Chapter #29

ORAL READING FLUENCY MEASURES FOR EDUCATIONAL MONITORING

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ABSTRACT
This study assessed oral reading fluency development in students from the 2nd to the 5th grade of Elementary School I over a school year. The research involved 400 students, aged 7 to 10 years, from a municipal public school in São Paulo. The Performance Assessment in Reading Fluency was employed, and students were evaluated in March, July, and November using three texts of similar complexity. The analysis considered the number of words read correctly and incorrectly per minute, with statistical analysis conducted using SPSS 22.0. The results revealed significant improvements in reading fluency over time. The Wilcoxon Signed Rank Test indicated a statistically significant difference between the third and first assessment moments, with increased words read correctly and decreased errors. The Mann-Whitney Test further supported these findings, indicating that the first assessment had fewer words read correctly per minute compared to the second and third assessments, along with fewer misspelt words. In conclusion, this study provides a simple, reliable, and valid method for monitoring and tracking the progressive development of oral reading fluency in students from the 2nd to the 5th grade of Elementary School I.

Keywords: oral reading fluency, measurement reading, screening, progress monitoring, assessment reading.

1. INTRODUCTION

Oral reading fluency is a multifaceted construct encompassing three key dimensions: automaticity, accuracy, and prosody (Kim, Quinn, & Petscher, 2021). Proficiency in these areas not only signifies a student's ability to decode words effortlessly but also signifies the liberation of cognitive resources for higher-order reading functions (Rasinski et al., 2017). Consequently, both the assessment and intervention of reading fluency have garnered significant attention from researchers (Bigozzi, Tarchi, Vagnoli, Valente, & Pinto, 2017; Kostewicz, Kubina, Selfridge, & Gallagher, 2016; Makebo, Bachore, & Ayele, 2022).

The evaluation of oral reading fluency has evolved in several ways, as highlighted in the literature (Hasbrouck & Tindal, 2006; 2017). It serves a dual purpose; the first (complicated by the small number of studies with Brazilian students who bring regulations to the population of other regions of the country; in addition to the lack of appropriate material), it would be based on the performance levels of the students, that is, based on short evaluations, comparing them with each other, thus obtaining a screening measure, an assessment focused on predicting the development and growth of reading skills (Alves et al., 2021; Pereira, Alves, Martins-Reis, & Celeste, 2021), which could determine whether a

student would need support in reading (extra help or alternative forms of instruction), which would contribute to the early identification of students at risk of reading difficulties (Arnesen et al., 2017). The second way to carry out the work with the students would be to observe the development of reading fluency with themselves over time and compare it to the class group. This second way of using oral reading fluency has been called a performance monitoring measure (Furey & Loftus-Rattan, 2022). Monitoring measures can be collected three times in the school year; they are short, individually administered assessments (typically 1 to 3 minutes in duration) that provide information on students' ongoing performance in reading fluency.

Thus, studies that assess reading fluency at the beginning of the school year and its growth throughout this year are critical. As few studies on oral reading fluency have been adapted as a screening and monitoring method in Brazil, this research is highly urgent. Furthermore, the need for psychometric validation of the screening measures concerns other researchers who are experts in reading fluency. While examining student progress over time is crucial, progress monitoring needs to be integrated into national reading assessments or broader reading tests.

2. BACKGROUND

Reading fluency has been demonstrated to be a valid and safe measure to monitor progress and can be used as a predictive skill. Fluency measures should be regularly presented to monitor student development. This progress monitoring data can be graphed, providing visual feedback to educators about student progress in an academic skill area such as reading, more specifically, oral reading fluency. Thus, to assess a student's progress, reading fluency data is plotted on a graph in the form of a time series. The horizontal axis of the graph represents time (i.e., the date on which each reading was performed) and the vertical axis represents the words read correctly in one minute (PCPM) during the administration of the so-called Curriculum-based measurement (CBM) (Deno, 1985). The method known as CBM is a curriculum-based monitoring method to measure growth in specific areas of knowledge and basic skills, and evaluate the effects of instructional programs (the response to intervention). Curriculum-based assessment has become popular in the field of education proposing that the basis of assessment of learning is what has been taught. Thus, the CBM assessment method is a procedure described as curriculum-based as it is used within the context of the school curriculum, assessing basic reading, spelling, writing and expression skills.

Based on the CBM assessment method, the identification of students with reading difficulties and at risk for difficulties can be carried out through reference norms in oral reading fluency (FLO), which allows for the analysis of 1 minute of reading (for example, scores of the number of words read correctly per minute - PCPM). This FLO assessment focuses on two of the three components of fluency (rate and accuracy) and requires the student to read for one minute from a text appropriate to their grade level and unpublished, meaning that they have not encountered the text before. At the end of one minute, errors are subtracted from the total words read to calculate the PCPM score (Hasbrouck & Tindal, 2006).

