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Dyslexia and dyscalculia in Ecuador. Prevalence study in school children

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Abstract | **Introduction:** Prevalence studies on specific learning disorders have reported significant variations. In Latin America, these percentages tend to be notably higher, with marked differences between school type and grade level. In Ecuador, research on this topic is very limited, making the present study an original contribution. **Objective:** This study reviews the prevalence of specific learning disorders in a random, stratified, probabilistic sample of 1,228 fourth- and sixth-grade students, comparing sex, school type, and grade level (Inclusion criteria: 1. enrollment in participating schools; 2. absence of disability-related educational needs; 3. IQ ≥ 85; 4. parental consent; and 5. ≥ 2 years of formal reading–writing instruction). **Method:** We used Raven's Progressive Matrices, Badyg E2 and E3, and PROLEC R. Results. The results revealed the prevalence of dyslexia to be at 25.8%, with dyscalculia being at 13.7%. The prevalence of specific learning disorders was significantly higher in public schools compared to private schools. Fourth-grade students had a significantly lower percentage of dyscalculia compared to sixth-grade students. No differences were observed based on sex. **Conclusion:** These findings underscore the potential role played by environmental factors, such as socioeconomic status, in shaping learning difficulties, particularly in public schools. In Latin American countries, impoverished environments, poverty, family stress, limited access to educational materials, and low parental educational levels have a profound impact on cognitive development and learning outcomes. These factors must be carefully considered when evaluating and addressing learning difficulties, as they are often fundamental contributors to the challenges students face.

Keywords: Dyslexia, dyscalculia, Ecuador, prevalence, specific learning disorder

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Dislexia y discalculia en Ecuador. Estudio de prevalencia en escolares

Resumen | **Introducción:** Los estudios de prevalencia sobre el trastorno específico del aprendizaje han informado variaciones significativas. En Latinoamérica, estos porcentajes tienden a ser notablemente más altos, con marcadas diferencias entre tipos de escuela y niveles educativos. En Ecuador, la investigación sobre este tema es muy limitada, lo que convierte al presente estudio en una contribución original. **Objetivo:** Este artículo revisa la prevalencia de trastornos específicos del aprendizaje en una muestra aleatoria, probabilística y estratificada de 1228 estudiantes de cuarto y sexto grado, comparando sexo, tipo de escuela y nivel educativo (criterios de inclusión: 1. matrícula en las escuelas participantes; 2. ausencia de necesidades educativas asociadas a discapacidad; 3. CI ≥ 85; 4. consentimiento parental; y 5. al menos dos años de instrucción formal en lectura y escritura). **Método:** Se utilizaron las Matrices Progresivas de Raven, Badyg E2 y E3, y PROLEC R.

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Resultados: Los resultados revelaron que la prevalencia de dislexia fue del 25.8% y de la de discalculia del 13.7%. La prevalencia de trastornos específicos del aprendizaje fue significativamente mayor en las escuelas públicas en comparación con las privadas. Los estudiantes de cuarto grado presentaron un porcentaje significativamente menor de discalculia en comparación con los de sexto grado. No se observaron diferencias en función del sexo. **Conclusión:** Estos hallazgos destacan el posible papel de los factores ambientales, como el nivel socioeconómico, en la configuración de las dificultades de aprendizaje, en especial en las escuelas públicas. En los países latinoamericanos, los entornos empobrecidos, la pobreza, el estrés familiar, el acceso limitado a materiales educativos y el bajo nivel educativo de los padres tienen un profundo efecto en el desarrollo cognitivo y los resultados de aprendizaje. Estos factores deben considerarse cuidadosamente al evaluar y abordar las dificultades de aprendizaje, ya que a menudo contribuyen de forma fundamental a los desafíos que enfrentan los estudiantes.

Palabras clave: Dislexia, discalculia, Ecuador, prevalencia, trastorno específico del aprendizaje

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Specific learning disorder (SLD) is a neurodevelopmental condition characterised by persistent difficulties in acquiring fundamental academic skills that fall significantly below what is expected for the individual's chronological age (American Psychiatric Association [APA], 2023). These disorders become evident during the school years and affect the reading, writing, and/or mathematical skills of students with neurotypical or higher intelligence. These difficulties are not explained by intellectual, developmental, sensory, neurological, or motor disorders, highlighting the condition's diagnostic specificity (APA, 2023). SLDs are of biological origin and can be presented by the interaction of genetic, epigenetic, and environmental factors (Cernigliaro et al., 2024).

