Paidéia
2018, Vol. 28, e2833. doi: http://dx.doi.org/10.1590/1982-4327e2833
ISSN 1982-4327 (online version)

Psychological Evaluation

Identifying Signs of Dyslexia Test: Evidence of Criterion Validity[1]

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Abstract: In Brazil, there is a lack of valid instruments for screening for Developmental Dyslexia (DD) and so the aim of this study was an in-depth investigation of evidence of validity based on the relations with external variables for the Identifying Signs of Dyslexia Test (TISD). More specifically, it seeks to investigate the validity of the criterion, i.e. whether such instruments would be capable of identifying this diagnosis. The research involved comparing two samples: (a) children with DD diagnosis (n = 15) and (b) children without complaints of reading and writing difficulties (n = 146). It was found that in all the subtests of which the instrument is made up (reading, writing, visual attention, calculation, motor skills, phonological awareness, rapid naming, short term memory) there were significant differences between the groups, and in the test total. The results suggest that the TISD was able to identify the group with DD, evidencing the validity of the criterion for this instrument.

Keywords: psychometry, learning, neuropsychology, psychological evaluation

Teste para Identificação de Sinais de Dislexia: Evidências de Validade de Critério

Resumo: No Brasil há escassez de instrumentos validados para triagem da Dislexia do Desenvolvimento (DD), dessa forma, o presente estudo objetivou investigar mais profundamente evidências de validade baseadas nas relações com variáveis externas para o Teste para Identificação de Sinais de Dislexia (TISD). Especificamente, buscou-se investigar a validade de critério, ou seja, se tal instrumento seria capaz de identificar esse diagnóstico. A pesquisa envolveu a comparação de duas amostras: (a) crianças com diagnóstico de DD (n = 15) e (b) crianças sem queixas de dificuldades em leitura e escrita (n = 146). Verificou-se que em todos os subtestes que compõem o instrumento (leitura, escrita, atenção visual, cálculo, habilidades motoras, consciência fonológica, nomeação rápida, memória de curto prazo) houve diferenças significativas entre os grupos, bem como no total do teste. Os resultados sugeriram que o TISD foi capaz de indicar o grupo com DD, o que evidencia validade de critério para tal instrumento.

Palavras-chave: psicometria, aprendizagem, neuropsicologia, avaliação psicológica

Test para la identificación de Señales de Dislexia: Evidencia de la Validez de Criterio

Resumen: En Brasil hay escasez de instrumentos validados para clasificar la Dislexia del Desarrollo (DD), de esta forma, el presente estudio objetivó investigar más profundamente evidencias de validez basadas en las relaciones con variables externas para la Prueba para Identificación de Señales de Dislexia (PISD). Específicamente, se buscó investigar la validez de criterio, o sea, si tal instrumento fuera capaz de identificar ese diagnóstico. La investigación incluyó la comparación de dos muestras: (a) niños con diagnóstico de DD (n = 15) y (b) niños sin quejas de dificultades en lectura y escritura (n = 146). Se verificó que en todas las subpruebas que componen el instrumento (lectura, escrita, atención visual, cálculo, habilidades motoras, conciencia fonológica, nombramiento rápido, memoria de corto plazo) hubo diferencias significativas entre los grupos, así como en el total de la prueba. Los resultados sugirieron que la PISD fue capaz de indicar el grupo con DD, que evidencia validez de criterio para tal instrumento.

Palabras clave: psicometría, aprendizaje, neuropsicología, evaluación psicológica

Learning disorders are changes in neurodevelopment that present as essential persistent difficulties in the learning of academic abilities, such as reading, writing and calculation (World Health Organization [WHO], 2008). Affected individuals may show poor performance in one or more of these abilities, which is not explained by lack of schooling, intellectual disability or uncorrected sensory

[1]Support: Article derived from the doctoral thesis of the first author under the supervision of the second, defended in 2016, in the Graduate Program in Psychology at the Pontifícia Universidade Católica de Campinas. Financial support from the National Council for Scientific and Technological Development (CNPq), case No. 140281/2014-2.

