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ORIGINAL ARTICLE

Validation of a test for early detection of literacy difficulties in Ecuador. Validation of a risk of difficulties test

Validation of a test for early detection of literacy difficulties in Ecuador. Validation of a hardship risk test

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Abstract

Introduction: Learning difficulties are the alterations with the most significant presence in school classrooms, and their indicators can be diagnosed and prevented early. This research aimed to validate the test for the early detection of difficulties in learning to read and write.

Methods: The research approach was quantitative, descriptive, and cross-sectional. Construct validity was used according to the original proposal of the test and reliability through Cronbach's alpha in a sample of 501 four-year-old Ecuadorian children.

Results: The validation of the instrument shows a moderate correlation between the subtasks and a high correlation between the subtasks and the total score. The reliability is good, $\alpha = 0.71$, very close to that of the Spanish population $\alpha = 0.73$. Therefore, the test can be used in the Ecuadorian context in its original version, adapting two words in the instructions to the linguistic reality of the country and for the qualification of the cutoff points of difficulty.

Conclusion: With the easy application of the "test of reading" in 4-year-old children, the authors recommended its application for the identification of dyslexia and phonological processing deficits in school children in Ecuador. The reading test's validity allows its application at a regional level.

Keywords: MESH: Reading, Reading Systems, Comprehension, Dyslexia, Open Reading Systems, Articulation Disorders.

Introduction

Preschool education, called initial training in Ecuador, is organized into two sublevels: the initial sublevel for 3-year-old children and the initial sublevel 2 for 4-year-old children. The latter is characterized by being compulsory and representing the gateway to the national education system [1]. This training aims to prepare the child and develop various skills necessary for

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entry into primary education, mainly so that it is ready to acquire literacy learning [2, 3].

Learning to read plays a fundamental role in the formation of every person, and it has also been considered a critical skill for success in life [4]. Early reading deficiencies highlight the need to disseminate the knowledge provided by cognitive sciences about learning and teaching reading. Studies in recent decades have shown the importance of explicit and systematic phonics instruction in the initial stages of learning to read [5].

Reading is considered a complex mental operation, qualified as cognitive by specialists, where brain plasticity is the motor element in the neural processes involved in learning to read [6]. It has been found that different areas of the brain are involved in this mental activity, so abnormalities in one or more areas of these brain areas cause reading disorders [7, 8].

Statistical data on the special education categories indicate that specific learning disorders (TEAp) are among the most commonly observed disabilities within them. According to the 43rd Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act in the United States of America, 2021, the proportion of children with ASD among all students with special educational needs is 37.1% [9].

Dyslexia is not a pathological disease but is an integral part of an internal disorder in children that impedes language development during the learning process [10]. Dyslexia is a specific learning disability of neurobiological origin. It is characterized by the inability to develop accurate and fluent reading and poor spelling [11, 12]. These difficulties result from a deficit in the phonological component of language that is unexpected about other cognitive abilities and adequate school instruction [13]. This phonological component has been supported by the Diagnostic and Statistical Manual of Mental Disorders [14].

Empirical evidence shows that there is a delay in identifying and treating learning difficulties, especially dyslexia. It has been shown that this condition is generally diagnosed once children are in second grade or later [15]. Dyslexia identification can cause a large gap between good and poor readers, and many children have reached a point where interventions are less effective than they were in early childhood. Relatedly, it has been shown that reading interventions are significantly more effective when delivered in kindergarten and first grade than when delivered in later grades [16].

Although learning disorders are diagnosed at school, empirical evidence shows that their manifestations are already evident early in preacademic skills, motor development, language development, and behavior [17, 18]. In this sense, longitudinal studies of families with dyslexia have shown some deficiencies at the language level, specifically lower speech perception at six months, poor receptive language at 12 months and expressive language at 18 months, less precision in consonant pronunciation at 30 months, and further impairment in phonological awareness, verbal short-term memory and literacy skills, rapid naming, and verbal short-term memory [19 - 22].

Additionally, other altered neuropsychological processes associated with dyslexia have been found, including Visoperception, Psychomotor Skills, Spatial Structuring, Visual-spatial Attention, Visual Search, Ability to extract and organize visual information from the environment, Auditory Processing, and rhythm [23-28]. These findings are consistent with the report of the US Department of Education, 2021, which indicates that in children aged 3 to 5 years, developmental delay (40.1%) and speech or language disorder (39.9%) are the most prevalent disabilities [9].