SLDs have significant implications for individuals' daily lives during their school years. Poor school performance rates and early school dropouts are higher for SLD students than those of their normotypical peers (Foreman-Murray et al., 2022). Additionally, SLD students may also present a greater risk of experiencing social isolation (Bruefach & Reynolds, 2022). These difficulties have been observed to continue into adulthood and manifest in various areas, particularly in the workplace and in psychological aspects (Wissell et al., 2021).

Given the significant consequences of experiencing an SLD, it is important to understand its prevalence in an educational system. This will help allocate sufficient resources to their prevention and treatment. Although SLDs are considered a distinct clinical category, they can present themselves in different forms depending on the academic skills that are affected.

Dyslexia is one of the specific disorders associated with reading acquisition (Wagner et al., 2020). It is characterised by difficulties in fluent word reading, poor decoding, and poor spelling (APA, 2023). According to the dual path model, the subtypes of dyslexia are: phonological dyslexia, which is linked to a selective deficiency in reading non-words; visual dyslexia, which affects the recognition and reading of common words or the spelling of irregular words (Coltheart et al., 2001); and mixed dyslexia, also known as deep dyslexia, which involves severe reading difficulties, where the individual makes both phonological and visual errors, often substituting words that do not visually resemble each other (Abeare & Whitman, 2009).

The prevalence rate of dyslexia ranges from 5% to 20% (Wagner et al., 2020). This variability is also evident in studies conducted specifically in Spanish, a language characterised by its transparent orthography where grapheme–phoneme conversion rules are generally applied (Ripoll et al., 2020). Population-based studies have found prevalence rates ranging from 2% to 3.3% (De los Reyes-Aragón et al., 2008; Jiménez & García, 2007; Jiménez et al., 2009), and between 8% and 11.8% (Carrillo et al., 2011; Jiménez & García, 2007), among students aged 7–14 years. One possible explanation for the variability in prevalence rates may lie in differences in identification procedures, such as the use of screening tools versus standardised assessments (Cai et al., 2020), as well as broader contextual factors, including misconceptions, varying conceptual frameworks, and diagnostic approaches (Daniel et al., 2024). Moreover, sex has been identified as a factor associated with dyslexia, with this condition reported to occur three to four times more often in boys than in girls (Granocchio et al., 2021).

Dyscalculia is a pattern of difficulties in learning and processing numerical information, performing arithmetic operations, and executing calculations fluently (APA, 2023). School-related problems include immature counting strategies, deficits in solving mathematical problems, transposition in writing of figures, automation of arithmetic facts, and confusion with arithmetic signs, among others (Cai et al., 2020).

The prevalence of dyscalculia shows different percentages in the various studies on this topic. Data obtained from samples of children aged 9 to 11 years indicate prevalence rates of 1.3% (Lewis et al., 1994), 7.8% (Bastos et al., 2016), 9.9% (Jovanović et al., 2013), and 13.8% (Barbaresi et al., 2005). These differences are mainly due to the definitions of dyscalculia used in the studies and the cut-off points in the mathematics tests (Castaldi et al., 2020; Desoete et al., 2004). Despite the indications of prevalence, its diagnosis continues to be underestimated, underscoring the need for additional comprehensive research on this topic (Dowker, 2024). Regarding the gender proportion in dyscalculia, the DSM-5-TR specifies the general higher prevalence of SLD in men vs. women, with a ratio of 2:1 to 3:1 (APA, 2023). However, this situation has not been particularly analysed, and studies have found inconsistent results

that do not allow conclusions to be drawn. Therefore, researchers tend to support the proposition that no sex-based distinctions exist (Devine et al, 2018; Morsanyi et al., 2018).

