

Research Article

Response to Intervention: A Phonological Awareness Program

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Keywords

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Abstract

The purpose was to stimulate phonological awareness in the school environment and to verify the effects on reading and writing skills. It is a non-randomized (quasi-experimental), double blind case-control clinical study, 69 students from elementary education participated, enrolled in the first grade, aged 6 to 7 grades of both genders. The participants were divided into Experimental (EG=48), and Control Group (CG=21), aiming to verify the intervention effects. The EG attended 60 days (3 months) of phonological awareness activities (syllables and phonemes), following the Response to Intervention (Tier 1), 15 to 25 minutes each day. The participants were evaluated before and after the intervention through standardized tests. Results: the performance of the EG was statistically superior ($p < 0,05$), to the CG in the phonemic awareness skills, reading, and writing levels. Approximately 80% of the students who participated reached the reading and writing alphabetical level, while only 30% of the students in the control group presented this performance. Conclusion: The training of phonological awareness following RTI promoted advances in reading and writing skills, generating positive effects in the literacy process. Replication of the study is recommended with larger samples.

ABBREVIATIONS

RTI: Response to Intervention; EG: Experimental group; CG: Control Group

INTRODUCTION

The 2015 PISA dataset [1], disclosed that half of the Brazilian school population did not reach the basic level of proficiency in reading and since 2009 the performance has been suffering consecutive falls. The reasons for the high rates of school failure are related mainly to the insufficient stimulation of the precursory abilities to literacy. In other words, the failures are centered mostly on the teaching process itself [2].

Phonological awareness is highlighted as a strong predictor of literacy, it is related to the perception of sound (phonological structure of a language) and later allows the understanding that writing is the representation of those sounds [3]. Most teachers do not know the subject and, consequently, there is insufficient practice of these activities in the classroom. Investments in the training of phonological awareness as a preventive measure for the difficulties in reading grow around the world, therefore the effectiveness of these procedures is well-known [3-6]. In this context programs such as Response to Intervention (RTI), are highlighted, carried out in the school environment itself, offering quality interventions to all students. The ones that present low

responsiveness are considered at risk for learning disabilities and start to receive interventions and systematic monitoring [3].

A clinical case-control study with 30 students presenting risk factors for reading disability evidenced that the training of the phonological abilities and grapheme-phoneme correspondence was efficient in identifying children with dyslexia. Among the children who participated in the the program, only one did not respond to the intervention and, after an interdisciplinary evaluation, the diagnosis was confirmed [7].

In a study carried through with 156 students who participate in different tiers of the RTI, the knowledge of the letters, the manipulation of syllables and phonemes were reported as aptitudes that demonstrated greater correspondence, that is, responsiveness, to the literacy process [8].

Compton et al. [9], monitored the progress of 252 children from the 1st to 2nd grade and by means of regression analyses they identified that the training of the phonological awareness, the speed of lexical processing and the phonological memory were the abilities of greater effectiveness in the development of reading and the prevention of learning disabilities.

Kruse et al. [10], analyzed 7 preschoolers that had not demonstrated any progress during tier 1 of the RTI. After interventions in small groups (tier 2 of RTI), carried through 2 times a week, they demonstrated advances in phonemic abilities,

especially in the identification of the initial sound of words. The authors emphasize that there is always students who need individualized attention in order to progress.

Beach and O'Connor [11], report that studies use different measurements and criteria to evaluate the progress of the students during and after the interventions, but frequently the students' response in tier 1 is enough to show the performance in reading throughout the first cycle of education.

The hypothesis raised by this study is that the stimulation of the phonological awareness, in the model of RTI (tier 1), generates positive effects in the literacy learning. It is believed that this approach strengthens the importance of the speech pathologist in the school, assisting teachers in their pedagogical practices.

MATERIALS AND METHODS

This is a non-randomized (quasi-experimental), double blind case-control clinical study. The study was approved by the Human Research Ethics Committee under appreciation no. 49807715.9.0000.5417. In addition, the study was registered in the National Clinical Trials Database, under identification code RBR-9qjr6.

Participants

Sixty nine students aged 6 to 7 years old, both genders (40% females and 60% males), enrolled in the 1st grade of the elementary public school.

Criteria of inclusion and exclusion

Excluded participants: (a) students whose parents or guardians did not sign the consent form or did not agree to the

disclosure of information and (b) children who presented severe physical, sensory, behavioral or intellectual impairment. There were 76 students enrolled in the 1st grade, however 7 were excluded (Figure 1), following the study inclusion and exclusion criteria: 4 parents/guardians did not agree to the publication of information regarding their children and 3 were excluded due to severe behavior or intellectual impairment (Autism Spectrum Disorder, Epileptic Syndromes under investigation, and Smith-Magenis Syndrome). The participants were distributed in 2 groups: Experimental Group (EG), composed of 48 students (2 groups of students of the 1st grade) that were exposed to RTI (tier 1) aiming to stimulate phonological awareness abilities and Control Group (CG), composed of 21 students (1 group of students of the 1st grade) that initially were not exposed to the stimulation of the phonological awareness.

