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Keywords

Reading
Child development
Language development
Mental processes
Comprehension

Descritores

Leitura
Desenvolvimento infantil
Desenvolvimento de linguagem
Processos mentais
Compreensão

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Received: 3/15/2010

Accepted: 7/21/2010

Effects of reading fluency stimulation with emphasis on prosody

Efeitos da estimulação da fluência de leitura com ênfase na prosódia

ABSTRACT

Purpose: To characterize the reading ability of children with five years of education according to temporal standards, as well as to compare the reading fluency performance of these children before and after a reading program based on prosody standards. **Methods:** Thirty two fourth-grade children participated in this study. They performed reading aloud and picture description tasks in order to verify reading rate, speech rate, text comprehension and the adequacy of prosody variation. Afterwards, it was carried out a reading stimulation program with emphasis on prosody, composed of five 15-minute sessions of reading tasks. At the end of the program, children were re-assessed, in order to verify their performance after stimulation. **Results:** Changes were observed in reading rate, number of words misread, and quality of prosody during the reading task. **Conclusions:** The reading program promoted positive changes in reading fluency measures.

RESUMO

Objetivo: Caracterizar a leitura de crianças com cinco anos de escolaridade segundo os parâmetros temporais, e comparar o desempenho da fluência de leitura pré e pós-estimulação de leitura por meio de programa baseado em padrões de prosódia. **Métodos:** Participaram 32 crianças do 5º ano do Ensino Fundamental I. As crianças realizaram leituras de textos e descrição de uma figura. Foram observados: taxa de leitura, velocidade de fala, compreensão de textos e adequação da variação da prosódia durante a leitura. Em seguida, foi aplicado o programa de estimulação de leitura com ênfase na prosódia, composto por cinco sessões de 15 minutos cada, com tarefas de leitura. Ao final do programa, foi realizado o mesmo procedimento de avaliação, a fim de se verificar o desempenho pós-estimulação. **Resultados:** Houve modificações quanto às médias da taxa de leitura, ao número de palavras lidas de forma incorreta e à qualidade da prosódia realizada durante a atividade de leitura. **Conclusão:** O programa de estimulação promoveu modificações positivas nas medidas de fluência de leitura.

Study carried out as part of the Lato Sensu Graduate Course in Language, Faculdade de Ciências Médicas da Santa Casa de São Paulo – FCMSCSP – São Paulo (SP), Brazil.

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INTRODUCTION

Beginning readers at the early stages of reading acquisition usually decipher texts in a slow manner, ignoring punctuation marks and expressing themselves with little prosody variation. As reading skills develop, most of them overcome these behaviors and their reading become more fluent; however, achieving reading fluency becomes harder for children who have reading disabilities⁽¹⁾.

During the development course in reading ability, achieving adequate fluency is important due to its close relation to comprehension⁽²⁾. Recently, a strong connection between reading fluency, decoding and comprehension has been identified, as oral reading fluency and a well-developed phonological awareness have been pointed as fundamental factors in the proficiency of readers^(3,4).

Some authors argue that as the perception of letter sequences becomes more automatic, attention to primary processes of visual decoding decreases, allowing attention to be transferred to other aspects of the reading processing, such as semantics. Consequently, reading fluency becomes increasingly more important in building a successful reader⁽⁵⁻⁷⁾.

Approaches to promote oral reading fluency in children have been divided into two categories – those that involve some sort of instruction in modeling or presenting the correct form; and those that involve some kind of quick and precise reading. Another approach is to perform a first reading of the text or listen to the text to be read. Repeated readings have been found to be an efficient strategy to promote fluency, increasing precision and fluency and promoting better reading comprehension⁽³⁾.

Problems in reading fluency are commonly observed in students with learning difficulties. Students with learning difficulties demonstrate a reduced reading rate and therefore read less text in the same period of time than other fluent readers. This slower rate can suggest that the person is using more cognitive demands to identify isolated words than the people who read with greater automaticity⁽⁸⁾.

Difficulties in decoding a written text can be reflected on the prosody organization of the text, compromising oral reading and comprehension. Prosody is a supra-segmental element of an utterance that is continuously present in speech through accent, intonation and utterance rhythm^(9,10).

For effective comprehension of the communicative intention it is necessary to process the correspondent syntactic structure, lexical choice and to detect prosody variation in language. Prosodic or supra-segmental aspects of speech occur through intensity, speed, stress, phrasal rhythm pattern and time. Prosody is essential in organizing verbal messages and transforming perceptual input in structural patterns that organize and store information in working memory⁽¹¹⁾.