Although dyslexia and dyscalculia are defined as distinct clinical categories, they frequently co-occur. Meta-analyses indicate that students with dyscalculia are more than twice as likely to also present dyslexia compared to their peers without dyscalculia (Joyner & Wagner, 2020). Complementary reviews estimate that around 40% of children diagnosed with dyscalculia also exhibit dyslexia (Starling-Alves et al., 2025). This overlap has been attributed to shared genetic influences, along with domain-specific biological and environmental factors (Willcutt et al., 2019). Moreover, studies on heritability and familial aggregation of SLDs suggest that common biological underpinnings may account for their frequent co-occurrence (Landerl & Moll, 2010).

Beyond genetic and familial influences, studies on the prevalence of SLDs have also analysed the influence of contextual factors, such as grade level and school type. Research on SLD distribution across grade levels provides mixed evidence. Several primary education studies have observed that signs of dyslexia tend to be less frequent in higher grades, although these reductions are generally not statistically significant (Feng et al., 2024; Sun et al., 2013). Conversely, other studies suggest increases in SLD prevalence with grade level (Abu-Hamour & Al-Hmouz, 2017; Ismail et al., 2019). This increase is explained by rising academic demands, which can reveal learning difficulties that were less noticeable in earlier grades. Notably, in adolescent populations, Ashraf and Najam (2020) found a high prevalence of SLD symptoms—39% overall, including 33% dyslexia and 45% dyscalculia—among secondary school students, underscoring the continued impact of SLDs during adolescence.

Regarding school type, studies have compared the results between public and private schools, as shown in research conducted in Jordan (Abu-Hamour & Al-Hmouz, 2017) and India (Chordia et al., 2020). The percentage of learning problems for children from private schools (2.2%) is much lower than that reported for children from public schools (12.1%). In addition, the learning and behaviour profiles of students with learning disabilities in private schools are also better when compared to those in public schools (Abu-Hamour, 2014).

In this context, the objective of this study was to determine the prevalence of dyslexia and dyscalculia, including cases of comorbidity, in a probabilistic sample of Ecuadorian school children. In addition, we compared sex, school type and grade level in these disorders. Although there are few recent studies addressing the prevalence of SLD in Ecuadorian school populations, some evidence is available. Among children aged approximately 5 to 13 years, reported dyslexia prevalence rates range from 26.57% (Vélez-Calvo et al., 2015) to 37.25% (Santacruz, 2018). The latter study also reported a dyscalculia prevalence of 12.96% in the same sample. These results highlight the need for updated and representative data on the prevalence of SLD in Ecuador.

Method

This study was conducted using a cross-sectional, descriptive design in Cuenca, Ecuador. Participants included children from urban schools. The target population for fourth grade comprised a total of 6,446 students, of whom 4,209 were enrolled in public schools and 2,237 in private schools. Similarly, the population for sixth grade consisted of 6,361 students, including 4,194 from public institutions and 2,167 from private institutions.

A random and probabilistic sampling method was employed, with the number of students per institution counted to meet the sample size based on Arkin and Colton's Tables, the tables provide sample size estimates based on population size and desired confidence levels (Arkin & Colton, 1963; error margin ±5%). Data was collected between February and May 2014, corresponding to the academic year under the Sierra school calendar

Participants

The total number of participants evaluated was slightly higher than the reference number provided by Arkin and Colton's (1963) tables, as we included full classrooms. In this regard, a total of 1,466 children of the fourth and sixth grades of General Basic Education attending 15 schools (9 public and 6 private) were considered in the study. Inclusion criteria were as follows: 1. Enrollment in participating schools, 2. No educational needs associated with disability, 3. IQ ≥ 85, 4. Parental consent to participate in the study, and 5. To have completed at least two years of instruction in reading and writing, and three years of formal instruction in mathematics. It is worth noting that, in Ecuador, formal education in literacy and mathematics begins in the first grade of basic education.

Participants who did not meet the inclusion criteria were excluded, resulting in a final sample of 1,228 subjects organized as follows: 50.2% male (n = 617), 49.8% female (n = 611); 50% in fourth grade (n = 614), 50% sixth grade (n = 614); 50.7% from public schools (n = 622), and 49.3% from private schools (n = 606). The mean age was 116.22 months (SD = 13.38 months), and the mean IQ was 104.71 (SD = 12.36 IQ points).