Stage 1: Elaboration of Materials: The materials were adapted from the proposal by Kruse et al. [10], who elaborated an intervention program that stimulates the blending, segmentation, and identification of syllables and phonemes. Each unit concentrates in a new ability with gradual increase in the difficulty levels, with average duration of 15 minutes, 3 to 4 times a week, totaling 36 days of activities. The target audience of the American researchers were preschoolers of the public school system (average age of 4.5 grades). The interventions occurred in Tier 2 of the RTI, that is, in small groups. The first adaptation for the present study consisted of the change of secondary to primary tier of the RTI, once there were no initiatives in any of these levels in the Brazilian schools.

Since it deals with the first tier of RTI, the interventions were extended for 60 days (approximately 3 months of the school calendar, 5 times per week). The Brazilian Basic National Common

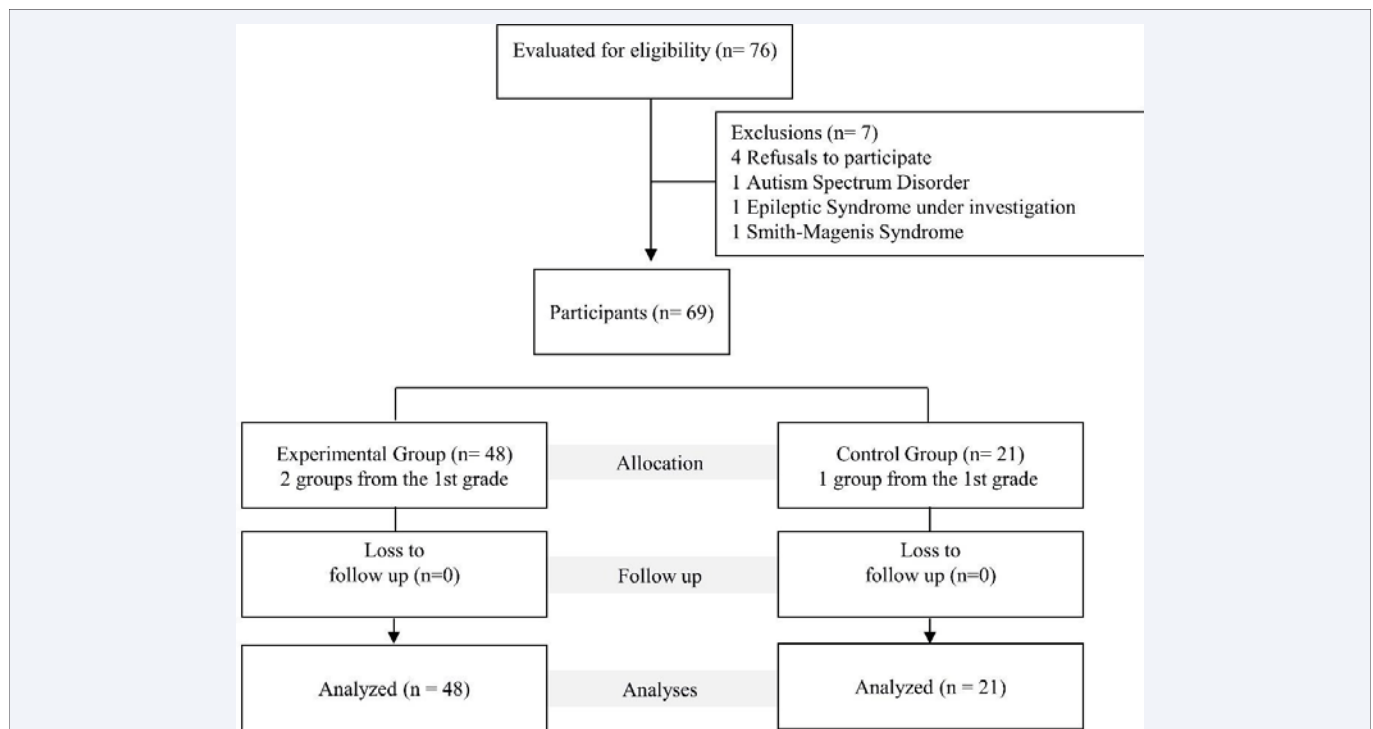


Figure 1 Flowchart of participants.

Curriculum envisioned the stimulation of the phonological awareness starting at the basic education level, reason that made us opt to carry the research with students from the 1st grade instead of preschoolers.

Among the 12 units, it was necessary to exclude the first two since the proposal was not applicable to the Portuguese language. The activity consisted in blending compound and two-syllable words, using figures to represent them. In Portuguese, it is difficult to do this activity because there are few compound words and most of them are hard to be represented by figures (usually one of the words are a verb or an adjective in Portuguese compound words). Therefore, these units were replaced by blending two or multi-syllable words. The 10 units and the phonological awareness abilities used in the RTI program in comparison of Kruse et al. [10], are shown in Table 1. Despite the divergences, this research follows the same curriculum and the strategies of the authors cited above.

