Original Article

Artigo Original

The relevance of syllable per minute measuring at the assessment of reading rate

A relevância da medida de sílabas por minuto na avaliação da velocidade de leitura

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Keywords

Learning
Reading
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ABSTRACT

Purpose: To verify whether there are differences in the assessment of reading rate of children at 3rd and 4th grade from elementary school using the measures of words read per minute and syllables read per minute. **Methods:** This research counted on 29 children from 3rd grade and 28 from the 4th grade of elementary school without reading and writing disorders. All children were asked to read aloud a text according to their schooling level. The procedure was recorded and the reading rate was calculated both in words and syllables read per minute. **Results:** Data indicated that syllable read per minute measure was more effective to calculate reading rate of children from different schooling levels since it provides a more reliable profile of reading rate. **Conclusion:** The present study showed evidences that syllable per minute measure is more precise to characterize children's performance since it considers linguistic and textual features.

Descritores

Aprendizagem
Leitura
Linguagem
Avaliação
Educação

RESUMO

Objetivo: Verificar se há diferenças na avaliação da velocidade de leitura de crianças do 3º e 4º anos do ensino fundamental, utilizando-se as medidas de palavras lidas por minuto e sílabas lidas por minuto. **Método:** Esta pesquisa contou com 29 crianças do terceiro ano e 28 do quarto ano do ensino fundamental sem alterações de leitura e escrita. Todos foram solicitados a realizar a leitura de um texto de acordo com a sua escolaridade. O procedimento foi gravado e a velocidade de leitura foi calculada em palavras e sílabas lidas por minuto. **Resultados:** Os dados indicaram que a medida de sílabas por minuto foi mais efetiva para aferir a diferença de velocidade de leitura de crianças de diferentes anos escolares, pois traça um perfil mais fidedigno da velocidade de leitura. **Conclusão:** A presente pesquisa mostrou evidências de que a medida em sílabas lidas por minuto é mais precisa na caracterização do desempenho das crianças, pois tal medida considera os aspectos linguístico-textuais.

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INTRODUCTION

The assessment of reading rate is a very common procedure at the clinical speech language therapy practice because it contributes to check the children's performance in such ability and monitor educational and therapeutic educational programs. Besides, the studies regarding the acquisition and typical development of the decoding abilities promoted consistent advances in the knowledge about the reading processing[1-4].

Understanding how the proficient reading is consolidated and how its fluency parameters have become, along the years, an important field of investigation for researchers of different areas of knowledge. This is due to the need of better understanding such processes in order to more efficiently interfere in the different learning disorders. And, besides that, the understanding of this phenomena is important for the development of public educational and political programs that aim at the improvement of children's literacy methods[5].

In international studies about reading, it is common the description of the use of standardized tests for assessment. These tests are formed by lists or words and texts that should be read by the children at a pre-established time interval[6-10]. For the Brazilian Portuguese there are not yet standardized tests for such evaluation and, this way, the reading rate has been calculated independently.

For the speed reading analyses, the most applied measure, at both national and international studies, is of words read per minute (WRPM)[2,3,7-9,11-14]. Such measure is extremely important however, one aspect should be highlighted, namely, it ignores the effect of the word extension and syllable structure. This way, on comparing the performance of children of different school ranges, in texts adequate to their school level, it is disregarded the fact that there is a complexity increase of the school texts, as they progress in their grades, and the results can be inconclusive.

To apply a measure that is independent from the type of text and from its complexity can facilitate the comparison of the reading rate of children that are in different school levels, because, this way, it is possible to neutralize the effect of number, extension and syllable structure of the words and, consequently, it will be reached higher precision at the performance comparison of children from different school grades[15].

In studies that evaluate the speaking speed[16-18], it is common the use of the syllables per minute (SRPM) measure, because it neutralizes the effect of the extension of the words. This way, the use of SRPM measure at the assessment of reading rate can offer more reliable results on isolating linguistic-textual facts.

In this way, the objective of this study was to verify if there are differences at the assessment of reading rate of children from the 3rd and 4th grades of the elementary school, using the words read per minute and read syllable per minute measures.