Instruments

Family sociodemographic characteristics

To obtain the family characteristics of the participating children, a questionnaire was designed to collect information on parental education and family income. The questionnaire was completed by the directors of the 15 schools, who accessed institutional records to gather this information.

Spanish version of Raven's Progressive Matrices. The Spanish version was used to estimate deductive reasoning ability and the "g" factor. For children aged 6 to 9, the Progressive Matrices Test (Raven et al., 1996) was used, while for 10-year-olds, the short version of the Raven General (Raven, 2001) was utilised. The Raven's Progressive Matrices Test, in its various forms (CPM, SPM, APM), is one of the most widely used tools worldwide for assessing fluid intelligence, both in clinical studies and

in educational and cross-cultural research (Hambleton et al., 2005). This test is widely used in the assessment of intelligence and was employed to rule out intellectual disability and other cognitive impairments.

PROLEC-R. The PROLEC-R reading subtest was administered to evaluate word and pseudoword reading accuracy and reading time (Cuetos et al., 2007). The word reading subtest consists of 40 words (20 high-frequency and 20 low-frequency words). The Cronbach's Alpha for this study was 0.72. The pseudoword reading subtest contains 40 pseudowords, altered versions of the words from the previous task (e.g., "globo" changed to "gloro"; Cronbach's Alpha in this study = 0.72). The validity of this test is established according to the student's educational grade or level. Reading accuracy was calculated by counting correct responses. This instrument is among the most used measures for the assessment of dyslexia in Spanish.

Badyg E2 and Badyg E3. Numerical calculation tests from Badyg E2 (Yuste, 2002) were used to assess the speed and accuracy of simple mental calculations (24 questions, e.g., "Circle the operation that results in a greater number"). The Badyg E3 problem solving test (Yuste, 2004) evaluated calculation speed, numerical reasoning, and the application of arithmetic operations to verbal-numerical problems (32 items, e.g., "Perform these operations"). The Cronbach's Alpha coefficient obtained was .88 for both tests. This test allows for the rigorous quantification of skills related to mathematical calculation.

Procedure

After obtaining parental informed consent and child assent, data collection took place over approximately three consecutive weeks in each institution, depending on the number of children to be evaluated. The assessments were conducted by a team of 15 psychologists who had previously received specific theoretical and practical training on the administration of these assessment tests. All assessments were carried out in accordance with the protocols for each test. During the fieldwork, a member of the research team remained at each school to ensure that the evaluations were carried out in accordance with the established protocols and to address any possible questions from the team of psychologists. The testing procedure was as follows: 1. The Raven test was administered in groups of ten children, following the group application guidelines of the test, with additional instructions for children who had difficulty understanding the task. Two evaluators were assigned to each group to provide individual attention (test duration: approximately 30 minutes). 2. Spelling and calculation tests (Badyg E2 or E3) were given in groups of ten children, following the recommended order and ensuring that children did not show signs of fatigue. The tests were completed independently by the children, with two evaluators present per group (test duration: approximately 1 hour). 3. The PROLEC-R word and pseudoword reading test was administered individually, recording both correct responses and reading times in a distraction-free environment (test duration: approximately 20 minutes). The tests were administered over three consecutive days, with each test conducted on a different day. The classrooms where the tests were administered were adequately illuminated, well ventilated, and had external noise control.

Data analysis

Students were classified into dyslexia and dyscalculia groups when their scores on standardised achievement were at least two standard deviations below the sample mean, in accordance with ICD-10 guidelines (2000).

To examine whether the likelihood of these learning disorders differed by sex, grade level, and school type, we calculated relative risks (RR) with 95% confidence intervals. Comparisons were made between male and female students, fourth- and sixth-grade students, and public and private schools. For each comparison, relative risks (RRs) and 95% confidence intervals (CIs) were calculated from 2 × 2 contingency Tables. Statistical significance was assessed using chi-square–based tests, with a two-sided alpha level of 0.05. All analyses were unadjusted; no multivariable models were fitted, and no adjustments were made for potential confounding variables such as socioeconomic status or parental education.

Analyses focused on these variables; other potential confounders (e.g., socioeconomic status or comorbid conditions) were not included.

All analyses were performed in R version 4.2.1 (R Core Team, 2022) using the epiR package, with statistical significance set at $p < 0.05$.

