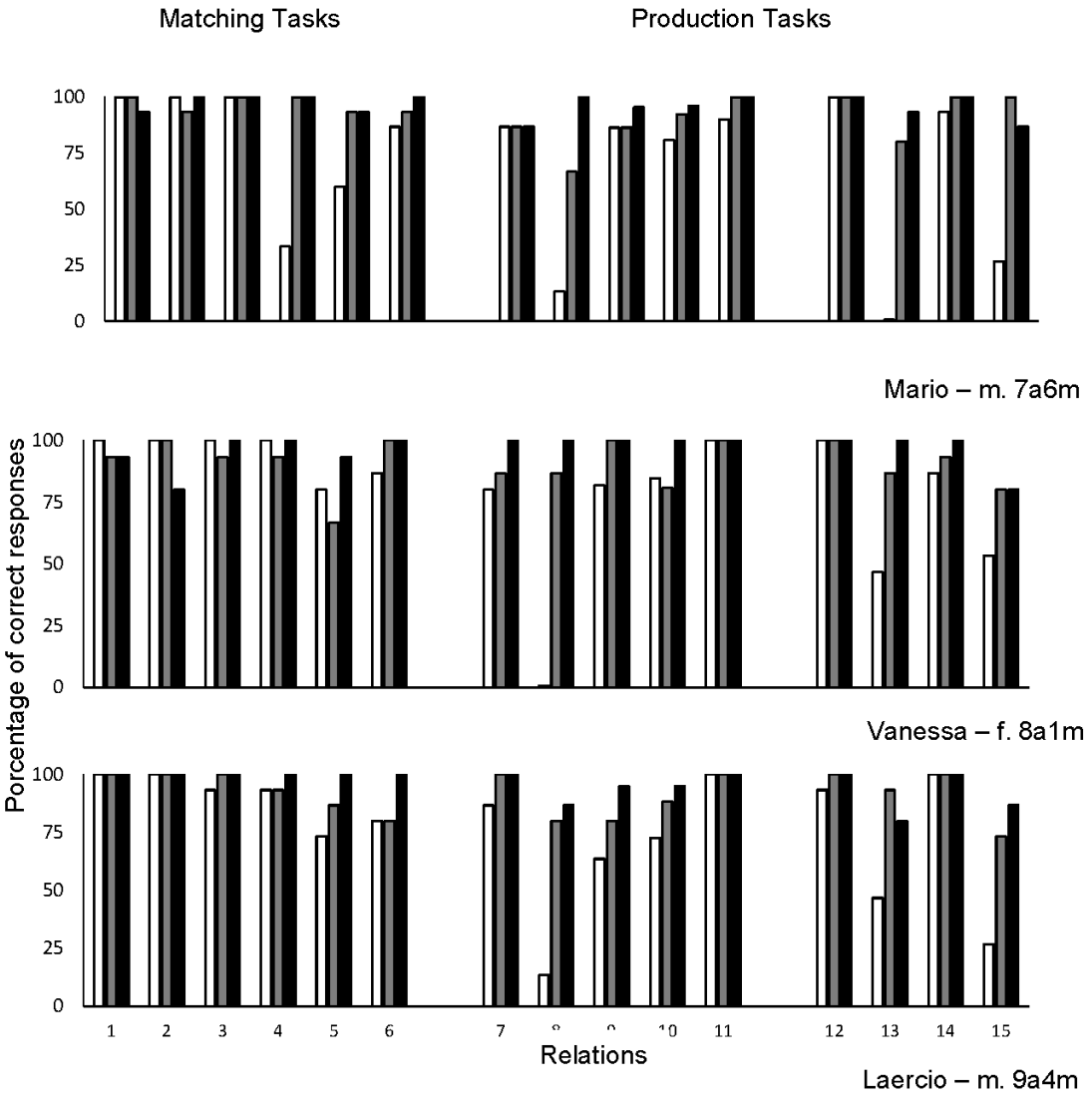
General Procedure

The research was develped in four phases: (1) concommittant application of tests for initial assessment of reading and writing repertoire as well as phonological awareness; (2) application of computer program for the teaching of reading and writing (Module 1, version 2.1, via GEIC); (3) after completion of the first two units of Module 1, general tests for the assessment of reading, writing and phonological awareness were reapplied in order to show advancements in reading and phonological awareness; and (4) after completion of all units, the same tests were given at the beginning and in the middle for a final assessment on reading, writing, and phonological awareness.

