Chapter # 29

RELATIONSHIP BETWEEN ORAL READING FLUENCY MEASURES AND VISUAL ATTENTION SPAN IN BRAZILIAN'S SCHOOLCHILDREN IN PANDEMIC CONTEXT

Reading fluency measures and Visual Attention Span

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ABSTRACT
The aim of this study was to relate the measures of oral reading fluency and visual attention span in Brazilian students from the 4th grade of elementary school. Eleven students were submitted to three measures of oral reading fluency and the global visual attention span (VAS) for five characters. The reading correct word per minute measure was used with three texts that differed in complexity. The study was carried out after the adoption of remote teaching in the Pandemic. Spearman analysis was performed between fluency and VAS variables, with no significance. The results revealed a greater number of correct words per minute in the third reading time compared to the first two times, revealing that the real reading performance of 4th grade students is the average of 39 to 40 words per minute and average of fixation of 50% of the characters. These findings indicate academic losses due to low reading fluency rate, fewer characters per fixation and lack of relationship between the variables. These results pointed out to the decrease in reading practices during the Pandemic. As conclusion, there is a need for further studies about this theme.

Keywords: reading fluency, visual perception, learning, educational measurement.

1. INTRODUCTION

In early March 2020, with the worsening caused by the new coronavirus Covid-19 pandemic, and to minimize the impacts of the disease, the suspension of face-to-face classes was decreed, replacing them with non-face-to-face activities and remote teaching (Sampaio, 2020). The return to face-to-face activities only occurred in August 2021, when this study had begun.

A fluent reader will have the ability to read aloud quickly, accurately, and expressively. Thus, due to its clinical and educational importance, following the proposal of this chapter, we will describe a brief review on the importance of fluency in the development of reading, in addition to the relationship with visoatencional aspects.

2. BACKGROUND

Good readers have adequate reading fluency. It is important to note that there is a progression from decoding to fluency, with increasing reading practices and advancing level of education. At the beginning of learning to read, all cognitive efforts are concentrated on

letter-sound conversion, as the reading process matures and becomes automatic, attentional resources can shift to processes related to comprehension, a skill that integrates reading fluency. to general language skills, memory, the ability to make inferences and knowledge of the world (Martins & Capellini, 2014, 2019, 2021)

For Martins & Capellini (2019) inadequate reading fluency can negatively impact the academic performance of students and be a determining factor in school failure. Since reading fluency is strongly related to comprehension, difficulties in this ability may represent a barrier to learning school contents, discouraging students, and weakening the school-student bond.

In addition, reading fluency is related to automaticity, accuracy, and prosody. Word recognition accuracy refers to the ability of readers to read the words in a text without pronunciation errors. In this way, reading with accuracy is related to the ability to decode the written word correctly, that is, it is necessary for the reader to have knowledge of the alphabetic system and the transparency relations of the language's orthographic system, in addition to having a wide range of vocabulary (frequent words) (Young & Rasinski, 2009).

In this way, the practice of reading can make the performance more automated and, consequently, faster. Therefore, automaticity refers to the ability of proficient readers to read the words in a text correctly and effortlessly so that they can use cognitive resources such as memory and attention to attend to the meaning of reading. Prosody refers to the ability of readers to read a text with expression and with appropriate intonation in sentences to reflect the semantic and syntactic content (Escudero & León, 2007; Levesque, Kieffer, & Deacon, 2017; Young & Rasinski, 2009).

Decoding and oral reading fluency are necessary for reading comprehension to be carried out efficiently, since it is considered a skill that depends on many other cognitive processes. Among these processes are those that involve linguistic components, such as morphological awareness, related to the knowledge of the word in its lexical, grammatical, and inflectional constituents; syntactic awareness, which concerns the structure of the clause, construction processes and punctuation; lexical-semantic awareness, which refers to the mental lexicon, meaning and sense of the word. Bearing in mind that meaning comes from the mental construction that depends on the interrelation between text, previous knowledge, and basic meaning, it is therefore also associated with the reader's ability to generate inferences (Escudero & León, 2007; Levesque, et al., 2017; Young & Rasinski, 2009).

