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Comparison between methods in learning stimulation program based on response to intervention

Abstract

Objective: to verify the effectiveness of a stimulation program for learning difficulties and to compare the benefits of different stimulation methods.

Method: Level 2 of the Response to Intervention Program was applied to a Brazilian sample of students from 1st to 3rd years of elementary school in a public school in a municipality located in the south of Brazil, with complaints of learning difficulties, totaling a sample of 51 participants. Three stimulation methods were compared, with the sample being divided as follows: group 1 (Metaphon) -19 participants; group 2 (Auditory Training) -16 participants; and group 3 (Control) -16 participants. Participants were assessed pre and post intervention using the Phonological Assessment Instrument, Phonological Awareness Sequential Assessment Instrument and School Performance Test protocols. The interventions took place in 10 45-minute sessions, in groups of 4 to 5 students.

Results: groups 1 and 2 demonstrated greater gains for participants compared to groups 3 in qualitative and quantitative analysis. The following results were statistically significant: qualification of phonological awareness, except group 1 for the syllabic portion; the difference in the gross number of correct answers in the pre and post-intervention assessments of groups 1 and 2. Groups 2 demonstrated good results, standing out from the other methods.

Conclusion: the intervention groups generally showed significant improvements after the reevaluations. It was possible to observe a positive outcome in the group stimulation.

Keywords: learning, learning disorders, child development, academic achievement

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Introduction

Learning is a recurring action in human life. Every individual is in constant learning throughout his / her growth, because this can be provided in several ways and in different fields, such as: motor, cognitive, linguistic, sphincter and psychosocial. Learning and stimuli have an impact on the child's development, growth and adult life.[1] An environment that provides good stimuli is necessary for healthy and creative growth.

The beginning of the school period is marked by learning to read and write by the process called literacy. A striking difference between learning the written language and acquiring the oral language is that there is a need for formal instruction for the child to become literate. Even if exposure to the world of letters during childhood facilitates literacy, formal instruction is necessary for learning to read and write,[2] while oral language acquisition occurs spontaneously and is biologically marked for the human species.[3]

Some children have difficulties in learning to read and write during the first years of school life. Due to the complexity of such a process, these difficulties are expected at the beginning of this path and should ideally be resolved in the first years of elementary school. However, education professionals and family members must be aware of learning difficulties, especially whether these difficulties persist or not. Because when reading and writing difficulties go beyond the literacy period, that is, they are persistent beyond the expected period, there may be a learning deficit. In Brazil, around 10% of school-age children have school difficulties.[4–6]

When educational institutions and education professionals are unable to overcome such difficulties, these students are referred to health services in search of a follow-up that helps to solve these problems.[7] Thus, the need for alternatives that help to enhance learning and solve any difficulties is clear.

An alternative for the prevention and early identification of disorders and learning difficulties is denominated "Response to intervention" (RTI),[8] which is prevention, detection and stimulation program. It is divided into three levels, which have differences in relation to the interventional professional, duration and frequency.

Level I of the RTI recommends stimulation aimed at all students and has a preventive character. This level is applied by the teachers themselves who receive training for the application, which has a frequency of three 20-minute weekly sessions, and the activities take place in the classroom. Children who manifest learning difficulties at the end of Level I are referred to Level II. At the second level, the stimulations occur in groups and with interventions of longer duration and specificity. They take place in a frequency of three 40-minute weekly sessions, and are under the responsibility of a specialist professional who may be a psychopedagogue, speech therapist, etc. Students who after passing Level II continue to have learning difficulties are taken to Level III. The third and last level consists of individual interventions with high intensity, as it occurs five times a week, applied by a specialist professional (psychopedagogue, speech therapist, etc.). The duration of the sessions is 45 to 60 minutes and the contents are geared to the child's difficulties.

The RTI model requires planning and organization of environments and professionals. Although it has a rigid model, several studies show that even adapted versions of the original RTI model, which used it as inspiration, adapting it to their reality, obtained good results with its execution.[8,9] Thus, the RTI model can serve as a basis for actions that suit the specific contexts of each Brazilian educational institution. When thinking about alternatives that can be effective in learning,

RTI or similar actions in goal can guarantee positive experiences in the context of school performance and learning. Several studies[10,11] analyze and defend data that express benefits in the school context that were generated by evaluations and stimulation activities.

Thus, seeking evidence on workshops and stimulation methods within the school context is to seek solutions to current problems in education and public health. Thinking about guiding an evidence-based practice, the present study is justified with the objective of verifying the effectiveness of a stimulation program for learning difficulties and comparing the benefits of different stimulation methods applied to the research participants.