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changes. Specifically, the disorder with reading impairment can also be termed Developmental Dyslexia - DD (American Psychiatric Association [APA], 2013).

Diagnostic manuals propose that diagnosis of DD be made after beginning formal education, based on the following criteria: (a) oral reading characterized by distortions, omissions and substitutions; (b) reduced reading speed, with misunderstandings; (c) impairment in the development of reading skills, with lower performance than expected for age, schooling and intelligence in standardized tests (APA, 2013; OMS, 2008).

Some of these tests for screening have been described in the literature. Internationally, there is the International Dyslexia Test (IDT), drawn up by Smythe and Everatt (2000). This instrument enables extensive investigation of different cognitive-linguistic abilities, such as reading, writing, mathematical skills, phonological awareness, auditory processing, phonological discrimination, short-term memory, auditory sequential memory, visual processing, visual discrimination and perception, sequential memory visual, processing speed, motor skills and reasoning. Another instrument is the Test of Dyslexia and Dysgraphia (TODD), by Cox (2002), which aims to aid diagnosis of DD and dysgraphia, evaluating memory of symbols and words, phonological skills, visual processing and rapid naming of symbols. There is also the Dyslexia Early Screening Test (DEST-2), by Nicolson and Fawcett (2004), which indicates risk of learning disorder based on evaluating the skills of rapid naming, phonemic discrimination, postural stability, rhyme, digits, naming digits, naming letters, ordering sounds, copying forms, attention, vocabulary, visual-motor coordination.

In the Brazilian context, there is a shortage of instruments for this purpose. A preliminary study for standardizing IDT (Smythe & Everatt, 2000) was undertaken by Capovilla Smythe, Capovilla and Everatt (2001), based on evaluation of the same abilities that make up the original instrument. Later, Capellini and Smythe (2008) published the protocol of cognitive-linguistic abilities, also based on the IDT, which evaluates reading, phonological awareness, auditory processing, visual processing and processing speed. Capellini et al. (2009) proposed the protocol for early identification of reading problems in 1st grade students to assess cognitive-linguistic abilities of alphabet knowledge, phonological awareness, rhyming production and identification, syllabic segmentation, word production based on given phoneme, phonemic synthesis and analysis, identification of initial sound, working memory, visual attention, speed of access to phonological information, reading of words and nonwords, and comprehension of phrases from the figures presented. However, studies searching for evidence of validity of all these instruments for the Brazilian population have not been finalized.

Recently, the Identifying Signs of Dyslexia (TISD) (RJR Alves, Lima, Salgado-Azoni, Carvalho, & Ciasca, 2015) aimed to evaluate academic and neuropsychological abilities that are currently impaired in children with DD (Figure 1). The TISD consists of 8 subtests: (1) Reading; (2) Writing; (3) Attention; (4) Calculation; (5) Motor Skills; (6) Phonological Awareness; (7) Rapid Naming; (8) Short Term Memory. The construction of its activities and the choice of skills to be evaluated were based on national and international publications focused on the evaluation of DD.

In order to make TISD available in educational and clinical contexts, psychometric studies guaranteeing its validity, have yet to be performed. Specifically, validity refers to the proof that the test actually measures what it aims to measure (Kline, 2015). The most recent classification indicates five types of validity investigation/evidence: (a) evidence based on relationships with external variables, (b) evidence based on internal structure, (c) evidence based on the response process, (d) evidence based on the consequences of testing, and (e) content-based evidence (American Educational Research Association [AERA], American Psychological Association [APA], National Council on Measurement in Education [NCME], 2014).

Some studies have already been conducted to investigate evidence of validity of the TISD. Initially, in its construction process, the draft was evaluated by expert judges to investigate evidence of content-based validity. The aim was to verify whether the selected skills and tasks performed were related to the evaluated construct, and favorable results were found (R.J.R. Alves et al., 2015).

