



Validation of the test for the early detection of learning difficulties in reading and writing

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Abstract

Introduction: early detection of difficulties in learning to read and write is key to starting intervention programs as soon as possible. But to detect these difficulties it is necessary to have tools with proven efficiency. Aims: The objective of this study was to validate a test developed with linguistic tasks related to reading, applied three years ago to 298 children with the aim of detecting possible difficulties before learning to read:

Material and method: a total of 190 children from that initial sample were evaluated when they were 7 years old with two reading tasks, one with real words and other with invented words. From each child, accuracy, speed and reading efficiency data were collected.

Results: despite the three years elapsed, a highly significant correlation, using the Pearson coefficient, was found between the early detection battery scores and the reading test scores. In addition, half of the children who had been classified as at-risk children because of low scores on that battery had serious reading problems.

Conclusions: the early detection of reading difficulties test, which is being widely used both by pediatricians and by nursery school teachers, due to its quick and easy application, has a strong empirical support. Although it is not a diagnostic test of dyslexia, it is capable of alerting about possible future difficulties in learning to read.

Key words:

- Dyslexia
- Reading

Validación del test para la detección temprana de las dificultades en el aprendizaje de la lectura y escritura

Resumen

Introducción: la detección temprana de las dificultades en el aprendizaje de la lectoescritura es clave para iniciar cuanto antes programas de intervención. Pero para detectar esas dificultades es necesario disponer de herramientas con probada eficacia. **Objetivos:** el objetivo de este estudio fue validar un test elaborado con tareas lingüísticas relacionadas con la lectura, aplicado hace tres años a 298 niños prelectores, con el que se pretendía detectar posibles dificultades antes de iniciar el aprendizaje de la lectura.

Material y método: un total de 190 niños de aquella muestra inicial fueron evaluados cuando tenían siete años con dos tareas de lectura, una de palabras reales y otra de palabras inventadas. De cada niño se recogieron datos de precisión, velocidad y eficiencia lectora.

Resultados: aunque habían pasado tres años, se encontró una correlación altamente significativa, medida mediante el coeficiente de correlación de Pearson, entre las puntuaciones en el test de detección temprana y las puntuaciones en la prueba de lectura. Además, la mitad de los niños que habían sido clasificados como niños de riesgo por haber obtenido bajas puntuaciones en ese test presentaban serios problemas de lectura.

Conclusiones: la prueba de detección temprana de las dificultades lectoras, que está siendo ampliamente utilizada, tanto por pediatras como por profesores de Educación Infantil, por su fácil y rápida aplicación, cuenta desde ahora con un sólido apoyo empírico. Aunque no es una prueba de diagnóstico de la dislexia, sí es capaz de alertar de posibles dificultades futuras en el aprendizaje de la lectura.

Palabras clave:

- Dislexia
- Lectura

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INTRODUCTION

Early detection of reading difficulties is essential to implement prevention programmes and thus mitigate many of the problems associated to such disorders. Intervention programmes in dyslexia are more effective the earlier they are initiated, as the younger the child the greater his or her neuroplasticity, and therefore, the greater the possibility to increase neural connections and networks responsible for reading. Several studies have found evidence that adequate intervention programmes can correct the abnormal brain activation patterns found in dyslexic individuals,¹ and that outcomes are better the younger they are when such interventions are performed.² Furthermore, early intervention may prevent many of the problems that have been associated with dyslexic disorders. On one hand, they can prevent school problems insofar as learning delays in reading are usually associated with poor academic performance, as most of the curriculum is learned through written materials. On the other hand, they can prevent psychological and emotional problems, as the awareness of having reading difficulties usually leads to a loss of self-esteem, a lack of interest in learning and in some cases behavioural problems.³

Dyslexia is usually diagnosed at age 8 or 9 years, when affected children already exhibit significant delays in reading. Although it is still possible to intervene at this age, it is best to detect this problem much earlier, even before children start to learn how to read, so that appropriate training can be initiated as early as possible to improve their future school experience. In recent years, many studies have been conducted on children considered to be at risk of dyslexia.⁴ These are children with deficits in specific skills that are closely related to reading and believed to be the root of dyslexic disorders. One of the skills that is most strongly associated with learning to read is phonological processing, which refers to the ability to break down speech into different segments (morphemes, syllables, phonemes...) and retain or retrieve phonological representations.^{5,6} The results

of phonological tasks are, in fact, the best predictors of success and/or failure in learning to read.^{7,8} And dyslexic individuals have deficits in phonological processing, in terms of phonological awareness, verbal short-term memory and naming speed.^{9,10} Therefore, phonological tasks may be used to identify children at risk of developing dyslexia before they start to learn how to read, with the purpose of working on these phonological skills to prevent or ameliorate future reading difficulties.