Materials and methods

The present study is characterized as a randomized controlled clinical trial, with data obtained through the actions of a health extension program in the school community. The study is composed with pre and post-intervention data, in order to have evidence regarding the factors that help the learning process of reading and writing in children with school difficulties. From this, the speech therapy clinic can be better designed for therapeutic activities in individual care, and teachers in the choice of activities in the classroom with an emphasis on skills that stimulate learning to read and write. Such results are presented by comparing the results of a Stimulation Program for children with learning difficulties with two therapeutic methods, namely, Groups 1 (G1 /Metaphon) and Groups 2 (G2 /AT), to verify which one best helps children with learning difficulties. As a way of monitoring the findings between groups, there is a third set of children who were kept under monitoring at the Learning Laboratory (a form of support that children with learning difficulties already receive). This third group of children was understood as a control group, being Groups 3 (G3 /Control).

Evaluation battery

The methodological process of data collection was divided into three stages, namely: pre-intervention, intervention and post-intervention. The first procedure with all the participants, which was the pre-intervention assessment, the instruments described below was used.

a) Phonological Assessment Instrument – IAF[12] -evaluates speech data, the results of which refer to the subject's phonological system, the phonological processes performed and the percentage of correct consonants (PCC). In this study, the PCC data are described and analyzed.

b) Phonological Awareness Sequential Assessment Instrument – CONFIAS[13] -assesses metaphonological skills, and syllabic and phonemic PA can be analyzed, whose results of this instrument are given as low or normal for phonological awareness (PA), in relation to the hypothesis of writing presented by the evaluated individual; the syllabic and phonemic PA data were used.

c) School Performance Test – TDE[14] -evaluates reading, writing and arithmetic skills; reading and writing data were analyzed in this study.

After the stimulation program interventions, the participants were reassessed using the same instruments used in the first evaluation period - IAF, CONFIAS and TDE.

Stimulation program

The stimulation interventions took place on the premises of the educational institution in a specific room for this program. The interventions took place during the participants' class shift, without loss of class time to the students due to the teachers' previous planning together with the researchers. Interventions took place in small groups. Both G1 /Metaphon and G2 /AT had 5 groups each, formed by 4 participants in each group, 10 in total. The interventions lasted 45 minutes, with two weekly sessions for 5 weeks, totaling 10 sessions. Those responsible for the stimulation were speech therapy and psychology students trained in the application of a specific method. Each group was attended by two applicators (according to the day of the week and shift) and for each method there were 3 responsible persons who were interchanged in the work pairs. The composition of the groups and the therapeutic method applied were defined by randomization, using a computerized draw system.

The therapeutic intervention groups G1 were submitted to an approach with the Metaphon therapeutic method, which involves aspects of PA, meta communication and correction strategies.[15] Specific play activities were worked out, as the method delimits, in relation to the concept, phoneme, word, sentence and story levels, always involving a pair of phonemes that contrast by a characteristic. At the concept level, this characteristic is worked on in various activities, demonstrating the difference that marks the distinction. For example, in association with animals that is in front of or behind the farm fence - alluding to the articulation point. At the phoneme level, sounds are presented that have the concept previously worked on. At the word level, minimal pairs are presented with the sounds worked. Minimal pairs are words that have only one phoneme that differentiate them. At the sentence level, the minimum pairs are used in sentences. Finally, at the story level, minimal pairs and sounds are used in larger contexts, such as narratives. The phoneme pairs worked were / f, v / - / s, ʃ /, in five sessions for each pair. These pairs were chosen for the purpose of working on the contrast of the distinctive features of sonority and the articulation point, respectively. Fricative sounds were chosen due to the ease of sustaining the emission and the better characterization of the contrasts.

The therapeutic intervention groups G2 were submitted to the auditory training (AT) approach.[16,17] The aspects worked on were: sound recognition; difference and attention to sounds; associations with everyday sounds; low- and high-pitched concept; short and long concept; concept of strong and weak; association of sounds with motor, tactile, olfactory and visual stimuli. All these aspects were worked through playful activities, such as: in the difference and attention to sounds, a memory game was played, where the children looked for pairs of pots that produced the same sound - each pot contained different grains inside ; in association with motor stimuli, children were exposed to different sounds and each one was associated with a movement, when listening to a sequence of sounds, children should present the corresponding sequence of movements; in association with everyday sounds, semantic descriptions of the sounds were presented orally and the children needed to identify what it was about, after which the sound was presented.

All activities were carried out in the same way, order and with the same materials in all groups of each method. The activities carried out in the groups were planned and organized in advance, so that the applicators could reproduce them in the groups in the most identical way possible. This care was taken so that all groups of each method participated in the same intervention and received the same type of stimulus in a given order.

The children who were randomly selected to remain in Control groups continued to receive the usual monitoring provided by the educational institution in the learning laboratory. The children in G3 /

Control received follow-up during the opposite class shift, in groups of 4 to 5 students once a week for 5 weeks, with teachers responsible for the Learning Laboratory. In this laboratory, school reinforcement activities, assistance with classroom tasks and complementary learning activities are carried out.