Thus, as oral reading fluency is a bridge between decoding and reading comprehension. According with Rasinski and Young (2017), lack of proficiency in the primary grades often leads to continued difficulty in reading in succeeding grades. They pointed out that some students can present difficulties to move on to full-time employment or higher education are identified as ‘below basic’ in reading achievement. They have been characterized as having trouble in interpreting the meaning of words in grade appropriate texts as well as achieving an adequate understanding of such texts. If comprehension can be considered the ultimate goal of reading, these students struggle to make meaning from the narrative and informational texts they encounter.

In this way, reading can be understood as a visual-perceptual task that requires string processing of several letters that make up words. Readers need to pay attention to each letter of the word, successively, for its identification (LaBerge & Samuels, 1974; Martins & Capellini, 2014, 2019, 2021). The involvement of attention in the visual processing of letter sequences was formalized by Bundesen (1990). Thus, for Bosse, Tainturier and Valdois (2007) the visual-attentional interval (VA) was defined as the number of distinct visual elements that can be processed simultaneously at once.

Bosse et al. (2007) studied the visual attentional capacity during reading, which is related to the number of distinct visual elements that can be processed simultaneously in a

visual fixation, being important in the acquisition of reading and its processes. Based on these studies, the reading task of the present study used the criterion of 5 characters in the selection of words, which is the average of characters that can be apprehended in the foveal region during the eye fixation movement. (Ans, Carbonnel & Valdois, 1998; Bosse et al., 2007).

Thus, a fluent reader is expected to present adequate accuracy in decoding words, automatic processing (speed) and prosody during reading and it is consolidated in the third school year, with readers who have achieved the automation of reading processes (Barth, Tolar, Fletcher, & Francis, 2014). In this way, it becomes important to measure and observe reading performance for schoolchildren from this school year and in subsequent years.

3. OBJECTIVE

The aim of this study was to relate the measures of oral reading fluency and visual attention span in Brazilian schoolchildren from the 4th grade of elementary school.

4. METHODS

This is a prospective, cross-sectional study. The procedures of this study were applied face-to-face during the Covid-19 Pandemic, following the recommendations of the World Health Organization (WHO). The study was approved by the research ethics committee of the Faculty of Philosophy and Sciences of the São Paulo State University – UNESP, São Paulo, Brazil, under number 5.050.126.

All schoolchildren presented the Free and Informed Consent Term. The schoolchildren were indicated by the teachers, who mentioned reading and learning difficulties. They underwent the followed procedures.

-Reading Fluency Text (ADFLU, Martins & Capellini, 2019). Each student performed reading fluency measurements of a 4th grade's text, three texts that differed in complexity. For each text, measures were taken, such as the number of words read correctly per minute (WCPM) and the measure of words read incorrectly per minute (WIPM) were measured. Therefore, for WCPM, words pronounced correctly, words corrected by oneself, repeated words, words mispronounced due to the accent and inserted words were considered. For WIPM, mispronounced words, words substituted for others, omitted words, words read out of order, addition or omission of morphemes and hesitations were considered errors (if a student hesitated with a word for 3 seconds, he was told the word and marked as incorrect). For the quantification of errors, punctuation rules were also used for unique situations, such as: lines or several words omitted, reading numbers, words with hyphens that can exist independently and abbreviations. (Good, Gruba, & Kaminski, 2002; Kaminski & Good, 1998).

-Visual Attentional Span Tasks - Global Report (Whole report condition), (Bosse et al, 2007; Valdois et al., 2014) – notebook version. The visual attention test is a software in which the stimulus will be presented on the notebook screen, aiming to verify the number of characters captured by eye fixation movements, during eye movement. In this subtest, a sequence of five consonants was displayed for 200ms in the center of the computer screen. The sequence constructed from 10 consonants (BPTFLMDSRH) without repetition. To avoid lexical activations, the sequence bears no relation to a real word. Each sequence was used 10 times, appearing twice in each position. The letters were presented in capital format, black on a white background, at a visual angle of 0.7°. To minimize the crowning effect (letter overlapping), the distance between adjacent letters was increased (0.57 cm inter-letter space). The entire array was presented at an angle of approximately 5.4°. The task was started after

10 training tests, so that the students received feedback. At the beginning of each test, a central fixation point was presented with a duration of 1000ms, followed by 50ms of a blank screen for. Then, the sequence of consonants was presented in the center of the screen with a duration of 200ms. Twenty experimental tests were displayed. The student must verbally report the name of the identified letters. The numbers of items reported accurately were measured, regardless of location, and the score was performed by correct answers and displayed as a percentage (maximum = 100).