The method was developed to create procedures for measuring the progressive development in a simple, reliable, and fast way, allowing teachers to frequently and repeatedly measure students' growth. However, despite the widespread use of progress monitoring in schools in developed countries, it is noted that in Brazil, few studies have focused on the topic, and there is no culture of tracking or monitoring in classrooms.

In a recent study, researchers investigated whether reading fluency could be used as an indicator of competence throughout the school year for Brazilian students in grades 3 to 5 of Elementary School I, based on assessments of reading speed, accuracy, and reading comprehension at two assessment points, with a five-month interval. The results indicated that in the intergroup comparison, the control group statistically outperformed the group of interest (students with special education needs) in both variables and all measures, while in the intragroup comparison, statistically significant improvement was observed only in the group of interest. Additionally, based on the Progression Coefficient, the results showed improvement in reading fluency measures for both groups. Thus, reading fluency also appears to be an indicator of reading competence for Special Education, for students with specific functional disorders such as dyslexia, dysorthographia, dysgraphia, dyscalculia, and attention deficit hyperactivity disorder, according to local resolution (Pereira et al., 2021).

The use of progress monitoring measures is closely related to Response to Intervention (RTI) programs. Therefore, oral reading fluency could be used as a tracking system to select children for RTI tier 2 programs, for example, as it is sensitive to changes over the course of the year. Shapiro, Zigmond, Wallace, and Marston (2011) noted that in conjunction with the RTI system, monitoring FLO also helps make decisions about the effectiveness of tiered instruction. Educators can administer a universal screening assessment to identify students at risk of low performance and also monitor the progress of intervention target students (Nese et al., 2012).

To assess reading fluency, scores for the number of words read correctly per minute (PCPM) and the number of words read incorrectly per minute (PIPM) must be measured with three texts of the same difficulty level, and then the median is calculated. Thus, the PCPM measure can be used for screening to identify academically at-risk students, placement in remedial and special education programs, monitoring student progress, improving teaching programs, and predicting performance in high-stakes assessments (Martins & Capellini, 2021). Researchers suggest that the best way to use the PCPM measure would be to calculate the average PCPM performance of students across three passages, meaning that PCPM and PIPM are calculated for each passage, and then the average of the three passages read is calculated. Alternatively, other methods used include the median of three passages, the average of the second and third passage, or the score from the third passage (Petscher & Kim, 2011).

Recommendations for using FLO as a CBM method have been reviewed by Ardoin, Christ, Morena, Cormier, and Klingbeil (2013) in the context of RTI (for making decisions). Since there are two types of analyses that can be done with collected FLO data, Ardoin et al. (2013) explain that, based on previous research, a cutoff rule or a decision rule from a trendline can be used. Both rules require a comparison between the observed growth rate and a goal rate (desired rate). The goal line is a straight line connecting the student's initial performance level to the desired performance level at the end of the intervention period. For the cutoff rule, it is observed whether the student's PCPM rate over time is above or below the established goal line. A commonly used guideline is that 3 to 5 consecutive data points below the goal line indicate ineffective intervention, requiring intensification of the intervention to produce greater changes (e.g., increased frequency, longer duration, or more individualized instruction) or even complete changes to better address the deficit. Similarly, 3 to 5 consecutive data points above the goal line indicate that the student may achieve greater gains than initially expected, and therefore, the goal should be increased. When the last 3 to 5 data points are above and below the goal line, the intervention is maintained, as the data suggest that the intervention is ongoing (Stecker, Fuchs, & Fuchs, 2008; Shapiro & Clemens, 2009).

3. OBJECTIVES

This study aimed to monitor the development of oral reading fluency in students from the 2nd to the 5th grade of Elementary School I during the school year.

4. METHODS

4.1. Participants

This study was approved by the home institution's research ethics committee (09575419.0.0000.5406). The study included 400 students from the 2nd to the 5th grade of Elementary School I from a municipal public school (in a medium- and a small-sized Brazilian city, Southeast Region of Brazil) in the interior of the State of São Paulo, aged from 7 years to 10 years and 11 months. The schools were selected through convenience sampling (simple convenience sample). The students participating in the studies did not have a history of repeating grades; they were monolinguals and native speakers of Brazilian Portuguese.

The inclusion criteria for the sample selection were as follows: informed consent form signed by the parents or guardians for the students; students with no history of neurological or psychiatric illnesses, uncorrected auditory and visual impairments, and cognitive performance within normal, according to the description at the school records and teachers' reports. The exclusion criteria for the sample selection were the presence of genetic or neurological syndromes in the students and students who did not present a satisfactory reading domain level for observing the variable proposed in the study.