Population

The population participating in this project consisted of children with complaints of learning difficulties at a public school in a region of low socioeconomic class in a municipality located in southern Brazil, sent by the teachers to the institution's learning laboratory, totaling an initial sample of 69 participants, from 1st to 3rd year of elementary school, between 6 and 10 years old, of both genders. The study is approved by the Research Ethics Committee under number 1.584.201.

After the period of intervention of the stimulation program, the participants were reassessed using the same instruments used in the first moment of evaluation - IAF, CONFIAS and TDE. Participants who completed the pre-intervention assessment battery were included in the Stimulation Program. Of the 69 participants, two were transferred to another school and seven did not complete the evaluation battery. Therefore, the sample of groups of stimulation interventions was composed of 60 participants.

The final sample included participants who completed the reevaluation battery and without suspected or diagnosed intellectual disability or neurological disorders. Of the 60 participants, three did not complete the reevaluation battery and six had suspected or diagnosed intellectual disability or neurological disorders - these participants were removed from the sample so that data analysis could be performed only with children without suspected intellectual deficit, which could distort the study's findings. Therefore, the final sample of this study was composed of 51 participants, divided as follows: G1 / Metaphon groups (19 participants); G2 /AT groups (16 participants); and G3 /Control groups (16 participants). The methodological development of the present study, as described above, can be seen in Figure 1.

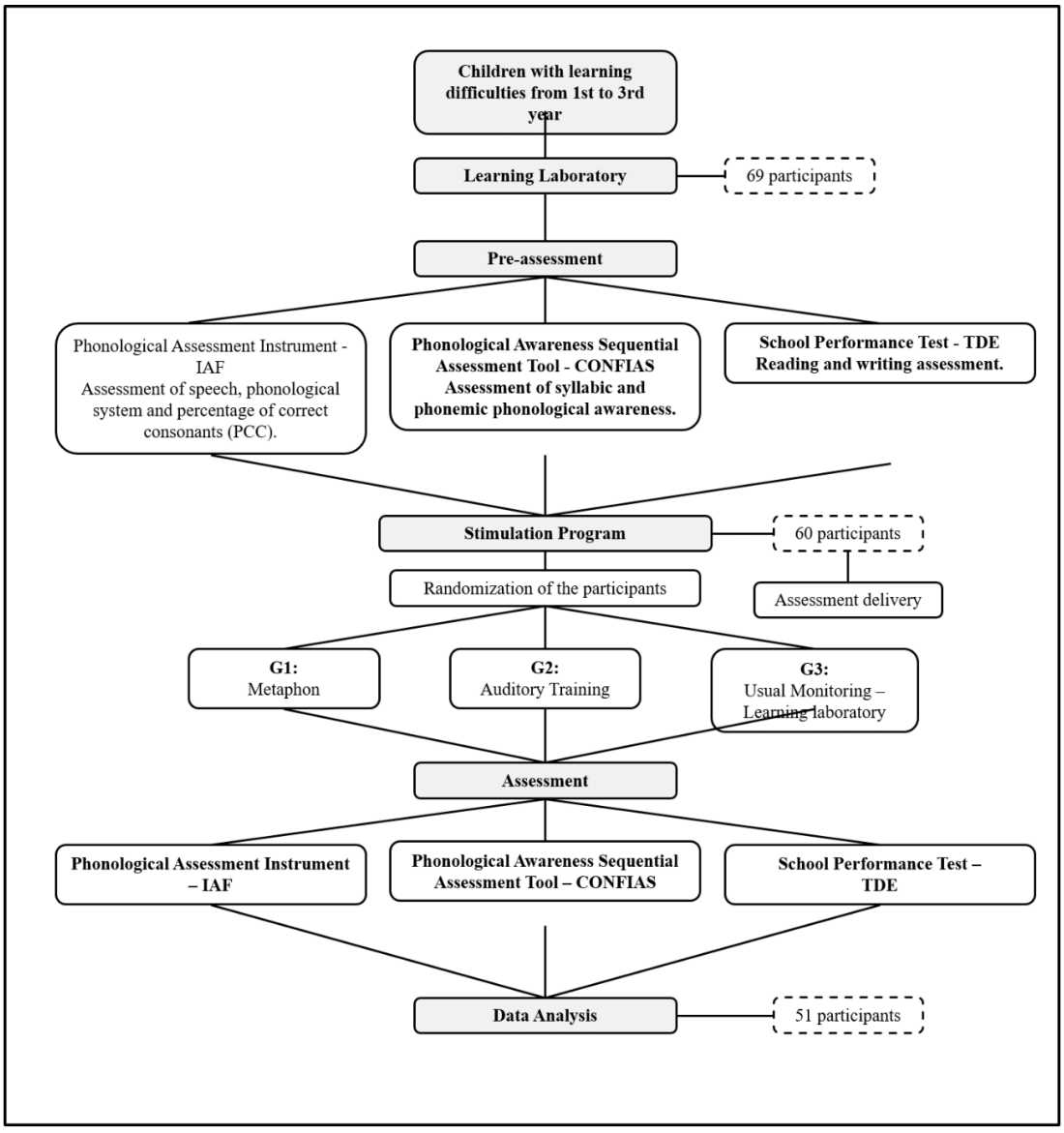

Figure 1 The methodological development of the present study.