Stage 2: Teacher Formation: The formation phase was presential, involving the dialogue between the researcher and the 3 teachers. Both teachers had been teaching basic education for at least 5 years. Still, they reported little knowledge about the importance of the phonological awareness, especially phonemic, in the acquisition of reading and writing. The meetings happened at the school during the scheduled activities suggested by the school principal.

Stage 3: Pretesting: To measure the performance and to monitor the progress of the participants, there were assessments before and after the intervention. The phonological awareness skills and the students' ability to read and write were evaluated by national standardized tests. The tests were applied individually, approximately 60 minutes long. They were applied by an external researcher (language and speech pathologist, experienced in evaluation procedures) to prevent measurement error. Thus, guaranteeing this is a blind study. The following tools were used:

- **The Phonological Awareness Assessment Tool - CONFIAS [12].** The test has two parts: the first one evaluates syllabic ability, composed of syllabic awareness, consisting of nine subtests: blending, segmenting, identification of initial syllable, identification of rhyme, production of word with syllable, identification of medial syllable, production of rhyme, exclusion, transposition. Correct answers are awarded one point and the incorrect ones are awarded zero points. The second part is composed of seven subtests and assesses phonological awareness: production of words that begin with the given sound, identification of initial phoneme, identification of final phoneme, exclusion, blending, segmentation, and transposition. Each subtest can receive up to 4 points for correct answers, except the exclusion of syllables and phonemes, which allow up to 8 points.

Normality values/parameters are offered according to the child's stage of writing development.

- **The Protocol for Assessing Cognitive-linguistic Abilities [13]** was used to verify the students' stages of writing development, classifying them in: pre-syllabic, syllabic, syllabic-alphabetic and alphabetic. The tool consists of a dictation of 30 real words and 10 non-words. The same protocol was used to verify the students' reading level, being classified in: logographic, alphabetic, and orthographic. The tool presents 50 real words and 10 nonwords for reading aloud.

Stage 4: Application of the RTI program: The teachers were responsible for applying the activities in the classroom. In addition, the responsible researcher (Speech-Language Pathologist) carried through weekly visits to monitor the activities, to clarify possible doubts, to adjust strategies, and to discuss the student's performance. In respect to the ethical aspects of research, the CG was also exposed to the stimulation program at the end of the pretesting. Phonological awareness were stimulated daily: blending, segmentation, and identification. During the entire program were executed activities of phonemes (sounds) - graphemes (letters) association. The intervention

Table 1: Activities from the RTI program in comparison of Kruse et al. 2015.

Units	PAth to Literacy Skills (Kruse et al., 2015)	Current research
Unit 1	Blending compound and two-syllable words	Excluded
Unit 2	Blending compound and two-syllable words Segmenting compound words	Excluded
Unit 3	Blending two-syllable words Segmenting compound and two-syllable words	Blending two-syllable words
Unit 4	Segmenting two-syllable words	Blending multi-syllable words
Unit 5	Concept of first First part of compound and two-syllable words	Concept of first First part of two-syllable words
Unit 6	Small parts of compound and two-syllable words with simple and complex sounds	Small parts of two-syllable words (simple and complex sounds)
Unit 7	First sounds of onset-rime	Same activity
Unit 8	First sounds of segmented one-syllable words (simple initial sounds)	Same activity
Unit 9	First sounds of segmented one-syllable words (complex initial sounds)	Same activity
Unit 10	First sounds of one-syllable words	Same activity
Unit 11	First sounds of one-syllable words	Same activity
Unit 12	First sounds of one-syllable, complex words	Same activity

Table 2: Phonological awareness performance between the groups, pre and post testing.

Skills	EG			CG			GE X GC	
	pre m	post m	p	pre m	post m	p	pre p	pos p
S1	3,94	3,96	0,316	3,90	3,95	0,317	0,632	0,912
S2	3,48	3,98	0,178	3,48	3,90	0,162	0,726	0,530
S3	3,77	3,79	0,860	3,24	3,43	0,146	0,053	0,086
S4	2,29	2,96	0,000*	2,29	2,52	0,025*	0,844	0,228
S5	3,10	3,62	0,000*	3,19	3,38	0,046*	0,757	0,269
S6	0,92	2,60	0,001*	0,90	1,05	0,083	0,974	0,001*
S7	0,83	1,35	0,125	0,81	1,00	0,078	0,842	0,402
S8	3,42	5,06	0,005*	3,43	3,67	0,252	0,948	0,036*
S9	1,23	2,46	0,023*	1,24	1,48	0,059	0,912	0,001*
F1	0,60	2,27	0,000*	0,62	0,71	0,157	0,952	0,002*
F2	0,71	2,81	0,000*	0,71	0,86	0,083	0,624	0,000*
F3	0,35	1,75	0,035*	0,38	0,43	0,317	0,703	0,017*
F4	0,13	1,35	0,004*	0,14	0,19	0,319	0,672	0,024*
F5	0,19	2,13	0,001*	0,19	0,24	0,247	0,983	0,000*
F6	0,15	1,56	0,026*	0,14	0,24	0,157	0,974	0,004*
F7	0,23	0,54	0,201	0,22	0,23	0,157	0,969	0,388

*p<0,05 - Student t Test

Abbreviations: EG= Experimental Group; CG= Control Group; pre= pretesting; pos= post testing; m= mean; S1= blending syllable S2= segmenting syllable; S3= identification of the first part of word; S4= rhyme identification; S5= producing words with syllables; S6= identification of the medial part of word; S7= producing rhymes; S8= syllable exclusions; S9= syllable transposition; F1= producing words with phonemes; F2= identification of the first part of word; F3= identification of the last part of word; F4= isolating phonemes; F5= blending phonemes; F6= segmenting phonemes; F7= phonemes transposition.