Three years ago, we developed a test for the early detection of reading and writing difficulties based on these deficits that are usually found in children at risk of dyslexia, which we presented in this journal.¹¹ It is a brief test consisting of six simple tasks that do not require any additional materials, most of which are assessed based on only 5 items, and which can be completed in 6 to 8 minutes, so that paediatricians performing the well-child checkups at age 4 years and early childhood educators may identify children with phonological problems who, without intervention, may have difficulties learning to read and write in the near future. Based on the results obtained by administering the test to a sample of 298 children aged 4 years, whose mean score was 22.80 out of 30, we defined the risk of dyslexia as a score of less than 16 (1.5 standard deviations below the mean).

This test has been widely accepted and is currently used in many paediatric clinics and early childhood education centres where Spanish is the primary language in Spain and Latin America for the purpose of identifying children at risk of dyslexia at an early stage. The test has also been included in the learning disorders algorithm of the Primary Care Paediatrics algorithm guideline in Spain.¹² But while there is considerable evidence that phonological deficits are associated with dyslexia,¹³ we needed to verify that this test could detect potential dyslexic disorders in Spanish-speaking children. To do so, we had to wait for tested children to start learning to read, so we could assess whether those that had scored low in this test were in fact having more difficulty learning to read compared

to children with higher scores. We performed this empirical assessment in the study presented here. The aim of the study was to assess whether the test for the early detection of dyslexia, which had been administered to a sample of children at age 4 years, was able to predict difficulties learning to read 3 years later in the same children. Our hypothesis was that children that scored low in the test would generally have greater difficulty learning to read.

MATERIALS AND METHODS

Participants

A total of 190 children of the 298 that had been evaluated at age 4 years participated in this reading assessment three years later. At the time of this new assessment, the children were aged 7 years, and all had already learned to read. This new evaluation was performed between December and January, after participants had completed the first term of the second year of primary education. The reasons why the rest of the schoolchildren in the original sample did not participate were widely varied: we could not locate them, they were no longer enrolled in the school, various disorders, refusal to participate, etc.

Materials

We used one list of 30 words set in size-24 Gabriola font (for example, “grano”) and arranged into 10 rows with 3 words each, and one list of nonwords (made-up words) with the same format. All the words had two syllables and different structures (CV, VC, CCV, etc). The nonwords had the same number of syllables and syllabic complexity as the words.

Task

We evaluated each child individually. First, the child was presented with the list of words and asked to read them all correctly and quickly. The evaluator started a stopwatch when the child

began to read and stopped it when the child finished reading the last word, and took note of any mistakes the child made while reading. The same procedure was followed for the list of nonwords. This provided measures of reading accuracy and speed.

RESULTS

The mean number of words read correctly was 28.12, and the mean number of nonwords was 26.15. Most mistakes corresponded to letter omissions, additions or substitutions. As for speed, participants spent a mean of 47.37 seconds reading the list of words and 63.38 seconds reading the nonwords. In order to have a single measure of reading skills, we combined both variables, reading accuracy and reading speed, to give rise to what we termed reading efficiency (RE).¹⁴ We calculated reading efficiency multiplying accuracy by one hundred and dividing the result by the reading speed. In this study, we calculated the reading efficiency for words (RE = 73.81), nonwords (RE = 46.81) and total stimuli (RE = 57.12).

We analysed the association between these three reading measures and the results obtained in the early detection tasks by means of Pearson correlation using the SPSS® software. **Table 1** shows the calculated correlations. As can be seen, test results for words, nonwords and the combination of both were significantly correlated with the three measures of reading skills (accuracy, speed and efficiency). When it came to words, the test was associated more strongly with reading speed compared to accuracy, while the opposite was true of nonwords; at any rate, both were associated more strongly with the composite reading efficiency measure.

The correlations of each of the tasks of the test with reading outcomes were obviously lower, as the score range for these tasks is narrow on account of the limited number of items (since our goal was to develop a brief detection tool). However, all were significantly correlated with at least one of the reading assessment measures. Of the

Table 1. Correlations between reading measures and early detection tasks

Reading measures	Test score
Words accuracy	0.18*
Words speed	0.21**
Words efficiency	0.21**
Nonwords accuracy	0.26**
Nonwords speed	0.19*
Nonwords efficiency	0.25**
Total accuracy	0.24**
Total speed	0.20**
Total efficiency	0.25**

* $P < .05$; ** $P < .001$.

six tasks (phoneme discrimination, syllable segmentation, phoneme identification, nonword repetition, digit repetition and verbal fluency), the three that were most strongly correlated with reading outcomes were phoneme identification, nonword repetition and digit repetition. On the other hand, some of them were associated more strongly with reading accuracy versus speed, and vice versa. Specifically, phonological awareness (phoneme discrimination, segmentation and identification) and verbal fluency tasks were associated more strongly with reading speed, while verbal memory tasks (repetition of nonwords and digits) were associated more strongly with reading accuracy.