With the Spanish language, longitudinal studies show evidence of early predictors of cognitive processes associated with reading difficulties. Specifically, it was determined that phonological awareness and rapid naming have predictive effects on learning to read since their follow-up study with 326 children from kindergarten and first grade with control and experimental groups up to the first three years of school indicated that the intervention group obtained significantly higher scores than the control group in the tests of phonological awareness and rapid naming and obtained better scores in precision tasks and reading speed in the first three grades of primary school [29].

From another perspective, but with similar results, the study carried out to validate the test for the early detection of reading and writing difficulties, initially applied to a sample of 298 prereader children, showed a highly positive correlation between test scores and the results of accuracy, speed and reading

efficiency three years later in the follow-up evaluation of a sample of 190 children from the initial sample. In addition, half of the children classified as at risk had severe reading difficulties [30].

Based on the above, research has highlighted the importance of recognizing the symptoms of learning difficulties during early childhood and implementing preventive intervention programs, which will positively affect future learning experiences. Today, there are several instruments and screening measures for dyslexia in the English language [31, 32], such as the DIBELS and "aimes Pearson webPlus," which provide a variety of tests used to detect risk based on deficits in letter knowledge, phonological awareness, and word reading [33]. Most screening tools are appropriate for kindergarten or first grade, such as the Boston Early Literacy Screeners [34]. There are also questionnaires for parents that provide insight into oral language development and family history, which can help gauge the risk of future learning difficulties [20, 35].

Based on these findings, and given the importance of reading in the life of the human being, and based on the few instruments developed in the Spanish language, the validation of the Cuetos test [36] is of fundamental interest, which is an instrument for the early detection of initial difficulties associated with reading and writing that is easy to apply and validated in different contexts of speaking the Spanish language.

Materials and methods

Design of the investigation

The design is an observational study from a prospective source.

Scenery

The study was carried out in 19 public and private educational centers in Cuenca-Ecuador. The study period was from January 1, 2021, to December 31, 2021.

Inclusion criteria

Four-year-old schoolchildren entered the study. Children with disabilities were excluded.

Study size

The sample was calculated based on the school population from the 2010 population and housing census. It was calculated with a confidence level of 95% and power of 80%, and there were 501 participants.

Variables

The variables were age, sex, and "risk of difficulties in phonological processes associated with reading."

Data sources/measurement

To detect the risk of difficulties in phonological processes associated with reading and writing in 4-year-old preschoolers, the test for early detection of difficulties in learning to read and write was used [35]. The test lasts 6 to 10 minutes per child; the application must be made individually. It consists of 6 subareas and five tasks in each subarea.

The subareas are phoneme discrimination, in which the child must indicate if the sound is the same or different after hearing two words. Segmentation of syllables the child must separate words into syllables by clapping. Phoneme Identification assesses the discrimination of the "rr" phoneme within a word. Repetition of Pseudowords: The child must repeat the words that the evaluator pronounces. Verbal memory is assessed by repeating a series of 2, 3, 4, and 5 digits. Verbal fluency is evaluated with time; in one minute, the child must name animals, and a score is assigned according to the number of animals.

In each subarea, the maximum score is five points, and the maximum total score is 30 points, which is the sum of the six partial scores. Total scores from 27 to 30 correspond to good performance, scores between 18 and 27 correspond to regular performance, scores between 16 and 18 points indicate slight difficulties, and scores less than 16 indicate severe difficulties.

This test is an essential tool for detecting reading and writing difficulties at an early age. Children with scores that reflect mild and moderate difficulties must be intervened on promptly to eliminate and reduce them, allowing them to improve and cement future learning in reading and writing.

Avoidance of bias

The researchers were trained in data collection. All evaluations were carried out individually by psychologists and teachers trained in using the instrument. The parents signed the consent prior to the evaluation. The data were validated and curated by the principal investigators. To avoid possible interviewer, information,

and memory biases, the leading investigator kept the data at all times with a guide and appropriate records. Observation and selection bias was avoided by applying the participant selection criteria.

The exact process indicated by the authors of the test was followed at the level of essays, order, as well as the instructions, adapting the language to the colloquial vocabulary of Ecuador, specifically the words "*palms"* for "*applause"* and "*vale"* for "*agree*." An alternate scale was also added to the evaluation within the discrimination subscale, considering that "z" is not a different phoneme from "s" in Latin America and, therefore, it is easier to discriminate by hearing, replacing it with words that have closer articulatory points such as the alveolar lingua "r" and the dental lingua "d," leaving the alternating scale as follows: "pan - paz" for "pan-par," "luz-luz" for "led-led" and " pez-tez" for "red-sed," the last two words "cal-col" and "fin-fin" were maintained.