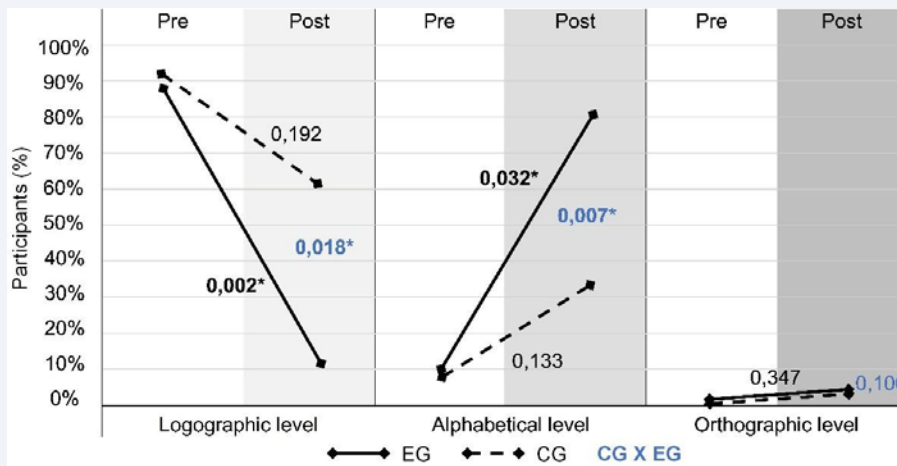


Figure 2 Reading level between the groups pre e post testing..

lasted 60 days, with an average duration of 25 minutes. We stress that the program has cumulative character, that is, a new activity associated with the activities of the previous sessions is inserted in each session.

Stage 5: Post testing: The students were reevaluated at the end of the interventions, during the months of July and August, by means of the same procedures and tools used in the pretesting. A blind evaluation was used again to prevent measurement error, characterizing the study as double-blind.

Data analysis

Data was analyzed using statistical software Statistica version 17.0. The results of the pre- and post-testing were analyzed statistically through the non-parametric Mann-

Whitney test and paired Student t-test. The non-parametric Spearman Correlation test was used to correlate the variables. A significance level of 5% (p<0.05), was considered in all the analyses.

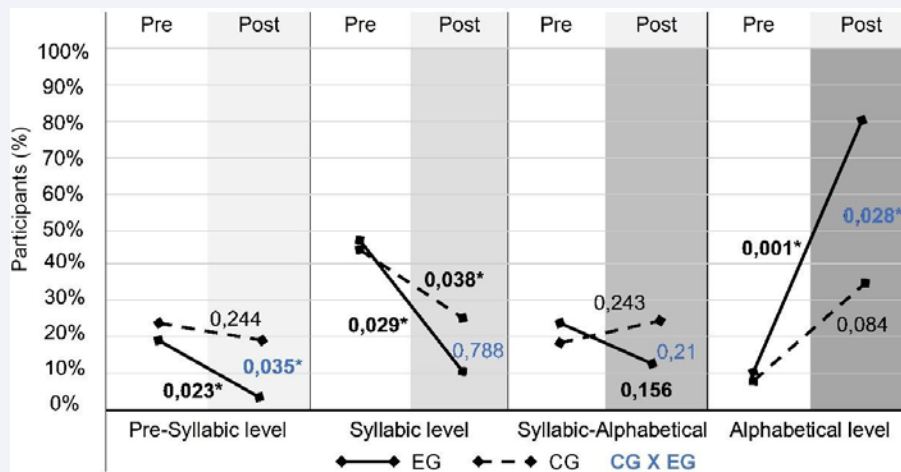


Figure 3 Writing level between the groups pre e post testing.

Table 3: Correlation between the abilities in EG and CG after RTI program.