A study with first grade Dutch speaking children, investigating correlations among auditory and visual processing, speech perception and phonological and orthographical abilities, found strong relations between speech perception and phonological processing in reading⁽¹²⁾.

Therefore, it could be considered that prosody in reading acts as an auditory representation of abstract information,

such as syntactic structure. Hence, information is more readily available to the linguistic processing system and to the storage in working memory⁽¹⁾. This concept gives a perspective of the relation between prosody and linguistic processing and, still, about the connection of prosody and reading comprehension mediated by working memory⁽⁹⁾.

It is possible to say, that oral reading, as much as speech, is based on linguistic processing of information, and so, prosody in reading, just as prosody in speech, is produced based by the structural representation that precedes complete lexical and semantic processing⁽¹⁾.

Therefore, taking fluency in reading as an important element of text comprehension, and trying to understand the relation of the prosodic elements with the capacity to promote reading fluency, we propose a preliminary study, using a reading intervention program with emphasis on prosodic elements, based on the theory of speed of processing information^(5,13) and on oral reading rate increase by acceleration⁽¹⁴⁾. It is expected that with the increase of sensibility to the temporal and prosodic aspects, an increase in oral reading fluency and, consequently, improvements in comprehension should occur.

The purpose of this study was to characterize children's reading according to temporal parameters and, compare the performance of reading fluency in children before (pre-test) and after (post-test) an intervention program with emphasis on prosody.

METHODS

This study was approved by the Ethics Committee of the Faculdade de Ciências Médicas da Santa Casa de São Paulo – FCMSCSP (Protocol no. 267/08). The data collection started after the school administrator, where the research took place and parents and/or guardian responsible for the children signed the permission forms.

The study included the participation of 32 children - 14 male and 18 female, with ages varying between 10 and 12 years old (mean of 10.62 years old) – that were enrolled in 5th grade of a Public Elementary School in São Paulo, and did not present any reading complaint. The reading program was conducted by the researchers, in the students' classroom, for seven weeks. We selected children who had the following characteristics: attending the 5th grade of an elementary school; participating in all of the steps of the reading program; with no hearing, visual or cognitive complaints and whose parents signed the permission to participate in the study.

Before starting the reading intervention program, we evaluated oral reading performance of each child (pre-test). Firstly, children read aloud two different texts, with an adjusted level of complexity according to their schooling year, in order to verify reading rate, as well as text comprehension, assessed through five direct questions. Then, we presented a picture, not related to the text read, and requested its description in order to collect a speech sample to measure speech rate. The readings of the texts and descriptions of picture were recorded with a Panasonic Recorder model RQ-L31 and BASF cassette tapes of

90 minutes. The analysis of speech rate was done according to the normative data parameters for speech fluency of the Child Language Test – ABFW⁽¹⁵⁾.

For the intervention program, children were divided into groups according to their reading rate. Two groups with ten children and one group with 12 children, were composed in such a way that half of the students, in each group, had a higher reading rate and the other half had a lower reading rate. In each group, we formed pairs of children (one with higher reading rate and another with lower reading rate), with the purpose of having children helping each other to notice the words read incorrectly, or omitted during reading, and also monitor the speed of reading. The pairs of children were maintained throughout the program. The researchers met with each group once a week for 15 minutes duration.

The intervention program was developed based on proposed methods to promote reading fluency^(3,6,8) by increasing oral reading rate through acceleration^(14,16,17).

The intervention program consisted of five sessions and used different texts for each session, varying according to syntactic complexity and word length. During the intervention, prosodic aspects of speech and written text were monitored giving feedback to the variation of intonation and acceleration of oral reading in order to increase the number of words read per minute (reading rate).

During the first session, children were exposed to variations in prosody, familiarizing them with prosodic features, in both speech and written text. The second and third sessions consisted of organizing the children in pairs, exposing them to vocabulary and content of the text through silent reading. The researchers then modeled reading aloud the text with proficient prosody and students were asked to reproduce the same model together with the other child.

During the fourth session, the students were not provided time to silently read the text. The researchers began the intervention session with modeling while the children silently followed the reading of the text, and afterwards they were requested to read aloud in pairs.