In a later study, we investigated evidence based on relationships with external variables, by comparing groups (criterion validity) and convergent validity analysis (which aims to collect data on correlation patterns between the test scores with other, already validated, test scores measuring the same construct or related constructs) (MN Alves et al., 2013). It compared groups of children with (n = 11) and no schooling complaints (n = 9) and performed correlation analyses between some of the TISD subtests with the School Performance Test (TDE) subtests (Stein, 1994). Significant differences were found between the two groups in the total TISD score and in the reading, writing, calculation, phonological awareness and working memory subtests, with poorer performance in the group with learning disabilities. Statistically significant, moderate, and high correlations between TISD and TDE subtests were observed (TISD ReadingxTDE Reading: r = -0.70; TISD WritingxTDE Writing: r = -0.88; TISD CalculationxTDE Arithmetic r = -0.73). Thus, initial evidence of validity was found based on relations with external variables.

Considering the favorable results found in preliminary studies, this study aimed to investigate in-depth validity evidence based on relations with external variables for the TISD. Specifically, we sought to investigate the criterion validity (Kline, 2015), that is, whether such instruments would be able to identify this diagnosis. For this, the procedure adopted was to compare a group of children with such diagnosis to a group of children without complaints of reading and writing difficulties.

Method

Participants

The sample consisted of two groups: Case Group (CG, composed of children diagnosed with Developmental

Dyslexia) and No Case Group (NG, children with no complaints of reading and writing difficulties). The CG was composed of 15 children and the NG of 146, the selection criteria of which are shown in the procedures section.

The age group of the CG was 8 to 12 years (M = 9.80, SD = 0.94), of whom eight were male (58.3%). The age range of NG was between 8 and 11 years (M = 9.28; SD = 0.86), 63 males (43.2%). The mean age of both groups was compared using the Mann-Whitney test, and a statistically significant difference was found (U = 775.50, p = 0.049). When comparing the sexes, using the chi-square test, no differences were found (χ^2 = 0.572, p = 0.587).

Among children in the CG, seven were in the fifth year of school (46.7%), five in the fourth year (33.3%), two in the third year (13.3%), and one in the sixth (6.7%). Furthermore, eleven attended public school (73.3%) and four private school (26.7%). The majority of the NG sample was in the fourth year (n = 58, 39.7%), followed by the fifth year (n = 57, 39%), and the third year (n = 31, 21.2%). A large part attended public school (n = 107; 73.3%). When comparing school years between groups, no statistically significant difference was observed (Fisher's test, p = 0.146). Likewise, when comparing the type of school, no difference was found (Fisher test, p = 0.632).

Instrument

Questionnaire for parents/guardians and *Questionnaire for teacher*. Composed of five open questions seeking to investigate the following characteristics: profile of reading and writing school skills and some common mistakes made by children with DD; possible neuropsychiatric disorders, mood, mental or genetic syndromes; use of psychotropic medication; repeating school year. A table was also drawn up with the diagnostic criteria for DD, in which it was requested to indicate whether the child met certain criteria or not; a questionnaire was filled out for each child. Average application time: 15 minutes.

Identifying Signs of Dyslexia Test (TISD) (R. J. R. Alves et al., 2015) (Table 1). It consists of a screening instrument aiming to evaluate signs indicative of DD. It is aimed at the 6 to 11 year-old age group, applied individually, with an average duration of 25 minutes. The TISD consists of 8 subtests evaluating both academic skills (reading, writing, calculus) and neuropsychological abilities related to written language (visual attention, motor skills, phonological awareness, rapid naming and short-term memory - it should be pointed out that initially, in previous studies, this last subtest was known as "working memory").