Skills	EG		CG		EG X CG		GC	
	CCoef (r) Reading	p-valor	CCoef (r) Writing	p-valor	CCoef (r) Reading	p-valor	CCoef (r) Writing	p-valor
S1	0,173	0,453	0,361	0,108	0,030	0,837	0,030	0,047*
S2	0,173	0,453	0,361	0,108	0,021	0,886	0,021	0,036*
S3	0,428	0,053	0,449	0,041*	0,727	0,046*	0,044	0,767
S4	0,150	0,268	0,223	0,453	0,028	0,848	0,028	0,848
S5	0,428	0,053	0,456	0,040*	0,060	0,685	0,060	0,035*
S6	0,711	<0,001*	0,630	0,156	0,550	0,012*	0,150	0,310
S7	0,286	0,422	0,238	0,256	0,221	0,132	0,221	0,132
S8	0,726	0,021*	0,610	0,024*	0,219	0,135	0,219	0,135
S9	0,244	0,096	0,592	0,038*	0,284	0,051	0,284	0,051
F1	0,728	0,004*	0,592	0,005*	0,710	0,028*	0,596	0,043*
F2	0,706	<0,001*	0,724	0,001*	0,523	0,042*	0,146	0,324
F3	0,737	<0,001*	0,928	0,002*	0,226	0,123	0,226	0,123
F4	0,573	0,007*	0,994	0,001*	0,241	0,099	0,241	0,099
F5	0,573	0,007*	0,994	0,001*	0,204	0,164	0,204	0,164
F6	0,583	0,006*	0,455	0,038*	0,225	0,125	0,225	0,125
F7	0,178	0,436	0,580	0,006*	0,309	0,568	0,309	0,032*

*p<0,05 – Spearman Correlation Coefficient

Abbreviations: CCoef= Correlation Coefficient; EG= Experimental Group; CG= Control Group; S1= blending syllable S2= segmenting syllable; S3= identification of the first part of word; S4= rhyme identification; S5= producing words with syllables; S6= identification of the medial part of word; S7= producing rhymes; S8= syllable exclusions; S9= syllable transposition; F1= producing words with phonemes; F2= identification of the first part of word; F3= identification of the last part of word; F4= isolating phonemes; F5= blending phonemes; F6= segmenting phonemes; F7= phonemes transposition.

RESULTS

Phonological Awareness Abilities

The test used to evaluate the phonological awareness investigated the syllabic and phonemic aspects. There was little correspondence between the RTI program and the syllabic abilities. Among the 9 abilities studied, only 3 showed statistically significant results (Table 2), verified through the comparison between the groups: identification of the initial syllable (S3),

exclusion of syllables (S8), and transposition of syllables (S9). Regarding phonemic awareness progress is seen in all the abilities in the EG after the RTI with exception of the transposition of phonemes (F7). In the CG, however, no significant changes were observed in the the evaluated abilities (p>0.05).

Comparing the performance between awareness of syllables and phonemes it is possible to observe higher effectiveness of the RTI program in the stimulation in the phonemic abilities.

Reading and Reading Abilities

Regarding reading levels, we verified similar performance in both groups in the pretesting (Figure 2). However, in the post testing the EG showed statistical significance ($p=0.032$), for the percentage (approximately 80%), of students who had reached the alphabetical level.

In the CG this number was approximately 30% ($p=0.133$). The visible differences, illustrated in the chart below, are also confirmed by the statistical analyses. It is noticed that the majority of the students exposed to the RTI reached the alphabetical level, showing statistically significant differences ($p=0.007$), when comparing the groups.

In the orthographic level, there was no significant progress in any of the groups ($p=0.347$) and, consequently, no progress was observed among the groups ($p=0.100$).

The impacts of intervention are also evident in the writing development stages (Figure 3). The majority of the participants of the EG and the CG started the first grade in the syllabic stage and, throughout the semester, 80% of those who participated in the RTI reached the alphabetical writing stage. Rate which was of 30% in the group that did not receive my stimuli.

In the CG the significant advances occurred only in the syllabic level ($p=0.038$). It is also highlighted that in this same group there were 5 students in the pre-syllabic level, 4 remained in this level (19%) and only 1 showed progress ($p=0.244$). That is, almost all these children did not obtain better performance in the post testing. In the EG, out of 9 students only 2 (4%) still remained in the pre-syllabic level. The advances in this group were statistically significant ($p=0.023$).

Correlations between Phonological Awareness, Reading and Writing skills

Phonological awareness training aims to influence the acquisition and development of reading and writing. In order to investigate the influence of a skill as a function of other, correlation measures were used. These offer valuable parameters about the effects of syllabic and phonemic awareness skills in relation to the acquisition of reading and writing. The Dancey and Reidy [25], classification was used for the measures of correction (r). The values of (r)= 0.10 to 0.30 are indicative of weak correlation, (r)=0.40 to 0.60 moderate, and (r)=0.70 to 1.00 strong.

In the EG there was a strong correlation (Table 3), among the reading level and the identification abilities (S6) and exclusion of syllables (S8), production of words from phonemes (F1), identification of initial phoneme (F2), and final phoneme (F3). Moderate correlations were verified in the exclusion (F4), blending (F5), and segmentation of phonemes (F6) aspects.

In this study we verified overlapping of the phonemic awareness in relation to the syllabic awareness. With the exception of transposition (S9), all the additional phonemic aptitudes demonstrated positive correlations to the development of reading.

Only 4 of the 16 abilities evaluated demonstrated statistic significance in the CG. Strong correlation only occurred between the reading level and the abilities of identification of initial syllable

(S3), and production of words from phonemes (F1). Moderate correlations were verified in the aspects of identification of medial syllable (S6) and identification of initial phoneme (F2). In the CG the correlations are equally distributed between the syllabic and phonemic abilities, there was no emphasis to the phonemic aspects as verified in the EG.