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Data analysis

The results of the pre- and post-intervention assessments were compared between each participant and in the groups with each other. Qualitative analyses were performed in relation to the subjective gains and gross hits of each subject in the instruments used in the pre and post-intervention assessments. In the quantitative analysis, the performance of all participants in the assessment instruments was characterized, considering the raw scores and the categorization of each instrument, through the z-scores calculation. Quantitative data analysis, considered the p-value at a 95% confidence level ($p < 0.05$), was performed using the Statistic Package for the Social Science (SPSS) for Windows (Version 20, SPSS Inc. ©, Chicago, Illinois).

Results

Regarding the composition of the sample, Table 1 presents the age, education and sex data of the research participants. Regarding age, it is observed that most of the participants are in the age group of 7 years old, followed by the age group of 8 years old. With regard to schooling, the 3rd year of elementary school is the range that concentrates most of the participants. As for the division by sex, the male gender is predominant in the total of participants representing 52.94% (27 participants), within the groups the division by sex was as follows: G1 /Metaphon - 42.11% boys and 57, 11% girls; G2 / AT - 68.75% boys and 31.25% girls; and G3 /Control - 50% boys and 50% girls.

Table 1 Epidemiological data from the sample

Epidemiological data from the sample						
Groups	**Age**		**Schooling**		**Gender**	
1/Metaphon	6 years	200.00%	1st grade	3		
		10.52%		15.78%	Female	11
	7 years	700.00%				57.89%
		36.84%				
	8 years	7				
		36.84%	2nd grade	10		
	9 years	3		52.63%		
		15.78%				
					Male	8
	10 years					42.11%
			3rd grade	6		
				31.57%		
G2/AT	6 years	3	1st grade	7		
		18.75%		43.75%	Female	5
	7 years	8				31.25%
		50%				
	8 years	1				
		6.25%	2nd grade	3		
	9 years	3		18.75%		
		18.75%				
					Male	11
	10 years	1				68.75%
		6.25%	3rd grade	6		
				37.50%		
G3/Control	6 years	2				
		12.50%	1st grade	4		
	7 years	4		25%	Female	8
		25%				50%
	8 years	7				
		43.75%	2nd grade	4		
	9 years	3		25%		
		18.75%				
					Male	8
	10 years					50%
			3rd grade	8		
				50%		

Key: AT, Auditory training.

The analysis of phonological awareness (PA), using the CONFIAS instrument, was divided into syllabic and phonemic PA. Table 2 shows the pre- and post-intervention results for syllabic PA in each group. Through it, it can be observed that the number of participants with lowered syllabic PA in the post-intervention assessment fell in all groups, being null for G2 /AT and G3 /Control. G1 /Metaphon participants who followed with lowered syllabic PA, obtained gains in the number of gross correct answers. The table also shows the difference in the average of correct answers pre and post (post-intervention result minus pre-intervention result) for each group. The differences reveal that all groups were statistically significant in such a comparison.

Table 3 shows the results of phonemic PA. The number of participants with decreased phonemic PA decreased in all groups

in the post-intervention moment. The G2 /AT had 50% of the participants with a reduced phonemic PA and this percentage dropped to 6.3%. The method used in the G2 /AT groups was statistically significant for phonemic PA. Regarding the difference between pre and post, all methods were significant, except G1 /Metaphon. All groups had participants who remained with a reduced phonemic PA. However, participants in the G1 /Metaphon and G2 /AT intervention groups achieved gross gains in the comparison between the pre and post-intervention assessments. The G3 /Control participants, who remained with a reduced phonemic PA, did not demonstrate gains in the post-intervention.

Table 4 shows the data regarding the performance of writing in the pre and post-intervention moment. Comparing the data, two G1 /Metaphon participants and one G3 /Control participant moved to the middle category in the post-intervention moment. There were no changes in G2 /AT. Differences before and after intervention and between groups were not significant.

Regarding reading performance, two participants in the G1 / Metaphon groups and three participants in the G3 /Control groups went from lower to medium. The G2 / AT did not present any changes, and no participant went to the higher level. The differences in outcome before and after the intervention were not significant and show that this is independent of the method. When analyzing the difference in the gross number of correct answers in the pre and post-intervention moments, G1 /Metaphon and G2 /AT obtained a statistically significant difference - the difference in G2 /TA being two points greater than the difference in G1 /Metaphon and three points being greater than G3 / Control. Table 5 shows these results in the pre and post-intervention moments.