The results were analyzed statistically, adopting the value $p< 0.05$ for the statistically significant values, being indicated with an asterisk ($*p< 0.05$). Application of the Friedman Test, to verify possible differences between the variables of interest, when compared concurrently. The Spearman Correlation was also used to verify two variables without any restriction regarding the distribution of values.

5. RESULTS

Table 1 presents the comparison for the reading fluency measures of the number of words read correctly per minute (WCPM) and words read incorrectly per minute (WIPM), three texts that differed in complexity, and one measure of Visual attentional span tasks (%VAS).

Table 1.
Comparison of read correctly per minute (WCPM) and words read incorrectly per minute (WIPM).

Variables	Mean (standard deviation)	p-value	Variables	Mean (standard deviation)	p-value
WCPM 1	39,18 (31,37)		WIPM 1	6 (2,32)	
WCPM 2	37,45 (26,89)	0,005*	WIPM 2	6(5,35)	0,839
WCPM 3	47,73 (30,56)		WIPM 3	13,73 (31,33)	
%VAS	55,9 (11,2)				

Caption: WCPM: number of words read correctly per minute; WIPM: words read incorrectly per minute; %VAS: Visual attentional span tasks.
Friedman Test ($*p< 0.05$).

Table 2 presents the analysis of Spearman's Correlation between the Visual attentional span tasks (%VAS) and the fluency measures.

Table 2.
Correlation between the Visual attentional span tasks (%VAS) and the fluency measures.

Variables	Statistic	%VAS	Variables	Statistic	%VAS
WCPM 1	correlation coefficient	0,527	WIPM 1	correlation coefficient	-0,266
	p-value	0,095		p-value	0,429
WCPM 2	correlation coefficient	0,397	WIPM 2	correlation coefficient	-0,261
	p-value	0,226		p-value	0,438
WCPM 3	correlation coefficient	0,478	WIPM 3	correlation coefficient	-0,303
	p-value	0,137		p-value	0,365

Caption: WCPM: number of words read correctly per minute; WIPM: words read incorrectly per minute; %VAS: Visual attentional span tasks.

The results revealed a greater number of correct words per minute in the third reading time compared to the first two times, revealing that the real reading performance of 4th grade schoolchildren is the average of 39 to 40 words per minute and average of fixation of 50% of the characters.

6. DISCUSSION

These findings indicate academic losses due to low reading fluency rate, fewer characters per fixation and lack of relationship between the variables.

The development of reading fluency is essential for schoolchildren, especially when they move from learning to read to reading to learn. To perform any activity automatically, it is necessary to carry out, for example, activities with some properties, such as reading without conscious attention, without effort, with speed and with autonomy (LaBerge & Samuels, 1974). Automatic decoding allows that conscious attention and memory, previously dedicated entirely to the word level, can be used in cognitive processes at the sentence level and in the meaning itself, specifically. (LaBerge & Samuels, 1974).

In addition, automatic word recognition is central to the construct of fluency and fluency's role in the comprehension of text. As automaticity develops, whether in terms of reading, perceptual-motor activities (eye movements, for example), or another skilled task, the learner's performance not only becomes accurate, but it also gets faster. With automatization of lower-level processes, readers can shift their attention from lower-level skills to higher level, integrative aspects of reading such as reading fluently with comprehension.

Disfluent readers, on the other hand, are unable to integrate these lower-level skills with higher level ones, primarily because of the effort they need to expend on word recognition (LaBerge & Samuels, 1974; Kuhn, Schwanenflugel, & Meisinger, 2010). It seems likely that seeing words in multiple contexts improves students' recognition of those words (Kuhn, et al., 2010). However, for the schoolchildren in this study, this repetition and reading experience may not have occurred satisfactorily.