Ethical declaration

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and followed international standards for ethical research in psychology and education. Participation was entirely voluntary, and the objectives of the study were clearly explained to all participants and their legal guardians. Written informed consent was obtained from parents or legal guardians prior to data collection. Institutional authorisation was obtained from the Zonal Education Coordination. Confidentiality and anonymity of all participants were strictly ensured, and the data was used exclusively for academic and scientific purposes.

The study is part of a broader research project approved by the University of Azuay, the University of Valencia, and funded by Senescyt through scholarship No. 018-CIBAE.

Results

Participants who did not meet the inclusion criteria were excluded, resulting in a final sample of 1,228 subjects. Participant characteristics can be found in Table 1.

The IQ was: fourth grade 98.36 (*SD* = 10.85); sixth grade 111.06 (*SD* = 10.36).

According to the school directors, parental education levels were as follows: 25% of private-school parents reported university-level education, and 26.7% reported secondary education, while in public schools, 3.68% had university education and 19.02% had secondary

education. A total of 7.45% of private-school parents had only completed primary education, compared to 16.15% in public schools, with 2% of public-school parents having no formal education.

Table 1. Descriptive characteristics of the participants

		Grade	
		Fourth *n*(%)	**Sixth *n*(%)**
Sex *n*(%)	Boys	301(49%)	316(51.5%)
	Girls	313(51%)	298(48.5%)
Type of school *n*(%)	Public	326(53.1%)	296(48.2%)
	Private	288(46.9%)	318(51.8%)
Age (months)	Mean (standard deviation)	104.2(5.1)	120.6(5.8)
	Range	90-135	112-164

In terms of income, based on Ecuador's minimum wage, 36.75% of private-school parents reported earning three to five times the minimum wage, compared to 6.5% in public schools. A total of 52.6% of public-school parents reported earning less than the minimum wage, compared to 4.15% of private-school parents.

The prevalence of dyslexia, categorised by subtype, was as follows: 10% visual dyslexia, 3.3% phonological dyslexia, and 12.5% mixed dyslexia, resulting in a total dyslexia prevalence of 25.8%. Dyscalculia had a prevalence of 13.7%. The distribution of dyslexia and dyscalculia in fourth and sixth grade is presented in Table 2.

Table 2. Distribution of dyslexia and dyscalculia by grades

		Grade	
		Fourth *n*(%)	**Sixth *n*(%)**
Reading	Normotypical reading performance	467(76.1%)	443(72.1%)
	Visual dyslexia	50(8.1%)	73(11.9%)
	Phonological dyslexia	19(3.1%)	22(3.6%)
	Mixed dyslexia	78(12.7%)	76(12.4%)
Mathematics	Normotypical mathematics performance	584(89.3%)	512(83.4%)
	Dyscalculia	66(10.7%)	102(16.6%)

The calculated RR for dyslexia indicated that male students had a 17% higher risk of presenting dyslexia compared to female students (Table 3). For dyscalculia, males had a 12% lower risk than females. However, the lack of statistical significance ($p > 0.05$) suggests that observed differences in learning disorder risks are not associated with sex.

The results showed statistically significant differences between public and private schools ($p < 0.05$) in both the prevalence figures of dyslexia (31.2% in public schools; 20.5% in private schools) and dyscalculia (17.7% in public schools; 9.2% in private schools) ($p < 0.05$) See Table 4.

Table 3. Comparison of RR between male and female students

Diagnosis	**Gender *n*(%)**		**RR (95% CI $p < .05$)**
Dyslexia	Male	172(27.9)	1.17 (0.96, 1.41)
	Female	143(23.9)	
Dyscalculia	Male	79(12.8)	0.88 (0.66, 1.16)
	Female	89(14.6)	

RR: Relative risk; CI: Confidence interval

Table 4. Comparison of RR between public and private schools

Diagnosis	**School type *n*(%)**		**RR (95% CI $p < .05$)***
Dyslexia	Public	194(31.2%)	0.66 (0.54, 0.80)*
	Private	124(20.5%)	
Dyscalculia	Public	110(17.7%)	0.54 (0.40, 0.73)*
	Private	58(9.2%)	

RR: Relative risk.