METHODS

Study approved by the Ethics Committee of the Institution under nº 149/11. This research counted on 29 children from the 3rd grade (GP1) and 28 from the 4th grade of the elementary school (GP2), totalizing 57 individuals. The parents/responsible for the children signed an informed consent form authorizing their children's participation in the study.

To participate on this research, children met the following inclusion criteria: lack of complaints or indicators related to hearing and/or sight alterations, lack of indicators of neurological, behavioral or cognitive disorders, as well as oral language alterations; lack of difficulties or disorders on learning how to read and lack of school record retentions; performance as expected for the age at the speech language therapy test ABFW[19]; performance classified as average or above for schooling at the total score of the School Performance Test (TDE)[20].

Procedure for individual's selection

All parents/responsible for the children signed an informed consent form authorizing their children's participation in the study. Besides, they answered a questionnaire regarding their children oral and written language[21]. The individuals' teachers also filled out a questionnaire regarding these children academic performance and behavioral characteristics[21]. Only proceeded with the research the children whose parents and/or teachers reported no type of complaint. The other cases were guided and forwarded to the speech language therapy service closest to their homes.

After this, the selected children went through speech language therapy evaluation regarding the phonological aspects of the oral language and written language evaluation. Related to the phonological aspects, it was applied the imitating test of the phonology part of the children language test ABFW[19] for the investigation regarding the speech language therapy system of the individuals. For the assessment of the written language, it was used the TDE[20], according to the manual guidelines for its application and interpretation.

Application of the experimental test and speed analyses through different measures

To characterize the reading rate, it was selected a text for GP1 and another for GP2, according to the school grade of the individuals, both texts belonging to the Assessment Test on the Reading Comprehension of Expositive Texts[22].

It should be highlighted that different authors have already pointed out that the texts used to obtain reading fluency parameters should be according to the individual's school grade, his socio cultural level and his literacy practices[1,9,23]. Due to such factors, it was opted to use different texts, respecting the reading profile of the students of different educational levels.

The children were requested to read the text according to the instructions given by the evaluator, which permeated the following aspects: keep the text on the table during all the reading; adequate body posture during the evaluation; start the reading and go through the end of the text avoiding interruptions, otherwise it would be restarted. The readings were recorded by the evaluator and transcribed for a more accurate analyses.

The reading rate was verified by analyzing the video recording performed during data collecting. It was exclusively accounted the reading time in seconds, being ignored pauses resulting from cough, yawning or any other event, by means of *software Real*

Player® using the option "edit video". The reading rate was calculated through two measures: WRPM and SRPM, according to description in Chart 1.

In this analyses, it was calculated the total reading time, being ignored pauses resulting from cough, hawk, nasal congestion or cold. This way, it was only accounted the total reading time.

To base the analyses of the two reading rate measures, it was calculated the number of monosyllables, disyllables, trisyllables and polysyllables in each one of the different texts. It was observed higher number of words of all extensions in the text used for the evaluation of GP2 students (Figure 1).

Besides, it was also identified higher quantity of trisyllables and polysyllables in the GP2 text, as well as higher number of syllables of all types, with larger difference in those of higher complexity (Figure 2).

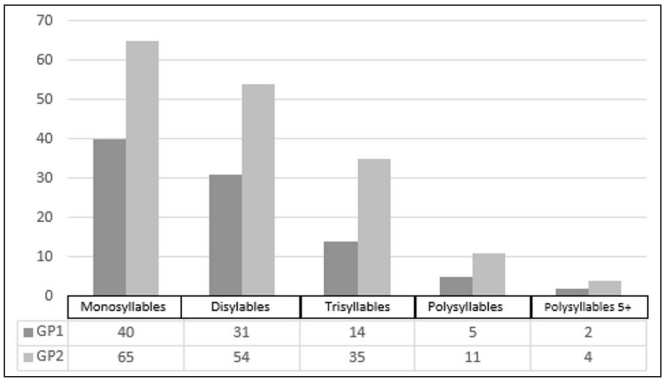
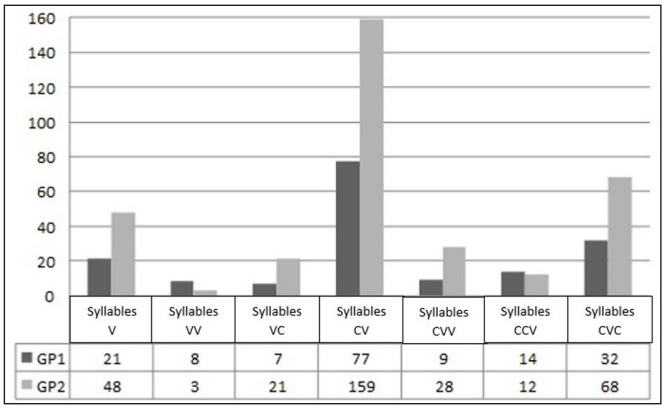