In addition to analysing the existing correlations, we sought to assess the outcomes of children that had scored low in the test and who were therefore considered to be at risk. Of the 190 children that participated in this follow-up study, 8 had been classified as being at risk because they had scores of less than 16. As the test predicted, these children had significantly lower scores in reading accuracy compared to the rest of participants for both words (mean of this group: 26.4; mean of the total sample: 28.2; $t = 1.98$; $P < .05$), and nonwords (mean of this group: 23.0; mean of the total sample: 26.3; $t = 2.66$; $P < .01$). Furthermore, reading speed was also slower in these children for both words (mean of this group: 63.0; mean of the total sample: 46.7; $t = 1.96$; $P < .05$) and nonwords (mean of this group: 80.9; mean of the total sample: 62.6; $t = 98$; $P < .05$). In fact, 4 of these children exhibited serious reading difficulties, with low

reading accuracy and slow reading speed: their mean reading efficiency was 23.5, compared to 57.12 in the total sample. In opposition to these, there were 10 children that had achieved the maximum possible score in the test (30 points), and this group obtained significantly higher reading scores compared to other participants in the three efficiency measures: words ($t = 2.25$; $P < .05$), nonwords ($t = 2.06$; $P < .05$) and total ($t = 2.27$; $P < .05$).

DISCUSSION

The results of this study on reading conducted in children previously assessed with a test for the early detection of reading and writing difficulties showed that while the latter is a brief test, it can predict reading difficulties three years after evaluation with considerable accuracy. The correlation is not very strong (although it is highly significant), which is only to be expected due to several reasons. First, because the test is purely exploratory and very brief, as it is designed to be performed in 6 to 8 minutes. Obviously, an instrument with a higher power would require further tasks and many more items per task, but this would make it harder to use for the professionals responsible for early detection, such as primary care paediatricians and early childhood educators, due to the scarce time they can devote to this task in their everyday work. But above all, it is because three years have elapsed and in this time a series of factors may have been at play that undoubtedly influence the skills developed by children and especially their learning of reading, and which therefore may have had an impact on the outcomes predicted by the test. Thus, a high score in the test does not guarantee that that child is going to learn without difficulty, as there are other factors (social, psychological, educational etc) that may lead to academic failure. High scores in the test only indicate that a child has the necessary skills to learn to read, but does not guarantee that the child will actually learn. And conversely, a low score in the test does not mean that the child will inevitably fail to learn how to read. For instance, a low score

may result from a lack of cooperation or attention on the part of the child during the administration of the test, so that the latter does not reflect the child's actual abilities. But it also could be that the child is in fact lacking phonological skills that are essential for learning to read at the time of testing, yet develops them later, either because the child is developing at a slower pace or because parents and teachers worked with the child on these skills in preparation for reading. Numerous studies have demonstrated that the neuroplasticity of children aged 4 and 5 years is enormous, and that appropriate training can result in the formation of new neural connections and networks that were not properly established previously. Simos (2002) demonstrated that intensive training in phonological processing over a period of 4 months achieved a radical change in temporoparietal cortex activation in children at risk of developing dyslexia. There is even evidence of the formation of new reading neural networks in dyslexic adults in association with intervention programmes.¹⁵ It is precisely on account of the constant changes that occur in the neural/linguistic system of children, especially the youngest ones, that tests cannot have a high predictive value. And in fact, this is exactly the actual

purpose of this test, to identify children at risk of having dyslexia so that appropriate phonological intervention programmes can be implemented to correct these problems and provide these children with a better foundation to ameliorate future difficulties in learning to read. Therein lies the considerable value of this test.

Last of all, we ought to emphasise that this test is not a tool for diagnosing dyslexia, as it was developed with the goal of providing a quick and easy tool to detect potential future problems in learning to read. Its purpose is solely to raise a red flag in children that score low in it. However, the reading disorder should be confirmed by means of longer and more specific tests should the child go on to develop reading difficulties.

CONFLICTS OF INTEREST

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ABBREVIATIONS

RE: reading efficiency.

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