Regarding grade level, students in fourth grade had a significantly lower risk (35%) of presenting dyscalculia compared to sixth-grade students (see Table 5). Although the RR for dyslexia also indicated a reduction in risk of 14%, the observed differences were not statistically significant.

Table 5. Comparison of RR between fourth and sixth grade students.

Diagnosis	**Grade *n*(%)**		**RR (95% CI $p < .05$)***
Dyslexia	Fourth	147(23.9%)	0.86 (0.71, 1.04)
	Sixth	171(20.9%)	
Dyscalculia	Fourth	66(10.7%)	0.65 (0.48, 0.86)*
	Sixth	102(16.6%)	

RR: Relative risk.

Finally, we obtained the comorbid group with dyslexia and dyscalculia (Table 6).

Table 6. Prevalence of comorbid dyslexia and dyscalculia and other specific learning difficulties

	***n*(%)**
Neurotypical	816(66.4%)
Comorbidity Dyslexia - Dyscalculia	74(6%)
Dyslexia	244(19.9%)
Dyscalculia	94(7.7%)
Total	1228(100%)

Discussion

This study aimed to determine the prevalence of dyslexia and dyscalculia in a probabilistic sample of Ecuadorian school children. Additionally, we compared sex, school type, and grade level in relation to these disorders.

In our sample of 1,228 subjects from fourth and sixth grades, 10% had visual dyslexia, 3.3% had phonological dyslexia, and 12.5% had mixed dyslexia. The total prevalence of dyslexia was 25.8%. Dyscalculia was observed in 13.7% of the students.

The prevalence of dyslexia in this study is notably higher than those reported in other studies in Spanish-speaking countries (Carrillo et al., 2011; De los Reyes Aragón et al., 2008; Jiménez & García, 2007; Jiménez et al., 2009). Specifically, within Latin America, our findings are higher than those reported in Colombia (De los Reyes Aragón et al., 2008) and align more closely with studies conducted in Guatemala (Jiménez et al., 2011) and Ecuador (Santacruz, 2018; Vélez-Calvo et al., 2015). Regarding dyslexia subtypes, Santacruz (2018) reported 14.2% visual, 11.7% mixed, and 11.3% phonological dyslexia, while Vélez-Calvo et al. (2015) found 9.7%, 8.7%, and 8.2%, respectively. Despite slight differences, phonological dyslexia is consistently the least prevalent subtype, including in the present study.

Regarding dyscalculia, the prevalence we found closely matches that reported in countries such as the United States (Barbaresi et al., 2005) or Serbia (Jovanović et al., 2013). Within Latin America, our findings are similar to those reported in Ecuador (Santacruz, 2018) and higher than those observed in Brazil (Bastos et al., 2016). They are also higher than the rates reported in other regions, such as the United Kingdom (Lewis et al., 1994).

Furthermore, 6% of the students in our sample presented both dyslexia and dyscalculia, indicating a notable comorbidity between these two learning disorders. This finding is lower than the rates reported in meta-analyses, which estimate that around 40% of children with dyscalculia also exhibit dyslexia (Starling-Alves et al., 2025). However, it still supports the evidence of a meaningful overlap between these disorders. These results highlight the importance of screening for both dyslexia and dyscalculia in students presenting difficulties in either domain, as comorbid cases may require more comprehensive or tailored interventions.

The differences observed in prevalence rates between countries and studies may be influenced by multiple factors, including variations in inclusion and exclusion criteria, language, evaluation protocols, and analysis methods (Leqouider et al., 2021). Environmental factors in Latin American countries should also be considered, as language and cognitive development are sensitive to influences such as impoverished environments, family stress (Hur & Bates, 2019; Justice et al., 2019), and parental educational level (Zou et al., 2023), among others. Regarding educational materials, Rosselli et al. (2012) specifically highlight that many households lack books and reading materials, and that schools often lack standardised assessment tools and intervention programmes. These factors impact the learning process and should be considered when evaluating learning disorders.

In addition to analysing prevalence rates, this study examined whether the likelihood of these learning disorders differed based on school type, grade level, and sex.