Figure 1. Number of words present in the different texts according to their extension



Caption: V= vowel; VV = vowel + vowel; VC = vowel + consonant; CV = consonant + vowel; CVV = consonant + vowel + vowel; CCV = consonant + consonant + vowel; CVC = consonant + vowel + consonant

Figure 2. Number of the type of syllabic structure present in different texts

Statistical method

Data were submitted to statistical analyses. To compare the distributions at the reading rate in both groups, it was applied Mann-Whitney test with significance level of 0.05. It is important to highlight that it was used a non-parametric test because the graphs of normal probability of the studied variables in the two groups showed deviations of normal distribution.

Besides, it was built a ROC curve to determine a hit cutoff value to measure SRPM, according to sensitivity and specificity values.

RESULTS

Data showed that there was no meaningful difference between the WRPM distributions in both groups (p=0.930) (Table 1). Therefore, such measure do not discriminate the children in these two groups. However, it was observed a meaningful difference in SLP (p=0.036), in which GP2 children tend to present higher values (Figure 3).

In Figure 4, it can be observed the joint behavior in SRPM and WRPM in both groups. It can be noticed that in both groups the performance of the students is more separated in the SRPM axis than in the WRPM.

To determine a cutoff value for SRPM that separates the children of the two groups with higher sensitivity and specificity, it was built a ROC curve (Figure 5). The curve coordinates are found in Table 2.

The sensitivity value was 0.54 and the specificity was 0.83, and in this study, the term sensitivity means the probability of correctly classifying a GP2 child, and specificity means the probability of correctly classifying a GP1 child. It should be noted that the values of sensitivity and specificity suggest that SPM measure is more specific than sensitive, that is to say, it better indicates who does not belong to GP2, in this case,

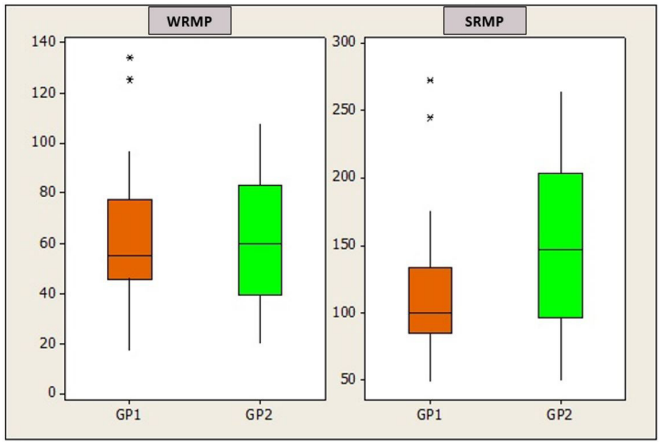


Figure 3. Box-plots for reading rate of GP1 and GP2 children

Chart 1. Measures used to calculate the reading rate

Measure	Calculation
Words read per minute (WRPM)	Number of words of the text x 60/ total reading time in seconds
Syllables read per minute (SRPM)	Number of syllables of the text x 60/ total reading time in seconds

Table 1. Descriptive statistics for reading rate in GP1 and GP2

Variable	Group	N	Average	Standard Deviation	Minimum	Median	Maximum
Words read per minute	GP1	29	60.1	27.4	17.3	55.2	134
	GP2	28	60.2	24.4	20.1	60	108
Syllables read per minute	GP1	29	115.2	51.0	48.8	100.2	272.3
	GP2	28	147.2	59.6	49.2	146.4	264