The schoolchildren in this study had visual-attentional difficulties, which were not related to reading fluency. This finding may be related to the fact that the visual-attentional interval plays an important role in reading acquisition, since it outlines the amount of orthographic information that can be processed at each stage of the reading process (Valdois, Bosse, & Tainturier, 2004). A larger VA range encompasses an entire string of letters in a word, allowing each letter to be accurately identified, in parallel, so that the word can also be identified, quickly.

The schoolchildren in this study presented 50% of this interval, suggesting a deficit in visual processing capacity, since they were unable to capture the entire visual-attentional interval, resulting in slow decoding (Bosse et al., 2007). Reading practice is necessary for the development of fluency, which will be stagnant and may compromise the student's opportunity to learn academic content, which also consecutively depends on good reading (Rasinski, 2017).

Bosse et al. (2007) and Zoubrinetzky, Bielle, and Valdois (2014), who reported a relatively strong dissociation between visual attention span and phonological deficits, we observed an important overlap. In fact, all dyslexic children with visual attention deficits also presented phonological deficits, either in accuracy or in speed, and none presented pure visual attention deficits, as observed in this study.

Saksida et al. (2016) corroborate this study, bringing important reflection on the visual attention deficit and phonological aspects. The authors report that most cases with visual attention deficit also present phonological deficit and, in these cases, the presence of visual

attention deficit does not seem to worsen their reading disability. This is consistent with the view that the development of visual attention follows the ability to read and that a phonological deficit can therefore delay the development of visual attention.

However, the authors still report that as phonological skills are reciprocally influenced by reading ability, a reading disability initially induced by a visual attention deficit would be expected to delay the development of phonological skills, perhaps to the point of criterion for a phonological deficit. Therefore, in agreement with the authors, we cannot exclude that some cases in the present study actually had visual attention deficit as the primary cause of dyslexia and phonological deficit as a secondary outcome.

Thus, the results of this study indicate that schoolchildren had difficulties in the formation of lexical representation in long-term lexical orthographic memory. Studies indicate that for the essential development in learning to read is the acquisition of automatic word reading skills (defined in this study as the ability to pronounce written words in isolation) (Steacy et al. 2017).

For the authors, the automation of word reading allows fluent and reliable retrieval of word representations from the orthographic lexicon, activating phonological, syntactic, morphological and semantic information to be used by the reader to form faithful representations of the text. As children learn to read, the orthographic lexicon expands through an increase in the absolute number of orthographically addressable entries, called "word-specific" representations (Steacy et al. 2017). Thus, we can infer that the students in this study had difficulties in the formation of orthographic lexicon, having unreliable representations, which would justify the reading errors, and confirm the risk for specific reading learning problems.

However, it is noteworthy that such findings may have been influenced by the lack of reading practices, aggravated by the pandemic. In the school context, Brazilian education has adopted social distancing and remote teaching, which have led to unfavorable situations for both professionals and families, such as forced digitization, lack of preparation for handling technological tools and greater elaboration and availability of academic rather than social content (Hoofman & Secord, 2021).

It is also important to highlight that, in recent studies (Santana, Capellini & Germano, 2022; Stolf et al., 2021), carried out after the end of remote teaching, indicated that students presented difficulties regarding predictive reading skills, such as alphabet recognition, phonological awareness, and cognitive-linguistic skills, which can impact the reading fluency performance.

However, as highlighted in these studies (Santana, et al., 2022; Stolf et al., 2021), such difficulties have already been indicated in study prior to the Covid-19 Pandemic (Germano, César, & Capellini, 2017), calling attention to the lack of instructional teaching of the alphabetic base of the Brazilian Portuguese writing system.

7. FUTURE RESEARCH DIRECTIONS

The students were characterized as at risk for learning problems, which brings us, as future implications, the need for continuity of studies that investigate reading fluency measures and their relationship with visual attentional performance, to favor early identification and carry out referrals to multidisciplinary care services.

8. CONCLUSION

These findings indicate academic losses due to low reading fluency rate, fewer characters per fixation and lack of relationship between the variables. Thus, it is important to measure and observe reading performance for schoolchildren from this grade onwards, since the impacts of low reading performance will be reflected in academic performance.

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