Results

Participants Vanessa and Laercio completed Module 1 by realizing 21 and 23 sessions, respectively. Participant Mario went through the teaching program twice. The first time, realized in the second semester of 2013, Mario went through the first and second units, realizing 28 sessions, and presenting a high rate of repetition of certain teaching steps, for example, eight repetitions of step 2 unit 1. In the second time, realized during the present research, in the second semester of 2014, the participant realized 23 sessions in order

Figure 2. *Percentage of correct responses in the relations of the Reading and Writing Diagnosis:* (1) picture – picture; (2) printed word – printed word; (3) spoken word - picture; (4) spoken word – printed word; (5) picture – printed word; (6) printed word - picture; (7) Picture naming; (8) printed word naming; (9) syllable naming; (10) letter naming; (11) vowel naming; (12) copy by composition; (13) dictation by composition; (14) handwritten copy; and (15) handwritten dictation of the first (pre-test/White bars), second (survey/gray bars) and third application (post-test/black bars).

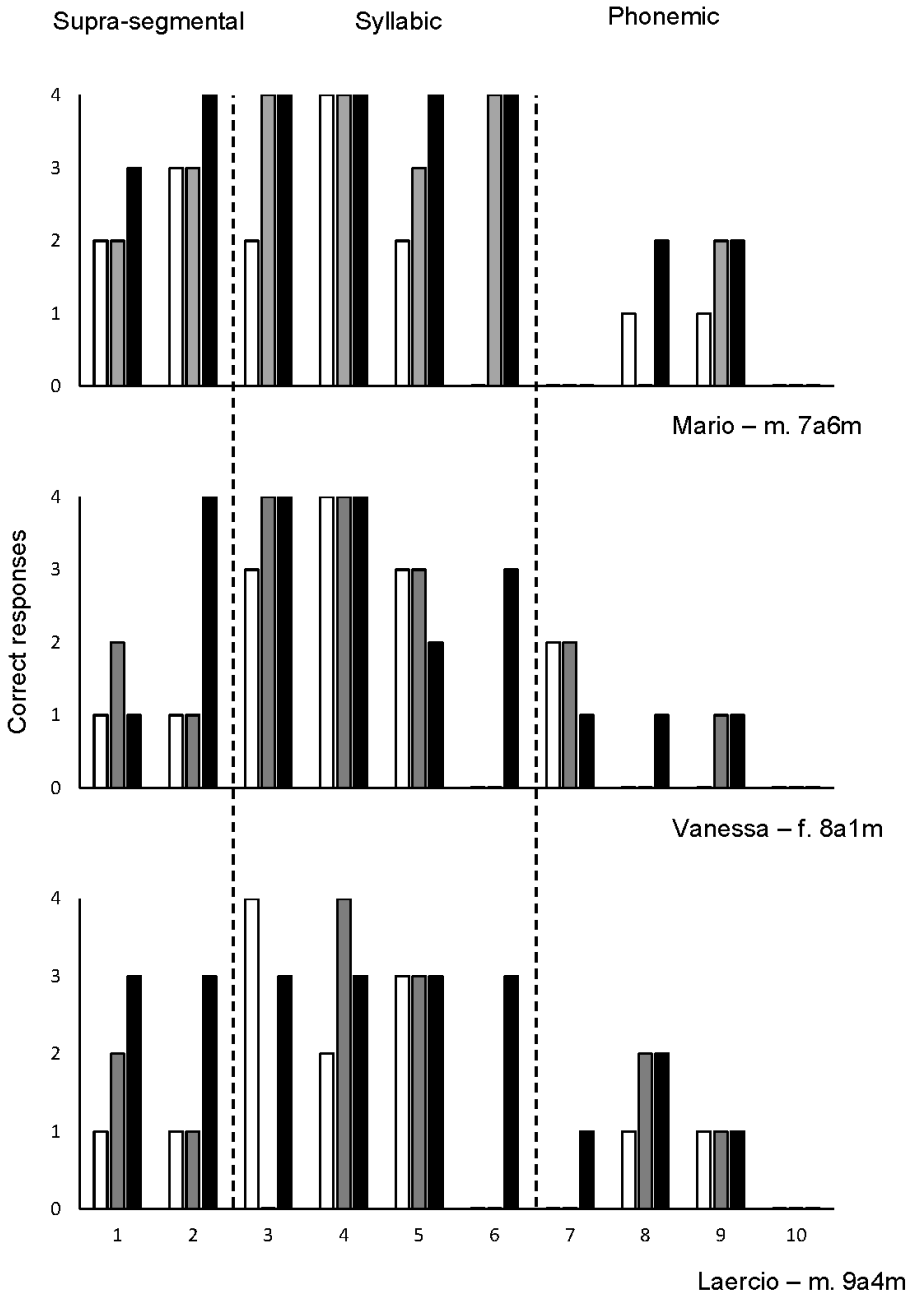


to complete the teaching program. Overall, the participants took from 1.2 to 1.3 realizations of teaching sessions in order to complete the module. The repetitions happened, especially, in the first teaching steps.

Figure 2 presents the general performance on the Reading and Writing Diagnosis on the three applications (pre-test/white bars, intermediate test/gray bars and post-test/black bars). It was observed that in the matching-to-sample tasks (relations between stimuli), participants presented higher rates of correct responses on the pre-test and kept performing well on the subsequent assessments.

Concerning their performance on the production tasks, the participants named most of the pictures correctly and kept or improved the level of their performances in the following applications. Concerning word reading, it was observed that the initial performance was low or nullified for the three participants. After completing half the reading program, the participants were tested again and presented over 75% of correct responses for word reading in the intermediate test (gray bars). After completing the program, in the post-test, two participants (Mario and Vanessa) presented 100% of correct responses for reading in the post-test. Laercio presented 80% of correct responses. Concerning the naming of syllables, letters and vowels, the three participants presented high percentages of correct responses and kept or improved the level of their performances in the last assessment.

