Specific reading disability in Brazilian Portuguese: evidence for a multiple-cognitive deficit model

Dificuldade específica de leitura em português: evidência de déficits cognitivos múltiplos

Developmental dyslexia or specific reading disability (RD) is an idiopathic learning disorder characterized by inaccurate and/or slow word recognition.[1] According to the predominant model found in the literature, RD results from deficits in phonological processing, most notably in phoneme awareness.

Although the phonological-deficit model has assumed a leading role in the literature, it has also come under increased scrutiny in recent years. In particular, numerous researchers have questioned its assumption that deficits in phonological processing are sufficient for the development of RD. For example, it has been shown[2] that children with Speech Sound Disorder, a condition often associated with deficits in phonological awareness do not usually exhibit word reading difficulties. Furthermore, RD deficits do not seem to be limited to the phonological component of language. Instead, children with RD often exhibit mild oral language difficulties.[1,3] They also show deficits in processing speed, particularly in rapid serial naming.[1] Noteworthy is that studies with children at risk for RD have shown that most of these deficits are evident in the preschool years and cannot, therefore, be regarded as a consequence of the poor literacy skills of children with RD.[3,4]

In view of this evidence, Pennington suggested that deficits in oral language and processing speed, in addition to deficits in phoneme awareness, are also involved in RD.[1] In what follows, we report the findings of a longitudinal study investigating the generality of Pennington's multiple-deficit model as applied to RD in Portuguese, a writing system characterized by more regular grapheme-phoneme correspondences than the English orthography.

The sample was composed of 13 Brazilian children who had exhibited marked difficulties in learning to read during their first school year and 13 typically developing children, matched for age, gender and educational environment. Six of the children with beginning reading difficulties still exhibited difficulties at the end of their second school year and were assigned to the group with persistent RD; also by that time, the remaining seven children had overcome their difficulties and were assigned to the group with transient RD. All children had either normal or above normal IQs (Table 1).

Table 1 - Mean age and mean scores (and SDs) on the various literacy and cognitive measures as a function of time and group

Time/Measures	Group		
	Persistent RD (n = 6)	Transient RD (n = 7)	Controls (n = 13)
TIME 1			
Age (months)	82.88 (2.72)[a]	83.67 (4.28)[a]	81.71 (3.73)[a]
Reading words (max. = 70)	12.83 (10.07)[a]	23.14 (9.63)[b]	50.85 (6.56)[c]
Spelling words (max. = 35)	3.83 (1.72)[a]	8.00 (3.16)[b]	15.08 (5.30)[b]
Reading pseudo-words (max. = 20)	2.67 (2.42)[a]	2.86 (3.48)[a]	13.00 (3.56)[b]
WISC-III: Full IQ	103.17 (15.29)[a]	108.43 (13.05)[ab]	117.23 (7.47)[b]
WISC-III: VC IQ	103.83 (17.81)[a]	106.29 (11.25)[a]	118.62 (9.48)[b]
WISC-III: FD IQ	97.83 (15.68)[a]	106.14 (8.90)[ab]	108.38 (15.76)[b]
WISC-III: PO IQ	95.83 (8.35)[a]	104.86 (16.28)[a]	108.15 (5.94)[a]
WISC-III: PS IQ	110.67 (6.56)[a]	115.86 (10.53)[ab]	120.92 (8.09)[b]
Composite PA[1]	-0.77 (0.88)[a]	-0.46 (0.39)[a]	0.60 (0.62)[b]
Composite RSN[1]	0.82 (0.87)[a]	-0.35 (0.50)[b]	-0.40 (0.58)[b]
Pseudo-word repetition	10.83 (4.26)[a]	14.17 (3.87)[ab]	15.77 (3.29)[b]
TIME 2			
Age (months)	95.27 (2.40)[a]	95.71 (4.43)[a]	93.95 (3.68)[a]
Reading Words (max. = 70)	41.83 (11.05)[a]	57.86 (3.58)[b]	58.15 (5.64)[b]
Spelling Words (max. = 35)	12.50 (3.56)[a]	19.86 (3.81)[b]	20.38 (3.62)[b]

ANOVAs, followed up by LSD pairwise comparisons, were performed to evaluate the significance of the differences between the groups on the various measures. Given the small Ns, nonparametric Mann-Whitney tests were also performed to test the significance of the pairwise differences. Cells with different superscripts differed significantly on both the LSD and the Mann-Whitney test. VC = Verbal Comprehension; FD = Freedom from Distractibility; PO = Perceptual Organization; PS = Processing Speed; PA = phoneme awareness (phoneme detection and phoneme deletion); RSN = rapid serial naming. [1]Scores for phoneme awareness and RSN are z scores.

Word reading and spelling skills were evaluated twice i.e., at the end of participants' first and second school years. At the first evaluation, children also completed tasks of phoneme awareness, phonological memory (pseudo-word repetition) and rapid serial naming (RSN), in addition to the subtests of the Wechsler Intelligence Scale for Children (WISC-III).[5] Both RD groups performed significantly below controls on the Verbal Comprehension factor of the WISC-III, p (p value) < 0.05, d (Cohen's d) = 1.16 and 1.21 when comparing the persistent and transient RD groups, respectively. The same was true for two measures that rely heavily on phonological processing, namely, phoneme awareness (Persistent RD vs. Controls: $p < 0.001$, $d = 1.93$; Transient RD vs. Controls: $p < 0.01$, $d = 1.92$) and pseudo-word reading (Persistent RD vs. Controls: $p < 0.001$, $d = 3.18$; Transient RD vs. Controls: $p < 0.01$, $d = 2.87$). Noteworthy was the fact that no significant difference was found between the two RD groups in any of these measures. In contrast, the children with persistent RD performed significantly below both the children with transient RD ($p < 0.01$; $d = 1.68$) and controls ($p < 0.001$; $d = 2.39$) on the RSN tasks. They also performed significantly below controls on the Processing Speed factor of the WISC-III ($p < 0.05$; $d = 1.34$). Similar results were obtained after controlling for differences in children's full IQs. These findings are consistent with Pennington's proposal that deficits in oral language and RSN are also involved in RD.[1]

However, the two RD groups did not perform equivalently on all phonological processing measures. In particular, the persistent RD group scored significantly lower than the transient RD group on one phonological task that assessed children's working memory, the digit-span subtest of the WISC-III (Mean raw score = 6.17 and 8.86, respectively, $p < 0.05$, $d = 1.36$). Although this might suggest that the severity of the phonological processing deficit represents an important factor that could explain persistent RD, the other evidence makes this assumption unlikely. As reported previously, the two RD groups performed equally poorly on the phoneme awareness and pseudo-word reading measures. In addition, they did not differ significantly on another measure of phonological memory i.e., the pseudo-word repetition task.

An obvious limitation of the present study is its small sample size. Clearly, studies including a more representative number of children at high risk for RD are needed before we can be fully confident as to the application of Pennington's[1] multiple-deficit model to cases of RD in Portuguese.

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** Modest*
*** Significant*
**** Significant. Amounts given to the author's institution or to a colleague for research in which the author has participation, not directly to the author.*
Note: UFMG = Universidade Federal de Minas Gerais; PUCMG = Pontifícia Universidade Católica de Minas Gerais.
For more information, see Instructions for Authors.

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