In the fifth session, children began reading the text silently, to familiarize themselves with the vocabulary and content of the text, and eventually ask questions about unknown words, and soon after, they read aloud with the researcher, to maintain the higher reading rate and prosody promoted during the previous sessions. The text was read aloud twice, and then, the participants practiced oral reading in pairs.

At the end of the five sessions of the intervention program, we used two different texts, leveled according to children's schooling level, in order to verify their performance on reading fluency through reading rate, as well as text comprehension, assessed through five direct questions. We also asked for a description of a picture, not related to the text, in order to verify the speech rate.

For the prosody analysis, we used a categorical scale determined by the researchers, in which prosody adequacy was classified in three levels: adequate, average and inadequate. The “adequate” classification refers to reading with appropriate prosody, intonation and stress pattern on the appropriate

syllable and moment of reading. The “average” classification refers to little variation of prosody in reading, with intonation and stress out of context. Students were classified as having “inadequate” prosody when demonstrating monotonous reading with no intonation.

For the initial reading rate (wpm), we calculated the number of words read per minute on both texts used on the pre-intervention, and then, for the later reading rate (wpm), we calculated the number of words read per minute on both texts on the post-intervention.

As for the analysis of the words read incorrectly (wri), we registered the number of words misread on both texts of the pre-intervention and on both texts of the post-intervention. We also registered the number of revisions made by the participants during reading and these were not counted as errors. We considered a revision when the child started to read the word wrongly, but soon after the beginning of the reading there was a correction, and the word was read correctly.

Statistical analysis

Statistical analysis for this study was performed with SPSS 13.0 for Windows, and the variables tested and analyzed were: speech rate, prosody, reading rate (wpm), text comprehension and words read incorrectly (wri).

RESULTS

At the beginning and end of the intervention program we calculated children's speech rate to set the baseline for the acceleration of oral reading. The mean values obtained were 73.81 wpm on the pre-intervention, and 72.72 wpm on the post-intervention (Figure 1).

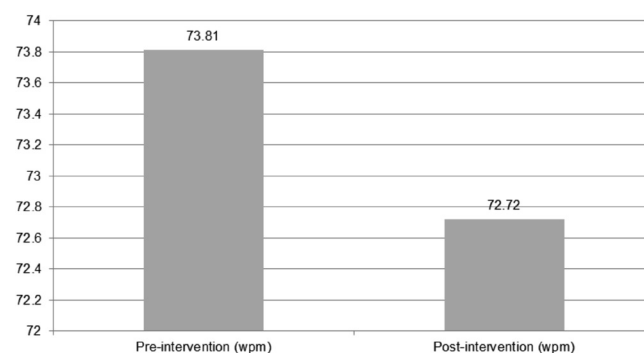


Figure 1. Mean values of speech rate on pre and post-intervention

On the pre-intervention, mean of reading rate was 95.53 wpm (text 1) and 94.49 wpm (text 2). As for the post-intervention, the mean of reading rate was 102.6 wpm (text 3), and 105.95 wpm (text 4) (Figure 2).

The correlation analysis between speech and reading rates was not significant (Spearman Correlation, $p > 0.05$).

Figure 3 shows the comparison between the mean of words read incorrectly (wri), and the number of revisions made during reading on the pre-intervention and on the post-intervention.

It is observed that a decrease on the mean of words read in-

Table 1. Central tendency measures of speech rate (wpm), words read incorrectly (wri), comprehension and prosody variables, pre and post reading intervention

Variable	Pre-intervention			Post-intervention			t-test	
	Min	Max	Mean (SD)	Min	Max	Mean (SD)	t	p-value
wpm (speech)	45.48	170.9	97.26 (30.69)	50.2	171.83	105.27 (29.25)	1.28	0.208
wri	0	12	2.5 (3.40)	0	9	1 (2.67)	10.94	0.01*
Comprehension	2	5	4 (1.14)	1	5	5 (1.09)	1.95	0.06
Prosody	1	3	2 (0.76)	1	3	3 (0.57)	3.94	0.00*

* Significant values (p<0.01) – Student's t-test

Legend: Min = minimum; Max = maximum; wpm = words per minute; wri = words read incorrectly; SD = standard deviation