A descriptive analysis was made on the performance of reading and writing, showing that 57.9% of G1 /Metaphon participants and 56.25% of G2 /AT had improvements in writing. Regarding reading, 63.2% of G1 /Metaphon participants and 50% of G2 / AT showed some type of gain. This improvement, although it was not always enough to appear in the change of reading and writing level, appeared in qualitative gains, such as: gross increase of correct answers in the test, greater number of written words, more letters per word, and increase of level in the writing hypothesis. The G3 /Control groups showed the lowest gain in the descriptive analysis, as 50% of the participants showed some type of improvement in writing and 37.4% in reading.

The results shown in Table 6 are about the percentage of correct consonants (PCC), which is calculated according to the correct consonants produced by the speaker and its result generates a speech intelligibility index according to a percentage categorization. This table shows data on the difference between the pre and post-intervention moments for each group. The differences were not statistically significant for any group studied. In descriptive analysis, it was noticed that in all groups there were participants with gains in percentage of speech intelligibility, being more precisely: 2 participants in G1 /Metaphon, 5 in G2 /AT and 5 in G3 /Control.

Table 2 Results of the evaluation of syllabic PA before and after intervention

Syllabic PA pre and post intervention							
	Syllabic PA			**p-value**	**Pre and post difference**		**Gross gain in post**
Groups	Lowered	Adequate		CM			
	Pre	6	13				
G1/Metaphon		31.60%	68.40%	0,125	4,316	0,001*	16
	Post	2	17				81.75%
		10.50%	89.50%				
	Pre	4	12				
G2/AT		25,0%	75,0%	0,125	3,875	0,012*	12
	Post		16				75.00%
			100%				
	Pre	3	13				
G3/Control		18.80%	81.30%	0,250	2,188	0,035*	10
	Post		16				62.50%
			100%				

Key: PA, Phonological awareness; AT, Auditory training; CM, comparison between groups.

Table 3 Results of the assessment of phonemic PA before and after intervention

Phonemic PA pre and post intervention							
		Phonemic PA		**p-value**	**Pre and post difference**	**p-value**	**Gross gain in post**
Groups		Lowered	Adequate	CM		Difference	
	Pre	500.00%	14				
G1/Metaphon		26.30%	73.70%	0,453	1,947	0,053	13
	Post	200.00%	17				65.55%
		10.50%	89.50%				
	Pre	800.00%	8				
G2/AT		50.00%	50%	0,016*	3,375	0,002*	15
	Post	100.00%	15				93.80%
		6.30%	93.80%				
	Pre	3	13				
G3/Control		18.80%	81%	1,000	1,813	0,011*	10
	Post	2	14				62.60%
		12.50%	87.50%				

Key: PA, Phonological awareness; AT, Auditory training; CM, Comparison between groups.

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Table 4 Results of the pre and post-intervention writing assessment

Pre and post intervention writing							
		Writing		**p-value**	**Extra gains**	**Pre and post difference**	**p-value difference**
Groups		Inferior	Average	CM			
	Pre	11	800.00%				
G1/Metaphon		57.90%	42.10%	0,500	1100.00%	1,00	0,151
	Post	9	10		57.90%		
		47.40%	52.60%				
	Pre	14	2				
G2/AT		88%	12.50%	1,000	9	0,81	0,132
	Post	14	2		56.25%		
		87.50%	12.50%				
	Pre	15	1				
G3/Control		94%	0	1,000	8	0,81	0,132
	Post	14	200.00%		50.00%		
		87.50%	12.50%				

Key: AT, Auditory training; CM, Comparison between groups.

Table 5 Results of the reading evaluation before and after intervention

Reading pre and post intervention								
		Reading			**p-value**	**Extra gains**	**Pre and post difference**	**p-value difference**
Groups		Inferior	Average	Superior	CM			
	Pre	9	9	1				
G1/Metaphon		47.40%	47.40%	5.30%	0,157	12	3,9	0,035*
	Post	7	11	1		63.20%		
		36.80%	57.90%	5.30%				
	Pre	13	3	0				
G2/AT		81.30%	18.80%	0.00%	1,000	8	5,81	0,030*
	Post	13	300%	0		50.00%		
		81.30%	18.80%	0.00%				
	Pre	10	5	1				
G3/Control		62.50%	31.30%	6.30%	0,223	6	2,84	0,157
	Post	7	800%	1		37.40%		
		43.80%	50.00%	6.30%				

Caption: AT, Auditory training. The P-value test was performed.

Table 6 Difference in the result of the percentage of correct consonants before and after intervention

Pre and post PCC difference		
Groups	Pre and Post Difference	PSI Gains
G1/Metaphon	0,0011	2
		10.60%
G2/AT	0,0175	6
		37.60%
G3/Control	0,0131	7
		43.80%

Legend: PCC, Percentage of correct consonants; AT, Auditory training; PSI, Percentage of speech intelligibility.