Table 1
TISD Composition (R. J. R. Alves et al., 2015)

Subtests	Description of subtests	Score
1. Reading 1.1 Letters 1.2 Words 1.3 Pseudowords	Recognition of 21 letters of the alphabet presented at random; reading nine words and nine pseudowords. Application: visual. Response: oral	Total = 39
2. Writing 2.1 Letters 2.2 Words 2.3 Pseudowords	Dictation of letters of the alphabet presented at random; nine words and nine pseudowords dictation. Application: visual. Response: motor	Total = 39
3. Visual attention	Set of 195 letters randomly distributed in which the child should look for a specific one, in this case the "p". Application: visual; (60 seconds timeout). Response: motor	Total = 195
4. Calculation	Four problems to be solved mentally, each corresponding to a mathematical operation. Application: oral. Answer: oral	Total = 4
5. Motor skills	Copy of a figure formed by lines and four geometric figures (circle, triangle, square and rectangle). Application: visual. Answer: motor	Total = 10
6. Phonological awareness 6.1 Rhyme 6.2 Rhyme production	Two tasks: one of rhyme identification (the purpose of which was to identify which words rhymed with each other); and another of rhyme production (the purpose of which was to say some word that rhymes with another). There was the support of the drawing of the target words. For example, when asked to rhyme for the word "giraffe", the figure of the giraffe is presented. Application: visual. Response: oral	Total = 6
7. Rapid naming 7.1 Letters 7.2 Numbers	Two different boards: one containing a set of 25 letters; and another set of 25 numbers; in both the child should name the stimuli as fast as he can. Application: visual, time recording. Response: oral	Total = 50 (added to the score obtained from the naming time)
8. Short term memory 8.1 Digits 8.2 Pseudowords	Two tasks: one for repeating six ascending sequences of digits; another to repeat six pseudoword sequences. Application: oral. Response: oral	Total = 12

The score is calculated based on the mistakes made, so that the higher the child's score, the worse is the performance. It is organized in four materials: "Instructions booklet for application and scoring", "Answer sheet", "Application book" and "Stimulus booklet".

The TISD was constructed in two stages. Initially, a review of the national and international literature was conducted to survey the main school and neuropsychological skills in DD assessment instruments. Based on this, the eight subtests composing the TISD were defined. The second stage consisted of composing the instrument: formulation of the items, instructions, administration procedures, preparation of the stimulus material, construction of the preliminary version and analysis of content by expert judges (R.J.R. Alves et al., 2015)

In a pilot study conducted by M.N. Alves et al. (2013) initial evidence of validity was verified based on relations with external variables. The TISD was able to differentiate between groups with (n = 11) and without learning difficulties (n = 9). Statistically significant and high negative correlations were observed between TISD and TDE subtests that evaluated the same ability (Reading r = -0,70; Writing r = -0.88; Calculus/Arithmetic r = -0.73).

Procedure

Data collection. Data from the CG group were collected at the Clinical Hospital of the State University of Campinas (UNICAMP), in the "Neuro-Learning Difficulties" outpatient clinic. There, the children first underwent a neuropsychological evaluation in which a battery of instruments were applied.

After this first stage of attending the outpatient clinic, and specifically investigating the reading and writing and neuropsychological difficulties, the team psychologists referred the children for interdisciplinary evaluation and the diagnosis was finalized, including that of DD. In cases where such diagnosis was confirmed, the parents/guardians were contacted and an individual meeting scheduled. At that meeting, the aims of this research were presented, and the parents/guardians asked to give their consent, by signing the "Free and Informed Consent Form" (TCLE), if they agreed to let their child participate. For those who authorized it, an individual session with the child/adolescent was scheduled, in which the TISD was applied in an average time of 25 minutes. In total, 15 children/adolescents were evaluated.

Regarding the NG group, all data were collected at the participants' school. A public school and a private school in the same city where the hospital was located were chosen. These data were collected as follows: (1) initially the research was presented to the teachers (preference was given to the Portuguese teachers), and if they agreed to participate, express authorization was requested through signing the TCLE; (2) those who agreed to participate completed a questionnaire that sought to investigate the inclusion criteria of the children in the research, i.e.: not meeting diagnostic criteria for DD (WHO, 2008); not having a complaint of possible neuropsychiatric or mood disorders or mental or genetic syndromes; not using psychotropic drugs.