Figure 3. Results obtained on the Phonological Awareness Test by Oral Production in the first (pre-test/white bars), second (survey/gray bars), and third (post-test/black bars) applications. The assessed skills were: 1) rhyme; 2) alliteration; 3) syllabic synthesis; 4) syllabic segmentation; 5) syllabic manipulation; 6) syllabic transposition; 7) phonemic synthesis; 8) phonemic segmentation; 9) phonemic manipulation; 10) phonemic transposition.



In the writing tasks, the participants presented high percentages of correct responses in the pre-test handwritten or by-composition copies and kept their high percentages on the other tests. On the handwritten or by-composition dictation tasks, most participants presented an initial repertoire of 50% of correct responses and reached over 80% of correct responses at the end of the program.

Figure 3 shows the results obtained on the Phonological Awareness Test by Oral Production in the first (pre-test/White bars), second (survey/gray bars) and third (post-test/black bars) applications.

For supra-segmental skills (rhymeand alliteration), most participants presented one correct response in rhyme and alliteration skills. In the following assessments, the participants presented improvement in performance. In the intermediate assessment (realized after completion of the first two units), two participants (Vanessa and Laercio) presented two correct responses in the rhyme skills and kept their good performances in the alliteration skills. Participant

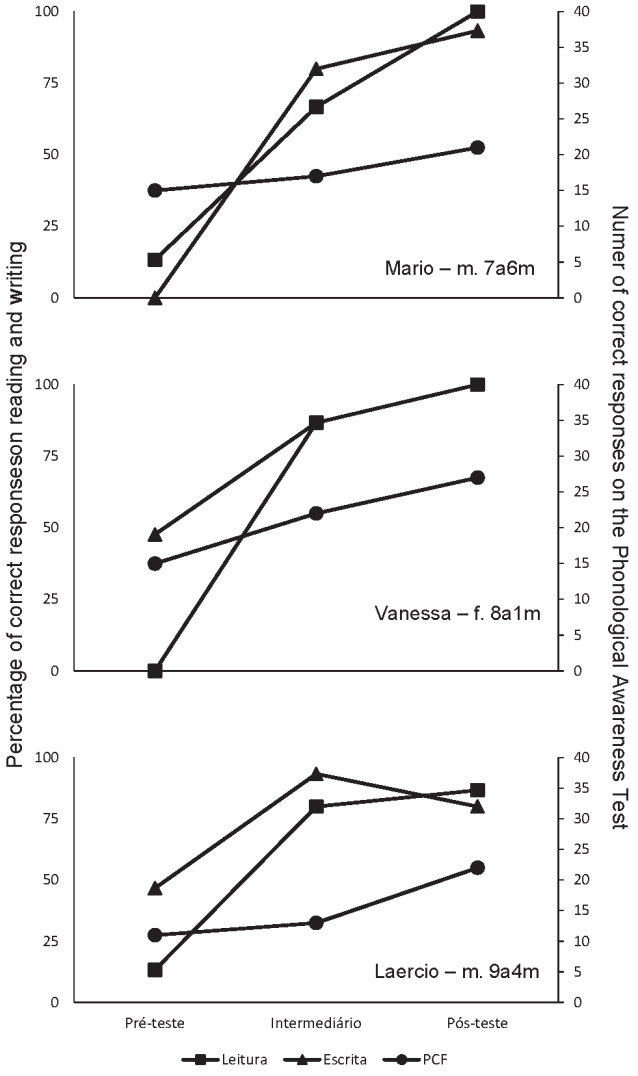
Mario presented two correct responses in rhyme and three correct response in alliteration. In the post-test (realized after completion of the four units), two participants (Mario and Laercio) presented three correct response in rhyme and participant Vanessa presented the initial performance (one correct response). In the alliteration skill, two participants (Mario and Vanessa) reached top scores (four correct responses) and Laercio presented three correct responses.