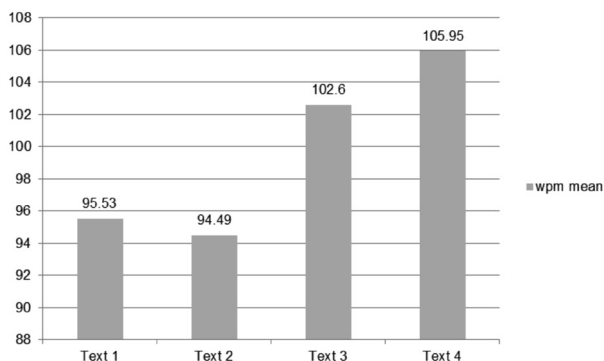


Figure 2. Mean value of reading rate in words per minute (wpm) on texts pre and post-intervention

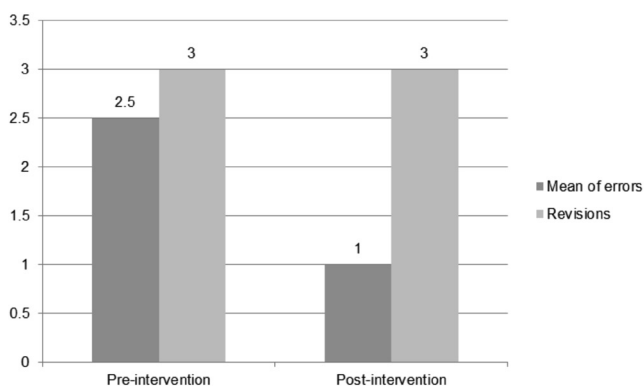


Figure 3. Comparison of words read incorrectly (wri) and revisions on pre and post-intervention

correctly occurred on the post-intervention, while the number of revisions remained the same.

Table 1 shows the means of central tendency and results of the statistic test, paired samples t-test, for the comparison of speech rate (wpm), words read incorrectly (wri), adequacy of prosody and comprehension, on pre and post-intervention.

The descriptive results of measures of reading performance are presented on Table 1. There was no statistically significant difference pre and post-intervention for the comprehension performance (t-test, t=-1.951, p=0.06) and for speech rate (t-test, t=1.285, p=0.208).

As for prosody, it was noticed that on pre-intervention, 28.2% (n=9) of the children had an adequate prosody, 40.6% (n=13) of the children had an average prosody, and 31.2% (n=10) had an inadequate prosody. On post-intervention, we

verified that 53.2% (n=17) of the children had an adequate prosody, 43.6% (n=14) had an average prosody, and 3.2% (n=1) had an inadequate prosody (Figure 4).

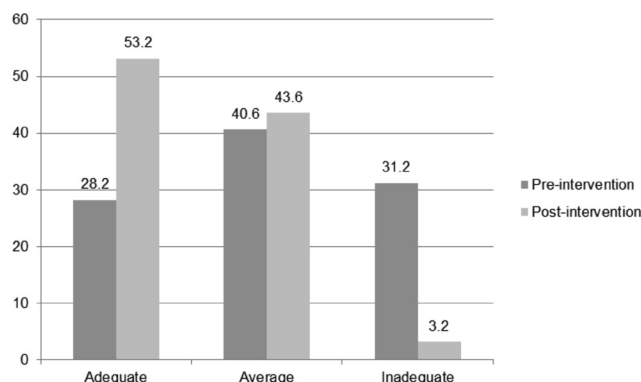


Figure 4. Comparison of adequacy of prosody in reading, pre and post-intervention

Based on the data shown above, it is possible to observe that there was a statistically significant difference in the comparison of the adequacy of prosody in reading (t-test, t=-3.947, p=0.00*), and on the number of words read incorrectly (t-test, t=10.94, p=0.01*), pre and post-intervention.

Table 2 shows the comparison of reading rate (wpm) among the texts read on pre-intervention (texts 1 and 2) and the ones read on the post-intervention (texts 3 and 4). It is noticed that a statistically significant difference occurred among all the texts, with the exception of the comparison between texts 1 and 2, both presented on the pre-intervention period.

Table 2. Comparison of reading rate in words per minute (wpm) among texts

	t	p-value
Text 1 – Text 2	1.090	0.284
Text 1 – Text 3	-4.458	0.000*
Text 1 – Text 4	-5.307	0.000*
Text 2 – Text 3	-5.361	0.000*
Text 3 – Text 4	-3.430	0.002*

* Significant values (p<0.01) – Paired samples t-test

DISCUSSION

The purpose of this study was to characterize children's

reading according to temporal parameters and, compare the performance of reading fluency in children before (pre-test) and after (post-test) an intervention program with emphasis on prosody.