Table 2. ROC curve coordinates

Sensitivity	1 - Specificity	Sensitivity	1 - Specificity
1.00	1.00	0.57	0.38
1.00	0.97	0.54	0.38
0.96	0.97	0.54	0.35
0.96	0.93	0.54	0.31
0.96	0.90	0.54	0.28
0.93	0.90	0.54	0.24
0.93	0.86	0.54	0.21
0.89	0.86	**0.54**	**0.17**
0.89	0.83	0.50	0.17
0.89	0.79	0.46	0.17
0.82	0.79	0.46	0.14
0.82	0.76	0.43	0.14
0.82	0.69	0.43	0.10
0.82	0.66	0.39	0.10
0.79	0.66	0.39	0.07
0.79	0.62	0.36	0.07
0.79	0.59	0.32	0.07
0.75	0.59	0.29	0.07
0.75	0.55	0.25	0.07
0.71	0.55	0.14	0.07
0.71	0.48	0.07	0.07
0.71	0.45	0.04	0.07
0.64	0.45	0.04	0.03
0.64	0.41	0.00	0.03
0.61	0.41	0.00	0.00
0.61	0.38		

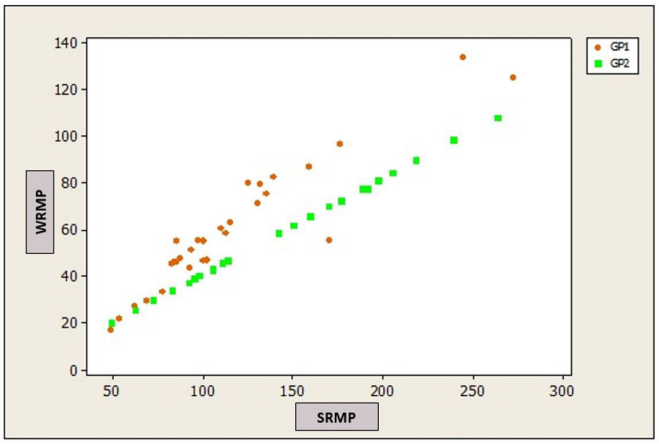


Figure 4. WRPM and SRPM dispersion diagrams in both groups

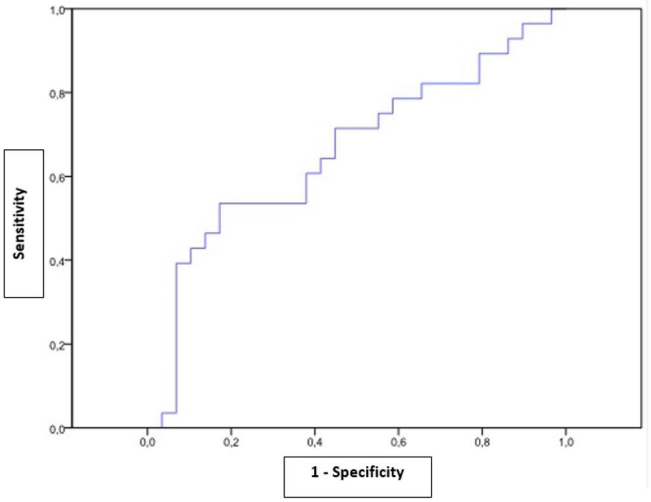


Figure 5. ROC curve for number of Syllables read per minute (Area 0.66)

the true negatives. With the cutoff value of 136 SRPM, it was observed that in GP1 only five children were above this value, while in GP2 sixteen children got equal or higher values than 136 SRPM and twelve presented SRPM below 136. This way, the cutoff value separates better the children belonging to GP1.

DISCUSSION

The present study shows evidences that the SRPM measure was more effective to assess the difference of reading rate in children of different education levels. Besides, such measure shows a better design of the reading rate and can be used to compare the reading of different texts. On the other hand, the words per minute measure (PPM) seems to be more adequate only when the children read the same text, because the different groups show similar performance regarding the grades, suggesting that such measure supplies little information when comparing children of different school year, indicating that, when reading texts adequate to their age and education, children present less difficulty to perform decoding.