In the syllabic skills (skills 3 to 6 indicated in Figure 3), participants presented high rates of correct responses since the initial assessment (pre-test). In the pre-test, the three participants presented two or more correct responses for three skills in this category (except for syllabic transposition). In the following assessments, participants Mario and Vanessa reached top scores in the synthesis and syllabic segmentation skills. Participant Laercio kept his rate of correct response in the intermediate and final assessments.

In the phonemic skills (skills 7 to 10 shown in picture 3), two participants (Mario and Laercio) presented one correct response in the phonemic segmentation and manipulation skills.In the following assessments, they presented improvement (two correct responses) in these skills. Participant Vanessa presented a performance of two correct responses in the phonemic synthesis, segmentation and manipulation skills. None of the participants presented correct responses in the phonemic transposition skill.

Figure 4 shows the performances in reading, writing and phonologic awareness. According to observations, the three participants presented improving performances in the three skills during the assessments. Regarding reading, the participants presented low levels of reading initially and, after going through Module 1 of the reading program, presented significant improvement in word reading. Regarding their performance in writing, two participants presented a writing repertoire and similar gain was observed in the reading and writing repertoires. In other words, the more participants went through the teaching technique, the more words they learned to write. Regarding their performance in phonological awareness, the participants presented an increase in the number of correct responses during the teaching procedure.

Figure 4. Percentage of correct responseson Reading and Writing Diagnosis Test (left vertical axis) and the number of correct responses in the total scores of the Phonological Awareness Test (right vertical axis).



Discussion

The present study aimed at investigating the development of phonological awareness skills by means of the acquisition of reading and writing by children with learning difficulties.The material employed was Module 1 in the individualized computer program for the teaching of reading and writing entitled Learning to Read and Write in Small Steps, or "*Aprendendo a ler e a escrever em pequenos passos*" (cf. de Souza & de Rose, 2006; de Souza et al., 2004). The results showed that the three participants learned to read words composed by simple syllables (consonant and vowel). They presented and kept a performance of above 50% of correct responses in the syllabic and supra-segmental skills. Regarding phonemic skills, the same evolution was not observed. Performances remained low and inconsistent.

The results obtained in the syllabic and supra-segmental skills could be expected. The rhyme skill (discriminating the final sounds of words) is considered to be of low complexity and the alliteration skill (discriminating the initial sounds of words) is considered to be of medium complexity (Puliezi & Maluf, 2012).The participants presented high percentage of correct responses in the syllabic skills since the beginning of the research, even though they had a low reading repertoire. This performance might be due to activites realized in the classroom since the first school years such as splitting words into smaller units (Bandini, 2003; Freitas, 2008).

Concerning phonemic skills, the results were low since the pre-test and did not present improvement in a

consistent way during the intermediate test and post-test. Considering that phonological awareness skills evolve in a continuum of complexity, results suggest that the skill to manipulate phonemes gets stronger when clear instructions are provided (Capovilla, Dias, & Montiel, 2007; Morais, 1995; Puliezi & Maluf, 2012). We suggest that future studies select participants already equipped with a reading and writing repertoire (reading and writing of consonant-vowel words) in order to check students' performances on phonological awareness skills, especially phonemic skills combined with the learning of complex words (for example, the hiatuses, consonant clusters and so on) including verbs.