Next, a meeting was convened with the parents/guardians of the children in whom all these criteria were met. At that meeting the research was presented and if the parents/guardians authorized it, they were asked to sign the TCLE. The parents/guardians also answered a questionnaire aiming to investigate the inclusion criteria of the children in the research, the same as those verified with the teachers. Following these procedures, it was found that all the children initially selected by the teachers could be included in the research.

The next and last step consisted of applying the TISD, with an average duration of 25 minutes, in an individual session. There was a total of 146 children. This step was performed during the child's regular period of attendance at school or in the evening, having checked the best period with the principal to avoid interfering with the child's routine activities.

Data analysis. The Statistical Package for Social Sciences 20.0 for Windows® (SPSS Inc, Chicago, IL, USA, 2008) program was used. Using descriptive statistic, data on frequency, average, standard deviation, minimum and maximum scores were obtained. Given the sample size and, consequently, lack of normal distribution, the types of inferential statistics analysis selected were all non-parametric. Levels of significance were: $p < 0.05$ (significant value), $p < 0.01$ (very significant value) and $p < 0.001$ (highly significant value). Effect size was also verified by means of Cohen's d (d). The reference values for this type of analysis were: < 0.2 - 0.3 as a small effect; 0.4 - 0.7 as medium effect; > 0.8 large effect (Cohen, 1988).

Ethical Considerations

All of the above procedures were authorized by the PUC-Campinas Research Ethics Committee (CAAE: 45679615.7.1001.5481).

Results

Table 2 shows the descriptive statistics (mean and standard deviation) as well as the comparison between the groups in the subtests and TISD total. For this comparison the Mann-Whitney test, complemented by Cohen's d (d), was used.

Table 2
Descriptive statistics and comparison of performance in the subtests and TISD total between the groups of children with Developmental Dyslexia and those without learning difficulties

TISD Subtests	Groups		*U*	*p*	*d*
	GD	GSD			
	M (SD)	M (SD)			
Reading	8.53 (5.22)	0.91 (1.37)	124.50	< 0.001***	-0.47
Writing	14.50 (4.14)	4.29 (2.38)	44.50	< 0.001***	-0.47
Visual Attention	4.42 (2.65)	2.03 (2.34)	440.00	< 0.001***	-0.28
Calculation	1.06 (1.03)	0.49 (0.69)	735.50	0.017*	-0.18
Motor Skills	5.21 (2.04)	4.02 (2.08)	679.50	0.036*	-0.16
Phonological Awareness	3.60 (1.54)	2.38 (1.35)	651.50	0.008**	-0.20
Rapid Naming	11.80 (5.44)	4.39 (3.02)	198.00	< 0.001***	-0.41
Short Term Memory	5.93 (1.48)	3.74 (1.76)	392.50	< 0.001***	-0.32
Total	54.07 (12.58)	22.29 (6.86)	32.00	< 0.001***	-0.47

Note. GD = Group with Developmental Dyslexia; GSD = Group without learning difficulties; M = Medium; SD = standard deviation; U = Mann-Whitney test; p = value of significance; d = Cohen's d. *Significant value; **Very significant value; ***Highly significant value.

It can be seen that in all subtests and in TISD total the group with DD showed statistically significant poorer performance, obtaining a higher score in the test, confirming its discriminative capacity. Moreover, the magnitude of the effect indicated medium effects for Reading, Writing, Rapid Naming and for the total. Small effects were observed for Visual Attention, Short Term Memory, Calculus, Motor Skills and Phonological Awareness.

Discussion

The results of the study indicated that the group with DD showed poorer performance in all subtests and in the TISD total, with higher scores, even with this group having a slightly higher mean age than that of the NG. Thus, it confirmed the discriminative ability of the test, of existence of performance differences between the CG and NG groups, even with some of the subtests having small difference effects between the groups.