Statistical method

Descriptive statistics are used: mean (M), standard deviation (SD), percentiles, and cutoff points to determine the levels of phonological performance and correlations between the subtests and between these and the total score [36]. The categorical variables of good performance (mean + 1 SD), average performance, mild difficulty (mean – 1 SD), and severe difficulty (mean -1.5 SD) were made. Cronbach's alpha was used for instrument validation.

Results

The study included 501 children.

General characteristics

A total of 501 children participated, 241 boys and 280 girls. The age was 56.4 ± 3.9 months.

Average score

The average score achieved was 20.5 out of 30 (Table 1).

No significant differences were found when comparing the original subtest's Phoneme Discrimination with the alternate test ($P > 0.05$).

In Figure 1, it can be seen that the distribution of the scores conforms to the standard curve with a slight bias toward the left side due to the group of children who have difficulties in phonological processing. Representative percentiles were calculated based on the total score (Table 2).

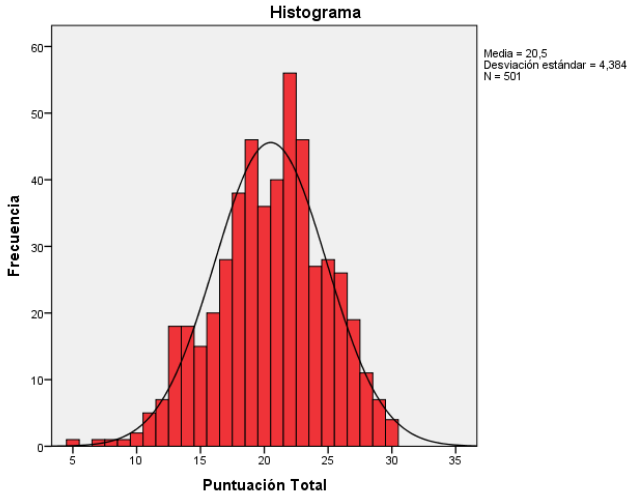

Figure 1. Histogram of the total score of the reading test.

Table 1. Mean scores and standard deviation (SD) in each subtask and the comprehensive reading test.

	Cases n=501
Discrimination	3.49 ± 1.20
Segmentation	3.06 ± 1.60
Identification	3.32 ± 1.12
Pseudowords	3.65 ± 1.45
Digits	3.59 ± 0.80
Fluency	3.39 ± 1.20
Total score	20.50 ± 4.38

Reliability

The value of Cronbach's alpha was 0.71.

Validity

Construct validity was used through the correlations between the six subtests that make up the test and with the total score on the test. Table 3 shows the categorical variables of the test. As seen in Table 4, the correlations between the subtests are moderate, except for the Repetition of pseudowords and Identification of phonemes, and in all cases, they are statistically significant. The correlations of the different subtests with the total test were high.

Table 2. Representative percentiles of the reading test

The total score on the test	percentile
10.00	1
11.00	2
12:00	3
13.00	4
13.00	6
2:00 p.m.	8
2:00 p.m.	10
15.00	13
16.00	15
17.00	20
18.00	25
7:00 p.m.	32
7:00 p.m.	40
21.00	51
22.00	59
23.00	67
24.00	80
26.00	87
27.00	92
28.00	97
30.00	100

Table 3. Qualitative categories

Test points	Classification	Frequency No.=501	%
Between 25 and	Good performance	95	19.0%
Between 17 and 24	Normal	317	63.3%
Between 14 and 16	mild difficulties	53	10.6%
Less than 14	severe difficulties	36	7.2%

Comparison of the validation of the test between Spain, Chile, and Ecuador

When comparing the correlations between the sub-tests and the total score of the countries in which the instrument has been validated, it is observed in Table 5 that all present high correlations, which indicates that all the linguistic tasks are associated with the reading prerequisites. Regarding the highest scores, it is shown that in the case of Spain, it is in Phoneme Identification, in Chile in Phoneme Discrimination, and in Ecuador in Syllable Segmentation; the lowest score is found in the case of Spain and Chile in verbal fluency and Ecuador in the identification of phonemes.