Discussion

The present study aimed to analyze the performance of children with school difficulties after participating in a stimulation program, based on the RTI model, and to compare the methods used. The sample was divided into three groups, namely: G1 /Metaphon groups; G2 / AT groups; G3 /Control groups. The choice of intervention models and a control was justified by comparing different intervention bases and premises. The G1 /Metaphon groups received linguistic-based stimulation, which works on phonology from the concrete concept, through phoneme contrast characteristics, to a narrative view. The G2 /AT groups received an intervention based on sound stimuli and correlation with tactile, olfactory and visual stimuli, without the use of specific linguistic material in the interventions. The G3 /Control groups received the usual stimulation from the institution offered by the Learning Laboratory, in which school reinforcement activities and help with homework topics are carried out.

The results presented by the sample of this study come from the pre and post-intervention evaluations, formed by a battery composed by the instruments IAF, CONFIAS and TDE. From these instruments, it was possible to obtain the following results: a) IAF -percentage of correct consonants; b) CONFIAS - low /adequate syllabic and phonemic awareness in relation to the writing hypothesis; c) TDE -reading and writing level according to grade-level.

The results obtained in the sample demonstrated quantitative and qualitative gains in the aspects evaluated in this study. Such findings are in line with that presented by another study with samples of Brazilian schoolchildren who applied Level 2 of the RTI model.[18] The stimulation applied in that study dealt with executive functions and had no linguistic character, as occurred in this study with G2 /AT. The sample was composed of 8 subjects and, although smaller than the sample in this study, it showed positive results in three of the nine skills evaluated.

The data from the evaluation of PA, both in relation to syllabic and phonemic PA, demonstrated the most satisfactory results, being

statistically better in comparisons before and after intervention and between methods. This fact brings a positive aspect to the stimulation groups, as PA is considered a prerequisite for learning to read and write.[2] Thus, when it is adequate, it represents an advance on the path of literacy. The results of reading and writing did not have a statistically significant increase in this study, which may have occurred due to the short period between the pre- and post-intervention evaluations, and it was not enough to show improvements in these aspects, although with adequate PA.

The results obtained in the PCC evaluations showed that all groups obtained positive results, with no emphasis on either method. A hypothesis for this event can be explained by the premises of phonological-based therapy, which aims to promote stimulation that allows the child to acquire phonemes in the shortest possible period and with the ability to generalize. Phonological-based therapy needs to help the child to understand the rule and phonological representation of phonemes.[19] Although the participants in this study had some linguistic gains, due to the input of stimulus received, for phonological gains a more specific monitoring for each subject would be necessary, considering the individuality of each phonological system. Thus, not all participants were provided with language benefits when applying the stimulation program, as they would have to be exposed to activities specifically designed to the needs of each individual's phonological system.

Regarding the comparison of the intervention models within the same stimulation program, the qualitative and quantitative results showed a certain emphasis on the auditory training method applied to G2, which is a phonotherapeutic method for the Auditory Processing Disorder (APD) therapy. The processing of auditory information refers to the understanding of sounds, more specifically, to the entire path that the sound takes in decoding and understanding by the central nervous system (CNS). APD negatively influences learning, as reported by several studies.[20,21] Thus, interventions based on auditory training can bring several benefits of hearing comprehension and acuity. Studies[16,17] relating auditory training in schoolchildren had positive results, corroborating with that found in the present study.

Although the Metaphon method used with G1 groups works on aspects directly related to language, it did not obtain such satisfactory results when compared to the other methods of this stimulation program. Metaphon is divided into 5 levels and the method guidelines explain that the child can only move to the next level after understanding the aspects worked on at the previous level. In the case of this study, the participants were exposed to two blocks of Metaphon, in which each block was composed of 5 sessions, in which one level was approached at each session. Thus, the stimulation program advanced in level regardless of each subject's understanding of the previous level. This was designed to maintain the format of the entire stimulation program for participants in G1 groups. This fact may be one of the reasons why this method has not resulted in greater gains.

Most of the participants in this study, even participating in a stimulation program, did not solve all their learning difficulties. Therefore, it is necessary to understand what the necessary aspects for learning are, which is linked to aspects from different areas.[22,23] The basis for uneventful learning is the healthy CNS, as seen at the beginning of this article, this aspect is part of a complex central function. In addition to the healthy CNS, looking at learning as something broad, as there are numerous factors related to the child's life and that can directly or indirectly influence their learning. Several studies[24–26] relate issues such as routine, sleep, family engagement, malnutrition and socioeconomic conditions to school performance. Inadequate sleep, for example, may compromise school performance, since it has the function of repairing learning processes and consolidating memory.[24] Issues such as prematurity and malnutrition are linked to possible delays in neuro psychomotor development, which can lead to delays in learning. Socioeconomic conditions, parental education level, quality of interaction between parents and children, cultural status, and cognitive level of stimulation are also factors related to child development.[25,26]