As the nomenclature itself and diagnostic criteria point out, DD is the specific disorder of reading, with the most evident effects being linked to this ability (APA, 2013). The TISD reading subtest aims to assess this ability. The negative effects presented by the children with this disorder, ascertained from this investigation, were expected. Other research has shown similar results, so that reading letters (Ellis, 2014; Torppa, Poikkeus, Laakso, Eklund, & Lyytinen, 2006; Ziegler, Perry, & Zorzi, 2014) and reading words are affected by the disorder (Capellini et al., 2007; Savill & Thierry, 2011; Zoccolotti et al., 2013), with greater negative effect found in reading pseudowords (Krafnick, Flowers, Napoliello, & Eden, 2011; Traficante, Marcolini, Luci, Zoccolotti, & Burani, 2011).

Negative effects on writing are also characteristic of this disorder, with errors very similar to those of reading (APA, 2013, Ellis, 2014). Thus, the results found here in this subtest were expected, with poorer performance of the diagnosed group. The literature indicates negative effects on writing letters (Brooks, Berninger, & Abbott, 2011; Torppa et al., 2006; Zorzi et al., 2012), words (Kast, Bezzola, Jäncke, & Meyer, 2011; Lovio, Näätänen, & Kujala, 2010; Salgado et al., 2006; Zorzi & Ciasca, 2009) and pseudowords (Lindgrén & Laine, 2011; Ramus & Szenkovits, 2008). The writing subtest consisted of all these skills.

Another school ability in which negative effects of DD are described is mathematics (Evans, Flowers, Napoliello, Olulade, & Eden, 2014). Specifically, in TISD, the Calculation subtest consisted only of problems to be solved mentally. The literature indicates the disadvantages individuals with DD face in this type of task, as found here, probably due to the fact that these deficits are accompanied by impairment of reading and the cognitive processes supporting it, such as phonological processing and executive functions (Simmons & Singleton, 2006, 2008, 2009). Silva, Moura, Wood and Hasse (2015) have described that phonological processing, the main deficit in DD, can affect symbolic aspects of mathematics, such as automation of arithmetic facts, problem solving and numerical transcoding. In a national study, Caldonazzo, Salgado, Capellini and Ciasca (2006) found that children with DD tended to perform well in calculations which did not involve the recognition/reading of algorithms and reading the problem itself. Thus, during the proposed inclusion of this subtest in the TISD it was expected that children with DD would probably present good performance in this subtest, but, seen empirically, the data showed the opposite. Thus, such ability was impaired in the diagnosed children, irrespective of how the problems were presented.

In relation to the Visual Attention subtest, the literature empirically indicates data such as those found here, indicating DD impairments in this ability. Some authors argue that the disorder itself could be explained mainly by this neuropsychological deficit (Facoetti & Turatto, 2000; Facoetti, Turatto, Lorusso, & Mascetti, 2001; Franceschini, Gori, Ruffino, Pedrolli, & Facoetti, 2012). The proposed task for TISD was based on verbal skills and, for this reason, the stimuli used were letters. As verified in the literature, the performance of individuals with DD is more affected in attention instruments that use verbal stimuli (Lima, Salgado-Azoni, & Ciasca, 2013; Lima, Travaini, Salgado-

Azoni, & Ciasca, 2012). Ziegler, Pech-Georgel, Dufau and Grainger (2010) also showed that there would also be significant deficits in digits, in addition to letters, but not in symbols. According to these authors, these findings would further confirm negative effects on verbal skills of this disorder.

Regarding the impairment of GC in the Motor Skills subtest, the literature indicates similar results. The theory formulated by Nicolson and Fawcett (2011) proposes that cerebellar dysfunctions are responsible for DD and that such a condition would be accompanied by deficits in motor skills, especially fine motor skills. In an empirical study that used a similar instrument to TISD to evaluate such abilities, performed by Santos and Jorge (2007), below-expected performance was found in children and adolescents with DD. Okuda, Lourencetti, Santos, Padula and Capellini (2011) also found deficits in fine motor coordination in schoolchildren with DD, specifically in dexterity. Other studies have also pointed out, in general, such motor deficit in the disorder (Brookes, Tinkler, Nicolson, & Fawcett, 2010; Danelli et al., 2013; Gabay, Schiff, & Vakil, 2012; Stoodley, Harrison, & Stein, 2006; Yang & Hong-Yan, 2011).