The correlation between phonological awareness and writing levels in the EG (Table 3), demonstrated strong rates for phonemic abilities (F2, F3, F4 and F5).

Moderate correlations were evidenced in syllabic activities (S3, S5, S8 and S9). Again, the phonemic abilities demonstrated greater correspondence with the progress in the writing of students that participated in the RTI. In the CG the opposite was observed, the syllabic abilities (blending, segmentation, and production of words from syllables) overlapped the phonemic ones. Despite the statistic significance, the absence of strong correlations is noted. All the measurements evidenced moderate correlations.

DISCUSSION

Among the participants of the RTI program, 80% on average, obtained advances in reading and writing and 14% ($n= 4$) did not present satisfactory responsiveness. The absence of progress in the phonological awareness, reading, and writing abilities in comparison to their peers is regarded as unsatisfactory.

These values are similar to those described by Louw and Wium [14]. The authors reported rates of 80% of responsiveness and 15% considered at risk for learning disorders due to low attainment. For Torgesen [15], when the interventions are effective, there is an estimate that only 2 to 6% of the student population does not respond satisfactorily.

The RTI presented here is directed towards the phonological awareness, for this ability is reported as the main precursor of literacy [3].

Other studies describe that the effectiveness of the first tier must include the stimulation of the vocabulary, of the phonological operational memory, association letter-sound, recognition of words and nonwords, reading fluency in addition to phonological awareness training [16, 17]. It is possible that the aspects mentioned previously, if present in the current research, would provide even more relevant results. However, since we're dealing with an adaptation of an existing model, the researchers opted to keep the original structure. Changes beyond the necessary ones could cause several research errors.

Similarly to what has been shown by the literature [18], it was evidenced that the manipulation of phonemes is a strong predictor for acquisition of reading and writing. Except for the transposition of phonemes, all others (blending, segmentation, identification, and exclusion of phonemes) demonstrated strong correlations with the development of reading and the writing in the present study.

In a national research carried through with students exposed to different literacy methods, difficulties in tests of phonemic transposition were also evidenced, even in the group of children whose literacy occurred through the phonic method [19].

A possible explanation for the findings about the transposition of phonemes is the fact of that this task is considered of bigger complexity, therefore demands greater effort from phonological operation memory [20].

Generally speaking, there was little correspondence between the RTI program and the syllabic abilities. Out of the 9 studied, only 3 (identification of medial syllable, exclusion and transposition of syllables) showed statistical significance. These were stimulated intensively in the first weeks of the program, unchaining positive effect.

The performance in blending, segmentation, identification, and production of words from syllables was similar in the pre- and post evaluations. Starting at the pretesting, the score was the highest in the test (4 points), indicating that these abilities were acquired still in early-childhood education. The same performance was registered in students not exposed to RTI. Therefore, there was no influence from RTI in these aspects.

Ehri et al. [18], present that the manipulation of syllables seems to develop itself spontaneously in certain levels, regardless of explicit instruction, which could justify the performance reported previously. Or still, these abilities had been acquired through school intervention. Catts et al., [4] had also evidenced similar performances in the control and experimental groups because the majority of the children was already receiving the training in phonological awareness as usual practice in preschool. Since we do not have information pertaining to the children's school curriculum, in terms of the abilities that were stimulated, it is not possible to state that the school was the only responsible for the progress observed. However, there is great chance of that because among the phonological awareness abilities, syllabic is the most used, despite the teachers not associating them with the terminology "phonological awareness".

Moderate correlations between phonological awareness and mastering reading and writing are commonly reported [21]. However, the authors did not clarify which aspects of the phonological awareness are interrelated. The present study offers contributions in this direction when it demonstrates that moderate correlations associate themselves with aspects of syllabic awareness and intensify themselves in the correlation with phoneme awareness. The aspects of phoneme blending, segmentation, identification, and exclusion were emphasized

Still regarding analysis of the phonemic awareness, we can observe that the statistical significance does not always translate into results of excellency, therefore the students' score, even after the intervention, came close to 50% of correct answers on the tests. At any rate, there was clinical relevance, since the majority of the students reached desirable levels of reading and writing. We question at this moment if there would be better results if the phonemic awareness was prioritized: Would we reach greater responsiveness?

Would we have faster results? We hope that these questions can be answered soon through new studies.

Such answers are fundamental to guide shorter interventions (lasting fewer weeks), and that can identify the signs of risk factors precociously.

Activities involving rhyme are present in a very subtle manner in the program, since they have not been considered essential to the development of reading [22]. Consequently, there wasn't significant progress in this ability. In the production of rhymes, for example, the students did not achieve even 50% of correct answers in the post testing.

Just as in Gillon's work [22], positive correlations between the handling of rhymes and the acquisition of the written language were found.

Some gain was observed in the identification of rhymes, but they are not attributed to the RTI directly, since these results also occurred in the control group. It is possible that the contributions come from the appropriate stimulation at school, since the teachers in fact use many children's books that favor rhyme.

An aspect to be considered is the ease to identify but not to produce rhyme. In rhyme activities, the child initially develops the ability to identify and to finally produce it. The latter is considered of bigger complexity, since in order to execute it, a lexical repertoire (vocabulary), and also a fast access to this last information [3], are necessary.