It is important to highlight the fact that, although the performances in phonological awareness did not reach high levels, it was possible to observe that participants presented escalating performances throughout the assessments. Crescent advancements were also observed in the reading and writing skills (cf. Figure 4). In general, it was observed that the performances in reading and writing presented a sharp rise and that the performance in phonological awareness, although lower than expected, presented improvement, which suggests that the writing and reading skills might have been a contributing factor in the improvement of manipulative and discriminative skills related to sounds that compose speech (phonological awareness).

Capovilla et al. (2007) emphasized the point that the scores on the Phonological Awareness Test by students from the 1st to 3rd years of Elementary School increased significantly with advancement in school years. The authors indicated that the results are in accordance with previous studies, which demonstrated that phonological awareness evolves gradually as a child learns how to discriminate words, syllables, and phonemes. Concerning phonemic segmentation skills, for example, Capovilla et al. (2007) demonstrate that there is no significant difference between the years. However, they observed that the scores increased linearly throughout the four years.In general, the authors highlight the fact the the results are in accordance with international researches, which suggests that phonemic awareness comes after syllabic skills.

It is important to remember that the teaching program for reading and writing employed in the present research does not include specific instructions for the correspondence between graphemes and phonemes. Control by smaller units (letters) can be developed by means of the relation of stimuli control by the relation between larger sound and print units (words) and syllables (de Roseet al., 1996; Mueller, Olmi, & Saunders, 2000; Skinner, 1957; Yoo & Saunders, 2014). Data demonstrated that the teaching of larger units (words) and smaller units (syllables) was conducive to the development of phonological awareness skills, although still incipient for phonemic skills.

Results indicate that the structure of the program for teaching reading and writing developed by Rose and collaborators (cf. de Souza & de Rose, 2006) has facilitated the progress observed in the phonological awareness skills of the participants, as well as the learning of reading and writing. Cardoso-Martins (1991) investigated the relation between phonological awareness and initial progress in the learning of Portuguese writing. The participants were children from low-income familes learning how to read and write by means of two different methods: 32 by the phonetic method and 26 by the syllabic method. The results confirmed obbservations by previous studies demonstrating that, in general, the variations in phonological awareness are linked to variations in the learning of reading and writing. The author emphasizes the fact that results suggest that variations in phonemic awareness, observed in the beginning of the literacy process, might be less important for the acquisition of reading and writing skills when the literacy method is syllabic.

Concerning the participants' performances on Module 1 in the program for teaching reading and writing developed by de Rose and collaborators, results demonstrated that the participants completed the teaching program and needed a small number of repetitions of each step. This result replicates and extends the data in the literature and demonstrates the efficacy of the reading and writing program (cf. de Souza & de Rose, 2006; Reis et al., 2009). It is also relevant to mention that during the assessments scheduled for the end of each unit, the participants presented improvement in their performance for reading words not directly taught (words composed by recombined syllables and letters, and pseudo-words).

Participant Mario took Module 1 of the reading and writing program for the second time. The first time, the participant repeated 28 times the steps of the first twounits. According to Bernardino Jr., Freitas, de Souza, Maranhe and Bandini (2006), the learning difficulties could be unrelated to problems with the material, with the procedure, or with the student's potential. Rather, it could be a matter of lacking phonological awareness skills. In a new opportunity (present research), the participant returned a year after the first experience. At his moment, the participant still presented learning difficulties for reading and writing, and could benefit from the program.

The study by Bernardino Jr. et al. (2006) verified that, if the students had been failing in the reading program developed by de Rose and collaborators and presented low scores in the Phonological Awareness Test (Capovilla & Capovilla, 1998), they would succeed in an intervention based on the teaching of phonological awareness skills. The eventual success of the intervention would produce effects on the learning of reading and writing. The students went through a program adapted by Capovilla (1999) during four semesters and, at the same time, continued on the reading and writing program. Results demonstrated that the strengthening of phonological awareness skills, especially the phonemic ones, contributed to improvements in reading as well as in writing by participants who had been failing systematically in the reading and writing program.

The results of the present study made it possible to verify the possibility of improving and amplifying the efficacy of computer-based procedures developed for individualized teaching of reading and writing (cf. de Souza & de Rose, 2006) while incorporating activities in order to guarantee the development of phonological awareness skills.