When comparing learning disorders by school type (public or private), we found statistically significant results, with a higher prevalence of learning disorders in public schools, a finding that aligns with national curriculum assessments conducted in Ecuador (Portes López et al., 2024). However, these differences may be explained by the socioeconomic status of families rather than by the type of school itself, given that in our sample parents of children in private schools reported substantially higher educational levels and incomes. Consistent with this interpretation, a study reported that children from lower socioeconomic backgrounds were 8.3% more likely to develop learning disorders than those from higher socioeconomic levels (Bozatlı et al., 2024; Okoli et al., 2022). Other studies have found that children from lower-income families are almost three times more likely to experience SLDs than those from higher-income families (Español-Martín, 2023). Furthermore, the lower educational levels reported by parents of children in public schools may also reflect an intergenerational component, given that SLDs show strong familial aggregation and heritability. Previous studies indicate that families of individuals with an SLD are at increased risk of having similar learning difficulties (Landerl & Moll, 2010; Willcutt et al., 2019), suggesting a possible familial predisposition in addition to socioeconomic factors.

Comparing the grade levels, we found that sixth-grade students had more dyscalculia-related issues compared to fourth-grade students. Several factors may explain this increase. First, one key explanation may be the growing complexity of mathematical content. Similar findings were reported by the 2023 national tests, where lower-performing children were found in higher levels (Instituto Nacional de Evaluación Educativa, 2024). This may be due to the increasingly abstract nature of the content as students progress in their education (Benedicto-López & Rodríguez-Cuadrado, 2019), which can expose more cases of dyscalculia. Second, socioeconomic influences may contribute to the observed pattern, as brain development is influenced by economic, cultural, and biological factors, and cognitive, adaptive, and behavioural skills depend on the socioeconomic and educational background of the child's family (Bozatlı et al., 2024; Hur & Bates, 2019; Okoli et al., 2022; Zou et al., 2023).

Finally, the RR analysis indicated that sex was not a significant factor influencing the likelihood of SLD, which aligns with previous research reporting no sex differences in the prevalence of dyslexia and/or dyscalculia (Devine et al., 2018; Ismail et al., 2019; Jiménez et al., 2011; Morsanyi et al., 2018; Santacruz, 2018; Vélez-Calvo et al., 2015). However, this contrasts with other studies that did find sex differences, showing that SLDs are more prevalent among males (Jovanović et al., 2013; Leqouider et al., 2021; Okoli et al., 2022; Sun et al., 2013). The lack of a sex effect in our sample may reflect the rela-

tively young ages assessed (fourth and sixth grades), as gender differences in reading often emerge during adolescence (Granocchio et al., 2021). Additionally, assessments are not sex-specific, and environmental factors such as socioeconomic status may influence performance, so observed differences could partly result from interactions between age, context, and measurement methods.

The results of this study may have important implications for educational policy planning in Ecuador. Although the prevalence rates for SLDs are like those of other Latin American countries, the results show that practically 1 in 4 students meet the reading performance criteria for dyslexia. This result may have significant implications for the school adjustment of many students. In fact, this result compromises educational success not only at the individual level, but also at the level of the national education system itself. Therefore, we believe these results should be considered when designing national plans for the prevention of SLDs, especially dyslexia. These plans could include actions to develop a reading promotion plan in early childhood and increased school hours dedicated to reading. Furthermore, it would be interesting to implement screening programmes in the early school years to identify students at risk of experiencing SLDs in the future. In this way, interventions could be implemented at an early age, before difficulties become more pronounced. In this regard, longitudinal evidence suggests that earlier identification and interventions are associated with more favourable academic trajectories. For instance, Mattison et al. (2022) found that at risk students identified earlier had reading and math scores closer to peer norms, and Partanen and Siegel (2014) reported long-term academic improvements following early intervention for reading disabilities.

Several limitations of this study should be acknowledged. First, sociodemographic variables, including parental educational level and income, as well as family history of SLD, were not controlled or balanced, which may have influenced the findings. Second, the severity levels of reading difficulties or the presence of comorbidities, such as ADHD or language disorders, were not examined, which could affect the prevalence and manifestation of SLDs and may have implications for educational and socio-healthcare interventions. These factors should be considered when interpreting the results and future studies should aim to include them to provide a more comprehensive understanding of the determinants and outcomes of learning disorders.

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