Capellini, Cesar, and Germano [13], also evidenced better performance in identification than in the production of rhyme in 1st and 2nd graders.

We emphasize that the methodology used in this study considers the absence of response from the child to the intervention as a risk factor for learning disabilities. Seven children were identified in these conditions in the EG. Since the study did not offer 2nd and 3rd tier of the RTI, these children were referred to tutoring offered by the school (remedial teaching).

After 2 months, their performance remained low so the teachers opted to refer these students to specialized institutions that have partnerships with the municipal schools. From these, 5 were diagnosed by a multidisciplinary team (involving psychologists, language and speech pathologists, and a neuropsychiatrist) with: Attention Deficit and Hyperactivity Disorder (3), Mixed Developmental Disorders of scholastic Skills (1) and Specific developmental disorders of speech and language (1) One of the students was identified as being at risk for Specific Reading Disorder (Dyslexia), but due to their age, the teams opted for speech therapy interventions and reevaluation in 6 months, having followed the criteria of DSM-[23]. This information was made available by the parents/guardian through reports from the institutions. One of the students did not conclude the evaluation process and was removed from the institution due to consecutive absences.

Thus, it can be said that since the beginning of basic education, it was possible to correctly identify children at risk for learning disabilities and to direct them for specialized services. These data emphasize that it is not necessary, not even recommendable to wait for the child's evolution for a long period. Early intervention is necessary, as confirmed by other studies [11,24,25].

In the control group, the teacher directed 3 children to specialized centers throughout the semester and, at the end of the study, 2 other children did not present any progress. Thus, the amount of children with learning difficulties in this group was

superior (23%) to EG (12%). Iuculano et al. [26], justify that the more delayed, the lesser the chance for responsiveness because there is interference of neuroplasticity.

Through “traditional” pedagogical practices, the students from the CG also obtained progress in reading and writing, however in lesser ratio and statistically inferior to the group exposed to the RTI.

The relations of significance between written language and phonological awareness were inferior in the CG and were concentrated in syllabic abilities. The predominance of syllable activities leaves little room for the association phoneme-grapheme, essential for the acquisition of alphabetical levels [27]. This association was not practiced enough in the classroom according to the results observed.

Approximately 10% of the students initiated 1st grade in the intended level of reading, the alphabetical one, and the majority was in the logographic level. Regarding writing: 21% (pre-syllabic), 46% (syllabic), 23% (syllabic-alphabetical) and 10% (alphabetical). This variability is commonly reported. The children start basic education at different cognitive-linguistic levels and how easily they will learn will be influenced by these aspects [38]. To carry through programs of RTI still in preschool could contribute to change this situation, equalizing abilities and performances.

For Christ et al. [28], programs with less than 14 weeks are probably questionable since they do not offer trustworthy parameters to the student’s progress. In the present RTI program activities were offered for 12 weeks, but opposing the authors cited previously, the results were clear and statistically significant.

Despite the relevance of a well structured first tier, its effectiveness is seldom reported, therefore the majority of the studies reflect in the investigation of later stages [29,30]. Still, the variability in the recommendations as to the number of weeks and the frequency in the follow-up evaluations are complicating factors to compare interventions [31].

As verified previously, developing actions in the school environment for children with learning disabilities is still a challenge for the Brazilian education system [32]. However, the interventions in the beginning of the school life, the stimulation of abilities precursory to literacy, the qualification of the teachers, as well as the employment of speech and language therapists in the schools are fundamental. We can see, then, factors that justify the importance and replication of this study.

CONCLUSION

The program, based on the RTI (tier 1), promoted significant advances in the phonological awareness of the students in the first grade, promoting the alphabetical acquisition of reading and writing.

The first limitation is related to the reduced size of the sample, what makes the generalization of results unfeasible. The other one is the lack of collective evaluation tools for the follow up of the students’ performance. For this reason, the evaluations occurred individually. We emphasize that the results of this study

need to be spread so that it can be understood how distant Brazil is from public policies of developed countries and how much the lack of investments in education, guided by scientific approach, has hindered the students.