4.2. Materials and Procedures

The Performance Assessment in Reading Fluency was applied (Martins & Capellini, 2018). This procedure assessed reading fluency based on the number of words read correctly per minute. The instrument presents 70 passages (narrative and expository), with the word count, presented progressively per line to facilitate the evaluation, with passages that contain 64 to 194 words.

Initially, the passages were designed for students from the 1st to the 4th grade. However, a readjustment was necessary since most Brazilian students are not readers in the 1st year. The collection was restructured to be used as an assessment from the 2nd to the 5th grade when the first cycle of education in Brazil ends.

A study of the complexity of the passages was conducted and based on the fluency of oral reading; they were sequenced from the easiest to the more difficult passages since there is a range of criticisms for research that only uses readability formulas for selecting equivalent level probes (Ardoin, Suldo, Witt, Aldrich, & McDonald, 2005; Begeny & Greene, 2014). After this classification, a statistical analysis was conducted to categorise the passages by quartile to group the most similar texts. The averages of the passages were analyzed by quartile distribution and categorized into: low (< first quartile – Q1), regular (between the first and third - Q1 and third quartile - Q3), and high (> than the third quartile Q3). The normal distribution was verified using the Shapiro-Wilk test with Lillifor correction. Comparison between performance categories was performed using ANOVA for repeated measures and post hoc comparisons using the Bonferroni test. The significance level adopted was 5%. Data were analyzed using SPSS software, version 19.0 for Windows. Thus, sets of three passages were selected for each time of the year (beginning, middle and end) for each grade.

Reading fluency measures were performed by collecting oral readings of three passages with the closest possible textual complexity in March, July and November. For the analysis of each passage, the analysis parameters of the errors made during reading were used, referring to words read correctly and incorrectly per minute.

In this approach, the types of errors that are marked as WIPM are mispronounced words, words substituted with others, words omitted, words read out of order, addition or omission of word endings, and hesitation (words on which the student paused more than 3 seconds, after which they are told the word, and it is marked as incorrect. If necessary, the student is said to continue with the following word (Martins & Capellini, 2018). The following items indicate all situations that are marked as WCPM: words pronounced correctly, self-corrections, words decoded slowly but ultimately read correctly, repeated words, words mispronounced due to dialect or regional differences, and words inserted. To quantify errors, scoring rules are also proposed for certain situations: lines or multiple words omitted; when one or more lines are not read (four or more omitted words in sequence), they are not considered errors, although those words are excluded from the WCPM (such that this rule is applied whenever a student skips four or more words within a sentence). If the student skips one, two, or three consecutive words, each word should be counted as an error (WIPM) (Martins & Capellini, 2018).

The Mann-Whitney Test was applied to verify possible differences between the three times of the year – March (beginning), July (middle) and November (end) for the WCPM and WIPM variables in each grade. After applying the Mann-Whitney Test, as statistical differences were found, the Wilcoxon Signed Rank Test was applied to identify which time of year variables (beginning, middle and end) differ when comparing two to two. The results were statistically analyzed using the Statistical Package for Social Sciences, version 22.0, with a significance level of 5% (0.050).

5. RESULTS

With the application of the Mann-Whitney Test, it was possible to verify that there was a statistically significant difference, indicating that the groups had a lower number of words read correctly per minute (WCPM) in the first reading measure compared to the second and third measures (see Table 1). This finding was also found in words read incorrectly per minute (WIPM), indicating that the number of errors decreased throughout the school year (see Table 2).

Table 1.
Comparison of WCPM measures in 3 moments of the school year.

	WCPM	n	Average	SD	Min	Max	Percentile 25	Percentile 50	Percentile 75	Sig. (p)
2nd grade	beginning of the year		16.89	4.13	7.00	30.00	14.00	17.00	20.00	
	middle of the year	100	23.38	4.94	9.00	32.00	21.00	24.00	27.00	< 0.001*
	end of year		27.14	5.91	10.00	37.00	24.00	28.00	31.00	

		n	Average	SD	Min	Max	Percentile 25	Percentile 50	Percentile 75	Sig. (p)
3rd grade	beginning of the year		44.01	7.45	34.00	68.00	39.00	42.00	48.00	
	middle of the year	100	49.75	7.39	36.00	73.00	44.25	49.00	55.00	< 0.001*
	end of year		54.29	6.80	36.00	69.00	49.25	55.00	59.00	
4th grade	beginning of the year		58.04	3.04	50.00	68.00	56.00	58.50	60.00	
	middle of the year	100	62.57	3.89	53.00	70.00	60.00	62.50	65.00	< 0.001*
	end of year		66.04	3.97	53.00	72.00	62.25	67.50	69.00	
5th grade	beginning of the year		62.34	4.74	54.00	71.00	58.25	62.00	67.00	
	middle of the year	100	64.30	4.60	56.00	72.00	60.00	64.00	68.75	< 0.001*
	end of year		71.02	5.08	58.00	79.00	68.00	71.00	75.00	

* Statistically significant difference

Table 2.
Text Comparison of WIPM measures in 3 moments of the school year.