Regarding the Phonological Awareness subtest, poor performance in the CG was also expected. The most accepted theory for DD is that of a deficit in phonological processing of information (Snowling & Hulme, 2012). Thus, phonological awareness would be one of the components of such processing, involving, basically, conscious access to phonological representations with the temporary maintenance and manipulation of these representations (Ramus & Szenkovits, 2008). In TISD, this ability was evaluated through identification and production of rhyme, a procedure also used in other studies, which indicated the sensitivity of these tests in identifying the disorder (Goswami, 2011; Kovelman et al., 2012; Pugh et al., 2000 Ziegler & Goswami, 2005).

In the Rapid Naming subtest, CG performance was expected to be poor, which was confirmed in the sample studied. The rapid naming task is used to evaluate lexical access (in the form of access to phonological representations), which is also a component of phonological processing (Shaywitz & Shaywitz, 2005). The data found reinforce the work of different researchers, whose studies have evidenced shortcomings rapid naming measures in DD (Andrade, Prado, & Capellini, 2011; Jones, Ashby, & Branigan, 2013; Jones, Branigan, & Kelly, 2009; Norton & Wolf, 2012). The double-deficit theory proposed by Denckla and Rudel (1976) has been used to explain specific problems in retrieving phonological information from long-term memory, an essential component for efficient reading performance.

CG impairment was also observed in the Short Term Memory subtests. This TISD subtest focused specifically on evaluating short-term memory through verbal content. The evaluation items were presented orally (digits and pseudowords) and should also be answered in this way. This type of memory is responsible for the brief storage of verbal material and is considered one of the components of phonological operational memory. Phonological operational memory (also called "working memory phonological loop") is also one of the components of phonological processing (Ramus & Szenkovits, 2008). In all cases, negative effects on all of its components, including short-term auditory memory, are frequently observed in DD (Capovilla et al., 2001; Martinez Perez, Majerus, Mahot, & Poncelet, 2012; Salles & Parente, 2002; Trecy, Steve, & Martine, 2013). Again, significant differences were found between CG and NG in this ability, proving the effectiveness of the subtest in differentiating them.

Finally, in relation to the TISD total score there were significant differences between the group with DD and that without reading and writing difficulties, with worse negative effects on the former. Considering the reported negative effects noted in all skills/subtests of the instrument in the DD group, it was expected that such difference would also be observed in the total score of the test, which was effectively verified. The results obtained in the study suggest that the test was able to differentiate groups, indicating evidence of validity based on relations with external variables, more specifically, criterion validity when discriminating the diagnostic group (Kline, 2015). It should be noted that some subtests such as Calculus, Motor Skills and Phonological Awareness had little effect in relation to the magnitude of the differences between the groups, so it is hoped that in future studies involving a greater number of subjects with DD and other evidence of validity, such subtests will be better investigated. Moreover, it is hoped that in future studies such discriminative capacity will be verified for other neurodevelopmental disorders, in order to obtain greater clinical applicability in the use of the instrument.

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Authors' Contribution:
All authors made substantial contributions to the conception and design of this study, to data analysis and interpretation, and to the manuscript revision and approval of the final version. All the authors assume public responsibility for the content of the manuscript.

Received: Jun. 28, 2016
1st Revision: Jan. 03, 2017
Approved: May. 02, 2018

How to cite this article:
Alves, R. J. R., Nakano, T. C., Lima, R. F., & Ciasca, S. M. (2018). Identifying signs of dyslexia test: Evidence of criterion validity. *Paidéia (Ribeirão Preto), 28*, e2833. doi: http://dx.doi.org/10.1590/1982-4327e2833