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REFERENCES

1. Programme for International Student Assessment (PISA). National Center for Education Statistics. EUA: 2015
2. Wermeier CA, Facchini L. Phonological awareness and metalinguistic activities: knowledge production in literacy. *Rev Acad Licencia&acturas*. 2016; 4: 88-98.
3. Melby-Lervag M, Lyster SA, Hulme C. Phonological skills and their role in learning to read: a meta-analytic review. *Psychol Bul*. 2012; 138: 322-352.
4. Catts HW, Nielsen DC, Bridges MS, Liu YS, Bontempo DE. Early identification of reading disabilities within a RTI framework. *J Learn Disabil*. 2015; 48: 281-297.
5. Clarke B, Doabler CT, Smolkowski K, Baker SK, Fien H, Cary MS. Examining the efficacy of a tier 2 kindergarten mathematics intervention. *J Learn Disabil*. 2016; 49: 152-165.
6. Fuchs D, Fuchs LS. Introduction to response to intervention: what, why, and how valid is it? *Read Res Q*. 2006; 4: 93-99.
7. Fukuda MTM, Capellini AS. Phonological skills and grapheme-phoneme training correspondence in children under dyslexia risk. *CEFAC*. 2011; 13: 227-235.
8. Greulich L, Al Otaiba S, Schatschneider C, Wanzek J, Ortiz M, Wagner R. Understanding inadequate response to first grade multi-tier intervention: nomothetic and idiographic perspectives. *J Learn Disabil*. 2014; 37: 204-217.
9. Compton DL, Fuchs D, Fuchs LS, Bryant JD. Selecting at-risk readers in first grade for early intervention: A two-year longitudinal study of decision rules and procedures. *J Educ Psychol*. 2006; 98: 394-409.
10. Kruse LG, Spencer TD, Olszewski A, Goldstein H. Small groups, big gains: efficacy of a tier 2 phonological awareness intervention with preschoolers with early literacy deficits. *Am J Speech Lang Pathol*. 2015; 24: 189-205.
11. Beach KD, O’Connor RE. Early response-to-intervention measures and criteria as predictors of reading disability in the beginning of third grade. *J Learn Disabil*. 2015; 48: 196-223.
12. Moojen S, Lamprecht R, Santos RM, Freitas GM, Brodacz R, Siqueira M, et al. CONFIAS - Consciência Fonológica: Instrumento de Avaliação Sequencial. São Paulo: Casa do Psicólogo; 2003.
13. Germano GD, César ABPC, Capellini SA. Screening protocol for early identification of Brazilian children at risk for dyslexia. *Front Psychol*. 2017; 8: 1763-1773.
14. Wium AM, Louw B. The South African national school curriculum: Implications for collaboration between teachers and speech-language therapists working in schools. *S African J Child Educ*. 2015; 5: 348-354.

15. Torgesen JK. Individual differences in response to early interventions in reading: the lingering problem of treatment resisters. *Learn Disabil Res Pract.* 2000; 15: 55-64.
16. Chard DJ, Vaughn S, Tyler BJ. A synthesis of research on effective interventions for building reading fluency with elementary students with learning disabilities. *J Learn Disabil.* 2002; 35: 386-406.
17. Hatcher PJ, Hulme C, Miles JNV, Carroll JM, Hatcher J, Gibbs S, et al. Efficacy of small group reading intervention for beginning readers with reading-delay: a randomised controlled trial. *J Child Psychol Psychiatry.* 2006; 47: 820-827.
18. Ehri LC, Nunes SR, Willows DM, Schuster BV, Yaghoub-Zadeh Z, Shanahan T. Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Read Res Quarterly.* 2001; 36: 250-287.
19. Schafer CM, Quitaiski LF, Giacchini V. Performance in phonological awareness and writing errors of children under different literacy methods. *Distúrb Comum.* 2017; 29: 318-329.
20. Oakhill J1, Kyle F. The relation between phonological awareness and working memory. *J Exp Child Psychol.* 2000; 75: 152-164.
21. Schatschneider C, Fletcher JM, Francis DJ, Carlson CD, Foorman BR. Kindergarten prediction of reading skills: A longitudinal comparative analysis. *J Educ Psychol.* 2004; 96: 265-282.
22. Gillon G. Facilitating phoneme awareness development in 3 and 4 year-old children with speech impairment. *Lang Speech Hear Serv Sch.* 2005; 36: 308-324.
23. Diagnostic and statistical manual of mental disorders (DSM 5). American Psychiatric Association. 5th ed. Arlington, VA: APA; 2013.
24. Wanzek J, Vaughn S, Scammacca N, Gatlin B, Walker MA, Capin P. Meta-Analyses of the Effects of Tier 2 Type Reading Interventions in Grades K-3. *Educ Psychol Rev.* 2016; 28: 551-576.
25. Milburn TF, Lonigan CJ, Allan DM, Phillips BM. Agreement among traditional and rti-based definitions of reading-related learning disability with preschool children. *Learn Individ Differ.* 2017; 55: 120-129.
26. Iuculano T, Rosenberg-Lee M, Richardson J, Tenison C, Fuchs L, Supekar K, Menon V. Cognitive tutoring induces widespread neuroplasticity and remediates brain function in children with mathematical learning disabilities. *Nature Communications.* 2015; 6: 8453.
27. Snowling M. Early identification and interventions for dyslexia: a contemporary view. 2013; 13: 7-14.
28. Christ TJ, Zopluoglu C, Monaghan BD, Van Norman ER. Curriculum-based measurement of oral reading: Multi-study evaluation of schedule, duration, and dataset quality on progress monitoring outcomes. *J Sch Psychol.* 2013; 51: 19-57.
29. Hill DR, King SA, Lemons CJ, Partanen JN. Fidelity of implementation and instructional alignment in response to intervention research. *Learn Disabil Res Prac.* 2012; 27: 116-124.
30. Al Otaiba S, Wagner RK, Miller B. "Waiting to Fail" redux: understanding inadequate response to intervention. *Learn Disabil Q.* 2014; 37: 129-133.

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