As for the characterization of children's reading, considering the results obtained on pre-intervention of the children, children's reading rate showed a mean of 95.53 and 94.49 wpm, and 46.6% of the children had an average quality of prosody. A study with English speaking children from 4th grade, found a reading rate mean of 140 wpm, in fluent readers, and 80 wpm in children who had more difficulty to read⁽¹⁸⁾.

There was an increase in the children's reading rate mean when comparing pre and post-intervention. This might have occurred due to the fact that reading texts aloud with an accelerated speed, had promoted faster phonological decoding. These data are in line with findings of other studies^(16,17,19). Specific literature refers that fluency in reading is primarily based on an isolated words decoding rate, and furthermore, proposes that fluency is the result of speed of processing in the cerebral systems that are activated with word reading⁽¹³⁾.

There was a significant decrease on the number of words read incorrectly when comparing pre and post-intervention, and the mean number of revisions in reading remained the same; which could have also occurred due to the faster phonological decoding.

Individual reading rate acceleration has been indicated as a factor which enhances reading effectiveness, and so, accelerated reading can promote more efficient use of cognitive abilities. Therefore, acceleration seems to focus on attention and overcome some of the limitations of the phonological processing⁽¹⁶⁾. And so, another possibility for the decrease on the number of words read incorrectly and the fact that the number of revisions remained the same is that it could be a reflex of caution and attention of the child on the reading task.

Some authors suggest that fluency in reading and the accuracy of word recognition are both related to the speed to which information is processed. The phonological processing system operates through an auditory route and based on speech, and so, it displays phonemic information about print symbols and articulatory movements⁽¹⁹⁾.

Therefore, based on this theory, an accelerated speed of oral reading enables the child to receive auditory and visual stimuli, which promotes an increase in the speed of processing of phonological information.

There was no significant change observed in comprehension. This may have occurred due to the procedures taken to assess comprehension: five directed questions; this may have been too easy a task for this age range. Had we used more open questions we could have promoted broader responses, enabling a more complete comprehension assessment, with more information to be analyzed.

Another possibility to consider is the fact that this study did not consider comprehension ability as a target, and therefore, it was not given much emphasis on this variable during the reading intervention program.

In analyzing prosody, students made significant improvement when comparing the pre and post-intervention performance. The reading intervention included explicit instruction in the connection between speech and written language. Written

language has rhythm and intonation that are also present in human's speech, and so, reading with adequate rhythm and intonation is very important for the reader to understand the message. According to the literature, prosody consists in hearing temporal patterns, as the prosodic pattern has an internal organization, created by certain perceptions based on rhythm, intonation and stress. Speech processing is coordinated by auditory information and, therefore, the prosody presence in oral reading is essential^(1,20,21).

A study with 4th grade Hebrew speaking children investigated the relation between prosody, comprehension and morphology. The findings were similar to the ones of the present research: their data indicating that children showed better performance on prosody in reading tasks and text comprehension. However, even with a good prosodic performance, manifestations such words read in a wrong way and inappropriate pauses in the text, had a negative correlation to prosody, which may have contributed to the performance in reading⁽¹¹⁾. These results show that with the increase of reading rate, a decrease in words read in a wrong way occurred, enabling an improvement in the use of prosody during the reading task.

Future directions of this intervention program would be to focus on comprehension, since an effective decoding is a prerequisite for reading comprehension, and this effectiveness is determined by automaticity, which involves speed, lack of effort on decoding and autonomy⁽²²⁾.

By adding instruction for quick word decoding in oral reading, the stimulation program in prosody could also have the monitoring of comprehension during the reading task, for a complete success in reading fluency.

This was a preliminary study to verify the effect of reading fluency intervention by emphasizing prosodic aspects. Other studies, with a different experimental design with the inclusion of, for example, a control group and independent evaluator would be necessary to prove the efficiency of an intervention program of this kind. Furthermore, it is important to note that this program was applied on children without reading complaints. It would be interesting to apply this same approach on children with complaints and compare the results.

CONCLUSION

It was possible to characterize children's reading according to temporal parameters, as well as compare the performance of reading fluency in children before (pre-test) and after (post-test) an intervention program with emphasis on prosody.

We concluded that after the intervention program there was no changes in comprehension performance and the number of revisions during reading aloud, however, there was a significant increase on words read per minute, on word reading accuracy and on prosody quality during reading aloud after the intervention program.

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