	WIPM	n	Average	SD	Min	Max	Percentile 25	Percentile 50	Percentile 75	Sig. (p)
2nd grade	beginning of the year		5.57	2.20	2.00	10.00	4.00	5.00	7.00	
	middle of the year	100	3.45	2.07	0.00	9.00	2.00	3.00	4.75	< 0.001*
	end of year		2.64	2.04	0.00	10.00	1.00	2.00	4.00	
3rd grade	beginning of the year		1.07	1.51	0.00	7.00	0.00	1.00	1.75	
	middle of the year	100	0.84	1.26	0.00	8.00	0.00	0.50	1.00	0.005*
	end of year		0.62	0.91	0.00	5.00	0.00	0.00	1.00	
4th grade	beginning of the year		0.71	1.31	0.00	5.00	0.00	0.00	1.00	
	middle of the year	100	0.29	0.62	0.00	3.00	0.00	0.00	0.00	< 0.001*
	end of year		0.07	0.26	0.00	1.00	0.00	0.00	0.00	

5th grade	beginning of the year		0.21	0.48	0.00	2.00	0.00	0.00	0.00	
	middle of the year	100	0.08	0.27	0.00	1.00	0.00	0.00	0.00	< 0.001*
	end of year		0.00	0.00	0.00	0.00	0.00	0.00	0.00	

* Statistically significant difference

With the application of the Wilcoxon Signed Rank Test, it was possible to verify that there was a statistically significant difference in the groups of this study both for the total number of words read correctly in one minute and the total number of words read incorrectly between the third moment of the fluency measure in comparison with the first moment when compared to peers, as can be seen in Table 3.

Table 3.
Comparison between pairs of reading measures at three times of the school year.

		2nd grade	3rd grade	4th grade	5th grade
WCPM and WIPM	Time of year	Sig. (p)	Sig. (p)	Sig. (p)	Sig. (p)
WCPM	middle X beginning	< 0.001*	< 0.001*	< 0.001*	< 0.001*
	end X beginning	< 0.001*	< 0.001*	< 0.001*	< 0.001*
	end X middle	< 0.001*	< 0.001*	< 0.001*	< 0.001*
WIPM	middle X beginning	< 0.001*	0.033	< 0.001*	0.009*
	end X beginning	< 0.001*	0.001	< 0.001*	< 0.001*
	end X middle	< 0.001*	0.009	0.001*	0.005*

* Statistically significant difference

6. FUTURE RESEARCH DIRECTIONS

Many limitations can be observed in this current research; therefore, the results must be interpreted cautiously. First, the study includes students from only one region of the country. Since Brazil is a country of continental dimensions, with significant cultural differences and even speech rates, research must expand to other areas and increase the sample size, schools, years and grades to assess the external validity of these findings.

However, this small study is also an impetus for discussions about methods, procedures and instrumentation to continue to be evaluated and developed, which may reach the context of supporting RTI models in Brazilian schools.

Based on the data presented in this chapter, experimental studies will be conducted to evaluate the effects of different teaching strategies to promote oral reading fluency.

7. DISCUSSION AND CONCLUSIONS

Data collection in three periods of the year, with a median of three passages with elementary school students, is an unprecedented form of monitoring in Brazil since we have yet to find scientific articles that used the WCPM measurement in this monitoring format. Moreover, this is just the first step to start disseminating this type of assessment among

teachers, and discussions about how to use these measures need to be the second step. This is because it is necessary that students are identified for their reading difficulties and also as at risk for future problems. When WCPM measures are collected systematically throughout the school year, they can be monitored to ensure that interventions are offered as identified (Deno, 1985; Nese, 2022; Stecker et al., 2008).

Progress monitoring data has been much discussed in the literature in the context of producing estimates of growth that are sufficiently reliable for educators to make meaningful inferences about a student's response to the intervention. WCPM data can be graphed over time and compared to a trend line of student performance against an established goal. These assessments are quick and consistent, ensuring that they can be administered uniformly across various time points. This consistency is critical for generating reliable data that can be used to drive instructional decisions. (Fuchs, Fuchs, Hosp, & Jenkins, 2001).

Monitoring carried out throughout the school year with students from 2nd to 5th grade revealed differences that are early evidence that measures of oral reading fluency can be used to monitor student progress over an entire year, and that brings several advantages discussed for educators, mainly making it possible to identify students at risk, monitor student learning outcomes, assess intervention effectiveness, and develop benchmarks for Brazilian students.

In conclusion, the adoption of WCPM measurements at multiple intervals throughout the school year in Brazil represents a promising step towards enhancing literacy education. As further research is conducted and discussions evolve on how to effectively utilize these measures, the potential benefits for students and educators alike are considerable.

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