Such result can have occurred due to some factors, such as the extension of the words in each text, number of words and syllabic structure of the words. With education evolution there gradually is an increase of the number, extension and complexity of the words used in school texts, according to what was observed in this study. This factor has significant importance in the calculation of WRPM, once it takes longer to pronounce a polysyllable word than a monosyllable one, which can take to mistaken interpretations. This way, there are evidences that the use of WRPM measure can be more adequate when assessing reading rate by means of a single text[15].

Studies for the Brazilian Portuguese[2,12,13] that verified reading fluency parameters, measuring the speed through WRPM, used texts that varied according to schooling, however without information regarding the characteristics of the texts used. This way, the lack of textual linguistic information, such as the word number, extension and its syllabic structure, implies in higher difficulty to use such measure as a benchmark to assess and classify reading rate of Brazilian students.

It is interesting to highlight that studies of oral language fluency have used SRPM measure for many years. A study[24] applied such measure in the Brazilian Portuguese with the intention of verifying speech fluency and suggested a standardization that started to be used in several other studies[16,25-27]. Later, such measure was also researched to complement the diagnostic of children with phonologic disorder[18] as well as to verify speech speed standards at the different speech language therapy alterations[17,26,27]. The results of the mentioned studies demonstrated that the SRPM measure was effective to identify differences and characteristics in different populations.

Considering the effectiveness of such measure in oral language, it was realized that to measure the reading fluency, SRPM calculation could also be effective on using different texts at the reading characterization of children from different levels of schooling. In this way, the present research showed evidences that the SRPM measure permitted better differentiation of the groups and provided a more precise design of the children's reading profile. This was evident at the statistics results that indicated stronger differences[15]. It is important to note that, for each text presented to the students, it was analyzed the number of words and syllables, as well as accounted the types of syllabic structures showing the important differences, according to the detailed description in the method.

It is worth highlighting that reading aloud can occur in two ways: by means of a direct visual process (Lexical Route) or through a process involving phonological mediation (Phonological Route), characterizing a reading model of double route widely disseminated in Brazil and internationally, that explains the reading cognitive processing[8,9,28-30]. The reading through the phonological route depends on the use of the conversion rules knowledge between grapheme and phoneme in order that the construction of the word pronunciation can be done. In turn, the reading through the lexical route depends on the recognition of one word previously acquired and memorized in the visual recognition system of words and in the recovery of the meaning and pronunciation by means of direct addressing to lexical, being this pronunciation obtained as a whole[8,9,28-30].

This way, it is possible to state that, regardless of the reading route used by the reader during the oral reading evaluation, the material of the reading rate analyses is the articulation of words in a certain period of time, that is, independently of the type of route that is used, the effect of the word extension can compromise the reading rate analyses[8,9,28-30]. This way, this study points at a measure that neutralizes the effect of the word extension and complexity of the syllable, what permits the best characterization of the children's reading in different schooling ranges, different readers' profiles, regardless of the type of reading route used by the child, besides being possible the use of such measure as a comparison parameter of children in different school ranges.

Several international studies pointed at evidences on the importance to verify the reading fluency in texts that are according to the child education[6-9,23].

These authors also highlighted the need of an effective measure for the comparison of the children's performance with different schooling.

This way, it is possible to observe that the present research brings contributions to the reading fluency study, once it indicates a more careful measure for the characterization of the reading rate. Besides, it was highlighted that the use of texts that are according to the children's school level points at more reliable data regarding the reading profile of the students.

CONCLUSION

The present research showed evidences that there are differences between 3rd and 4th school year students when the measure in syllables read per minute was applied providing, therefore, a more precise characterization of the children's performance.

Besides, data also indicate that the SRPM measure can be used to compare the reading rate when using different texts, once it considers the textual linguistic aspects. Additionally, it can also compare the performance of the students that study at different school years and help at the designing of the acquisition pattern and reading development.

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Author contributions

AJCS was responsible for the study design, data collect and analyses, results analyses and interpretation, manuscript writing and review; MSC contributed to results interpretation and to the discussion and review of the manuscript; HFW was responsible for study design, results analyses and interpretation, manuscript writing and review.