Considering the results of studies that taught phonological awareness skills (Bandini, 2003; Bernadino Jr. et al., 2006; Capovilla et al., 2004; Freitas, 2008) and studies conducted on Child Education (Camilo & Mota, 2013; Moreschi & Barrera, 2017; Pestun, Omote, Barreto, & Matsuo, 2010; Santos & Maluf, 2010; Santos & Barrera, 2017), which demonstrated the importance of stimulating phonological awareness for the development of reading and writing skills, we suggest that future studies develop teaching programs for phonological awareness conducive to the development of educational strategies that facilitate and lead to the acquisition of reading and writing skills.

References

Bandini, H. H. M. (2003). *Um programa para promoção de Consciência Fonológica em pré-escolares aplicado em sala de aula* (Dissertação de mestrado). Universidade Federal de São Carlos, São Carlos, SP.

Barrera, S. D.; Maluf, M. R. (2003). Consciência metalinguística e alfabetização: um estudo com crianças da primeira série do ensino fundamental. *Psicologia, Reflexão e Crítica*, *16(3)*, 491-502.

Bernardino Júnior, J. A.; Freitas, F. R.; de Souza, D. G.; Maranhe, E. A.; Bandini, H. H. M. (2006). Aquisição de leitura e escrita como resultado do ensino de habilidades de consciência fonológica. *Revista Brasileira de Educação Especial, 12*, 423-450.

Camilo, C. S. L.; Mota, M. M. P. E. (2013). Prática pedagógica e o desenvolvimento da consciência fonológica. *Estudos e Pesquisas em Psicologia*, *13*(2), 447-459.

Capovilla, A. G. S. (1999). *Leitura, escrita e consciência fonológica: desenvolvimento, intercorrelações e intervenções.* (Tese de Doutorado). Universidade de São Paulo, São Paulo, SP.

Capovilla, A. G. S.; Capovilla, F. (1998). Prova de Consciência Fonológica: desenvolvimento de dez habilidades da pré-escola à segunda série. *Temas em Desenvolvimento, 7*(40), 5-14.

Capovilla, A. G. S.; Dias N. M.; Montiel J. M. (2007). Desenvolvimento dos componentes da consciência fonológica no ensino fundamental e correlação com nota escolar. *Psico-UFS*, *12*, 55-64.

Capovilla, A. G. S.; Gutschow, C. R. D.; Capovilla, F. C. (2004). Habilidades que predizem competência de leitura e escrita. *Psicologia: Teoria e Prática*, *6*, 13-26.

Cardoso-Martins, C. (1991). A consciência fonológica e a aprendizagem de inicial de leitura e escrita. *Cadernos de Pesquisa*, *76*, 41-49.

de Rose J. C. (2005). Análise comportamental da aprendizagem de leitura e escrita. *Revista Brasileira de Análise do Comportamento*, *1*, 29-50.

de Rose, J. C.; de Souza, D. G.; Hanna, E. S. (1996). Teaching reading and spelling: exclusion and stimulus equivalence. *Journal of Applied Behavior Analysis*, *29*(4), 451-469.

de Souza, D. G.; de Rose J. C. (2006). Desenvolvendo programas para o ensino individualizados para o ensino de leitura. *Acta Comportamentalia*, *14*, 77-98.

de Souza, D. G.; de Rose, J. C.; Hanna, E. S. (1996). *Diagnóstico de leitura e escrita: tarefas para avaliação de repertórios rudimentares de leitura e escrita*. Produção técnica para avaliação de alunos candidatos ao ensino pelo Programa Aprendendo a ler e a escrever em pequenos passos.

de Souza, D. G.; de Rose, J. C. C.; Hanna, E. S.; Calcagno, S.; Galvão, O. F. (2004). Análise comportamental da aprendizagem de leitura e escrita e a construção de um currículo suplementar. In Hubner, M. M. C.; Marinotti, M. (Orgs.), *Análise do comportamento para a educação: Contribuições recentes* (pp. 177-203). Santo André (SP): ESETec, Editores Associados.

de Souza, D. G.; de Rose, J. C.; Faleiros, T. C.; Bortoloti, R.; Hanna, E. S.; McIlvane, W. J. (2009). Teaching generative reading via recombination of minimal textual units: a legacy of verbal behavior to children in Brazil. *International Journal of Psychology and Psychological Therapy*, *9*, 19-44.