Aspects related to learning and which concern the educational environment are equally important for learning, as it is the method of literacy used by education professionals. A systematic review[27] shows that Brazil started literacy with the use of the Alphabetical Method, starting from the teaching of letters and their respective names. After the end of the Empire, Brazil went through a period of widespread dissemination and use of the Global Literacy Method. Such a method makes associations between whole words and their meanings, bringing texts from the beginning of learning. In addition to these, there is the Phonic Method, which uses an increasing degree of difficulty, values sounds, working on grapheme-phoneme decoding skills and phonological awareness. The most effective and efficient results in learning to read and write are with the use of the Phonic Method, however this is the least practiced method in Brazilian education, as described in other studies.[27,28]

The use of less effective methods of literacy, going against scientific evidence,[27,28] may be one of the causes of poor performance of Brazilian students in appraisals of learning such as, for example, the Brazilian Assessment of the End of the Literacy Cycle - ABC test. This assessment is carried out with students from the 3rd year of elementary school and is under the responsibility of the *Todos pela Educação* movement, assessing knowledge of mathematics, writing and reading. The last edition, with data released by the National Institute of Educational Studies and Research Anísio Teixeira (INEP), took place in 2016[29] presenting unsatisfactory results,[6] as described below.

The national average in the reading test, for the expected score, was 56.1% - 79% in private institutions and 48.6% in public institutions. In the written test, the national average was 53.4% - 82.4% in private institutions and 43.9% in public institutions.[29] In both tests, the average of public educational institutions showed that more than half of the students had scores below the expected at the end of the 3rd year of elementary school.

The indexes presented above express the need for teaching that provides quality and effective learning. And, this understanding of the set of particularities involved in learning is what can more plausibly guide actions aimed at its success.

Conclusion

The present study fulfills the objectives for which it was proposed. Some limitations found were the loss of participants during the methodological steps and the need to carry out the stimulations during the class period, taking the participants out of formal instruction in two periods during the week. Despite working with a restricted sample, it was possible to observe significant improvements in the evaluations. Thus, it is possible to verify effectiveness in methods of stimulating learning, as well as the RTI approach, bringing evidence to the practice of the teaching-health relationship.

Through this study it was possible to verify and compare data on health promotion activities within the school context and perceive its benefits in a descriptive and quantitative way, analyzing measures related to learning before and after the stimulation actions. The

findings of this study demonstrate a positive influence of each method of stimulation in the development of the skills worked and how their differences should be considered for the application of the method in the form of intervention to groups. In addition, this study demonstrates that there are benefits with group interventions, which may be an alternative prior to the indication of individual specialized care. It is proved that stimulation programs are learning enhancers and that Auditory Training is a possible resource for such stimulation.

Currently, there are health professionals and specific areas that build a relationship with health and education actions. This is the case, for example, in areas such as educational speech therapy and public health, which would be able to act with steps that begin from the assumption advocated by the RTI model. Actions in these areas and on such a basis would certainly help education and public health in Brazil. Since in addition to helping to solve learning difficulties, they would also reduce the number of referrals of children to health services. Health promotion activities integrate students, work on social and psychological issues, improve the understanding of education professionals about the health and difficulties of their students, in addition to developing skills, especially in cases of group stimulation.

Ethics statement

The participants involved in this research, through their parents or guardians, gave their consent to participate by signing a Free and Informed Consent Form. The study is approved by the Research Ethics Committee under number 1.584.201.

Author contributions

Amanda Faleiro - organization and execution of all processes developed in the research and writing of the study.

Letícia Pacheco Ribas - guidance and supervision of all processes developed in research and writing.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