Table 4. Correlations between the subtests and the total score in the test.

	Test subtests					
	Discrimination	Segmentation	ID	pseudowords	digits	Fluency
Phoneme Discrimination						
Syllable Segmentation	.263**					
Phoneme Identification	.208**	.268**				
pseudowords	.151**	.215**	.089*			
Digit Repeat	.241**	.323**	.198**	.344**		
Verbal fluency	.186**	.210**	.216**	.200**	.220**	
Total score	.567**	.692**	.535**	.590**	.590**	.562**

** $P<0.01$. * $P<0.05$

Table 5. Cross-Country Comparison of Correlations Between Subtests and Total Score

subtests	Spain (2015)	Chile (2020)	Ecuador (2021)
phoneme discrimination	.580**	.667**	.567**
syllable segmentation	.642**	.665**	.692**
phoneme identification	.672**	.665**	.535**
repetition of pseudowords	.573*	.641**	.590**
digit repetition	.646**	.612**	.590**
Verbal fluency	.480*	.598**	.562**

** $p<.01$. * $p<.05$.

Discussion

In this investigation, the validity and reliability of the test for the early detection of learning difficulties in reading and writing were analyzed [35]. The same standards used by the test authors regarding population characteristics and test administration were followed.

It is essential to note that in this study, in the phoneme discrimination subtest, two lists of words were used (one original and the other adjusted to the characteristics of phonemics in Latin America), as described in the method, without finding significant differences between the two lists. Hence, using the

same list of words from the original test is adequate for our context.

This test has proven to be a valuable and accurate tool for the early detection of literacy difficulties, as exposed by the longitudinal study by Cuetos [29]. This test has also been confirmed by extensive research, which indicates that early phonological processing deficits are associated with later learning problems [12, 19, 22, 28].

This background determines the need for early detection with an instrument adjusted to the characteristics of the population in which it is applied. It will make it possible to identify deficits to undertake intervention actions focused on basic skills that favor literacy processes, avoiding school failure and improving the quality of life of children and families [37- 39].

The data from this research, with a sample of 501 children, present high correlations between all the test components. This trial shows good construct validity and is consistent with the results obtained in the Spanish and Chilean populations [35, 40]. On the other hand, there is also evidence of high reliability according to the Cronbach test, which indicates that the instrument accurately measures the initial difficulties in reading and writing. The latter is confirmed in the longitudinal study of the test's creators, where it was found that the children who obtained lower scores in the initial evaluation presented specific learning disorders three years later [35].

For the cutoff points of the test, scores between 14 and 16 indicate mild difficulties, and scores less than 14 indicate severe difficulties. These results are very similar to those of the Chilean population, possibly due to the same population and cultural characteristics of Latin America [40].

Finally, validating this instrument based on the characteristics of Ecuadorian children and considering its value and easy application constitutes an outstanding contribution. For this reason, dissemination is necessary for different educational, pediatric, and clinical consultation contexts. In addition, it is a priority to train teachers, psychologists, and health personnel who care for the child population so that they use the test as a requirement at the initial ages. Thus, interventions can be generated according to the detected needs.

Conclusions

With the easy application of the "test of reading" in children aged 4 years, the authors recommended the application for the identification of dyslexia and phonological processing deficits in school children in Ecuador. The reading test's validity allows its application at a regional level.

Abbreviations

SD: Standard deviation.
TEAp: Specific learning disorders.

Supplementary information

No supplementary materials are declared.

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Author contributions

Elisa Piedra-Martínez: Conceptualization, Data preservation, Fundraising, Research, Resources, Software, Writing - original draft.
Andrea Freire- Pesántez: Conceptualization, Data conservation, Supervision, Acquisition of funds, Research, Resources.
Cindy López-Orellana: Conceptualization, Supervision, Funding, Research, Resources.
Eulalia Tapia-Encalada: Conceptualization, Supervision, Acquisition of funds, Research, Resources.
All authors read and approved the final version of the manuscript.

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Availability of data and materials

The data sets generated and analyzed during the current study are not publicly available due to participant confidentiality but are available through the corresponding author upon reasonable scholarly request.

Statements

Ethics committee approval and consent to participate

The Research Commission of the University of Azuay approved this protocol. This research required informed assent from the tutors of the participants.

Publication Consent

This does not apply to studies that do not publish MRI/CT/Rx images or physical examination photographs.

Conflicts of interest

The authors declare they have no conflicts of interest.

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