Fonseca, M. L. (1997). *Diagnóstico de repertórios iniciais de leitura e escrita: uma análise baseada na concepção de relações de equivalência* (Dissertação de Mestrado). Universidade Federal de São Carlos, São Carlos SP.

Freitas, F. R. (2008). *Desenvolvimento de habilidades de Consciência Fonológica: independência e interdependência funcional no repertório de leitores iniciantes* (Dissertação de mestrado). Universidade Federal de São Carlos, São Carlos, SP.

Instituto Brasileiro de Geografia Estatística [IBGE] (2015). *Síntese de Indicadores Sociais* – SIS (*Pesquisa Nacional por Amostra de Domicílios 2015)*. Recuperado: https://www.ibge.gov.br/estatisticas-novoportal/sociais/educacao/9221-sintese-de-indicadores-sociais.html?&t=resultados

Instituto Paulo Montenegro (2016). *Indicador de Alfabetismo Funcional*. Recuperado:https://drive.google.com/file/d/0B5WoZxXFQTCRRWFyakMxOTNyb1k/view

Justino, M. I. S. V.; Barrera, S. D. (2012). Efeitos de uma intervenção na abordagem fônica em alunos com dificuldades de alfabetização. *Psicologia: Teoria e Pesquisa*, *28*(4), 399-407.

Morais, J. (1995). *A arte de ler.* São Paulo, SP: Editora Unesp.

Moreschi, M. S. M.; Barrera, S. D. (2017). Programa Multissensorial/Fônico: Efeitos em pré-escolares em risco de apresentarem dificuldades de alfabetização. *Psico*, *48*(1), 70-80.

Mueller, M. M.; Olmi, D. J.; Saunders, K. J. (2000). Recombinative generalization of within-syllable units in prereading children. *Journal of Applied Behavior Analysis,* 33, 515-531.

Nunes, C.; Frota, S.; Mousinho, R. (2009). Consciência fonológica e o processo de aprendizagem de leitura e escrita: implicações teóricas para o embasamento da prática fonoaudiológica. *Revista CEFAC*, *11*(2), 207-212.

Pestun, M. S. V.; Omote, L. C. F.; Barreto, D. C. M.; Matsuo, T. (2010). Estimulação da consciência fonológica na educação infantil: prevenção de dificuldades na escrita. *Psicologia Escolar e Educacional*, *14*(1), 95-104.

Puliezi, S.; Maluf, M. R. (2012). A contribuição da consciência fonológica, memória de trabalho e velocidade de nomeação na aquisição inicial da leitura. *Boletim Academia Paulista de Psicologia*, *32*(82), 213-227.

Reis, T.; de Souza, D. G.; de Rose, J. C. (2009). Avaliação de um programa para o ensino de leitura e escrita. *Estudos de Avaliação Educacional, 20*, 425-449.

Santos, M. J.; Barrera, S. D. (2017). Impacto do treino em habilidades de consciência fonológica na escrita de pré-escolares. *Psicologia Escolar e Educacional*, *21*(1), 93-102.

Santos, M. J.; Maluf, M. R. (2010). Consciência fonológica e linguagem escrita: efeitos de um programa de intervenção. *Educar em Revista, 38,* 57-71.

Sidman, M. (1994). *Equivalence relations and behavior: A research story*. Boston, MA: Authors Cooperative.

Sidman, M.; Tailby, W. (1982). Conditional discrimination vs. matching-to-sample: an expansion of the testing paradigm. *Journal of the Experimental Analysis of Behavior, 37*, 5-22.

Skinner, B.F. (1957). *Verbal Behavior*. Englewood Cliffs: Prentice Hall.

Yoo, J. H.; Saunders, K. J. (2014). The discrimination of printed words by prereading children. *European Journal of Behavior Analysis*, 15(2), 123-135.

Received on: April 09, 2018
Approved on: December 26, 2018

This work has been carried out with the support of Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES/PROEX Processo #23028.005155/2017-67). The first author had a Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) master's scholarship. The second author receives financing from the call for proposals 01/2016 (CNPq, Processo #427409/2016-0). This research is part of the Instituto Nacional de Ciência e Tecnologia sobre Comportamento, Cognição e Ensino (CNPq, Processo #465686/2014-1; FAPESP Proceso #2014/50909-8; CAPES Processo #88887.136407/2017-00) scientific program. The translation of the article was financed by CAPES (PROEX Processo 23038.006212/2019-97).

This paper was translated from Portuguese by Régis Lima.