References

1. Ribeiro FG, Braun G, Carraro A, et al. An empirical assessment of the healthy early childhood program in Rio Grande do Sul State, Brazil. *Cad Saúde Pública*. 2018;34(4):e00027917.
2. Albuquerque A, Martins MA. Escrita inventada no jardim–de–infância: contributos para a aprendizagem da leitura e escrita. *Aná Psicológica*. 2018;36(3):341–354
3. Ribas LP. Avaliação Fonológica da Criança Adaptada (AFCA). In: Cardoso MC. *Fonoaudiologia na Infância: Avaliação e Terapia*. *Revinter*. 2015;85–116.
4. Rocha G, Martins RF. A apropriação de habilidades de leitura e escrita na alfabetização: estudo exploratório de dados de uma avaliação externa. *Aval Pol Públ Educ*. 2014;22(85):977–1000.
5. Prado DGA, Armigliato ME, Salgado C, et al. Dyslexia and learning disorders: familial history. *Distúrbios da Comunicação*. 2012;24(1):77–84.
6. Matta TRG, Befi–Lopes DB. Adaptação do dyslexia early screening test -second Ed para o Português Brasileiro: resultados preliminares. *CoDAS*. 2015;27(3):301–303.
7. Sampaio AP, Maldonade IR, Bagarollo MF. Atenção às queixas escolares na visão de profissionais da atenção primária à saúde no município de Campinas. *Distúrbios da Comunicação*. 2018;30(4):667–668.
8. Almeida RP, Piza CJMT, Cardoso TSG, et al. Prevenção e remediação das dificuldades de aprendizagem: adaptação do modelo de resposta à intervenção em uma amostra brasileira. *Rev Bras Educ*. 2016;21(66):611–630.
9. Diuk B, Ferroni M, Mena M, et al. Response to intervention and spelling acquisition in children from low- income backgrounds. *Pág Educ*. 2017;10(2):96–110.
10. Silva B, Luz T, Mousinho R. A eficácia das oficinas de estimulação em um modelo de resposta à intervenção. *Rev Psicopedag*. 2012;29(88):15–24.
11. Sacon A, Pretto L, Bonamigo E, et al. Estimulação em grupos na educação infantil: proposta de atividades. *RCS*. 2013;9(16):101–109.
12. Ribas LP. Instrumento de avaliação fonológica -IAF. Software. Não publicado. 2015.
13. Moojen S, Lamprecht RR, Santos RM, et al. CONFIAS -Consciência fonológica: instrumento de avaliação sequencial. *Casa do Psicólogo*. 2003.
14. Stein LM. TDE -teste de desempenho escolar: manual para aplicação e interpretação. *Casa do Psicólogo*. 1994.
15. Mota HB. Terapia fonoaudiológica para os desvios fonológicos. *Revinter*. 2001.
16. Pinheiro FH, Capellini SA. Treinamento auditivo em escolares com distúrbio de aprendizagem. *Pró- Fono Rev de Atual Cient*. 2010;22(1):49–54.
17. Juchem LS. Auditory processing in learning difficulties: a therapeutic intervention program. Dissertação (Mestrado em Fonoaudiologia) -Universidade Federal de Santa Maria, Santa Maria. 2004.
18. Alcantara JK. Programa de resposta à intervenção (RTI) em segunda camada para desenvolvimento das funções executivas no 1º ano do ensino fundamental. Dissertação (Mestrado em Fonoaudiologia) – Universidade Estadual Paulista "Júlio de Mesquita Filho, Marília. 2019.
19. Souza TGG. Programa de intervenção práxico–produtivo para crianças com transtorno fonológico. Tese (Doutorado em Fonoaudiologia) -Faculdade de Odontologia de Bauru. 2016.
20. Ribas A, Rosa MRD, Klagenberg K. Avaliação do processamento auditivo em crianças com dificuldades de aprendizagem. *Rev Psicoped*. 2007;24(73):2–8.
21. Engelmann L, Ferreira MIDC. Avaliação do processamento auditivo em crianças com dificuldades de aprendizagem. *Rev Soc Bras. Fonoaudiol*. 2009;14(1):69–74.
22. Rotta NT. Dificuldades para a aprendizagem. In: Rotta NT, Ohlweiler L, Riesgo RSS. Transtornos da aprendizagem: abordagem neurobiológica e multidisciplinar. *Artmed Editora*. 2015;94–106.
23. Moojen S, França M. Dislexia: visão fonoaudiológica e psicopedagógica. In: Rotta NT, Ohlweiler L, Riesgo RSS. Transtornos da aprendizagem: abordagem neurobiológica e multidisciplinar. *Artmed Editora*. 2015;148–161.

24. Ernestina MMS, Simões P, Duarte J, et al. Perspetiva dos pais sobre as perturbações do sono das crianças em idade pré-escolar. *Rev Port de Enf de Saúde Mental*. 2018;(sped6):39–45.

25. Zago JTC, Pinto PAF, Leite HR, et al. Associação entre o desenvolvimento neuropsicomotor e fatores de risco biológico e ambientais em crianças na primeira infância. *Rev CEFAC*. 2017;19(3):320–329.

26. Tella P, Piccolo LR, Rangel ML, et al. Socioeconomic diversities and infant development at 6 to 9 months in a poverty area of São Paulo, Brazil. *Trends Psychiatry Psychother*. 2018;40(3):232–240.

27. Sebra, AG, Dias NM. Métodos de alfabetização: delimitação de procedimentos e considerações para uma prática eficaz. *Rev Psicopedag*. 2011;28(87):306–320.

28. Santos DST, Vidal ERS, Gutiérrez AJC. Análise dos aspectos qualitativos e da eficácia dos métodos de alfabetização no Brasil. *Pedagogia em Ação*. 2019;10(2):132–161.

29. INEP –Brasil. *Resultados da avaliação nacional de alfabetização*. 2009.