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FACTORS INFLUENCING THE DETECTION RATE OF DYSLEXIA IN PRIMARY EDUCATION IN NAVARRE

FACTORES INFLUYENTES EN LA TASA DE DETECCIÓN DE LA DISLEXIA EN EDUCACIÓN PRIMARIA EN NAVARRA

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ABSTRACT

Studies on the prevalence of dyslexia in Spain have established a range between 11.8% (Gallego et al., 2011) and 3.2% (Jiménez et al., 2009) of dyslexic individuals, and have shown that the detection of dyslexia is influenced by age, diagnostic protocols, coexistence with other difficulties, gender, individual characteristics, and economic and social factors. However, no studies have analysed the effect of some factors on the detection of dyslexia within the school environment. Based on data from the regional census of the Department of Education of the Government of Navarre for the academic year 2021-2022, this study analyses a sample of more than 13,500 students in the 3rd and 5th year of Primary Education in 209 schools. Based on an empirical quantitative descriptive research design, this study compared the diagnostic rate depending on 5 factors: school type, context, size, linguistic programme, and participation in projects aimed at reading skills improvement. The results showed that the overall diagnosis rate for dyslexia is 3.17% (3rd year) and 4.88% (5th

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year) and that the only factors showing significant differences in diagnosis rate were size (lower detection rate in big schools and higher in small schools) and the linguistic programme of the school (lower detection rate in bilingual programmes in English than in monolingual programmes).

Key Words: dyslexia; dyslexia detection; dyslexia in primary education; bilingual programmes in English.

RESUMEN

En España, los estudios de prevalencia de la dislexia han establecido una horquilla de entre un 11.8% (Gallego et al., 2011) y un 3.2% (Jiménez et al., 2009) de personas disléxicas, y han demostrado que en la tasa de diagnóstico influyen la edad, los protocolos de diagnóstico, la coexistencia con otras dificultades, el género, las características individuales y los factores socioeconómicos. Sin embargo, no hay trabajos que analicen el efecto de diversos factores en la detección de la dislexia en el contexto escolar. Basado en los datos del censo escolar del Dpto. de Educación del Gobierno de Navarra del curso 2021-2022, este estudio analiza una muestra de más de 13.500 estudiantes de 3º y 5º de Educación Primaria de 209 centros escolares. Siguiendo un diseño de investigación empírico, cuantitativo descriptivo, se calculó la tasa de diagnóstico de cada centro escolar y se estudió la incidencia de 5 factores: titularidad de los centros, contexto, tamaño, programa lingüístico y participación en proyectos de fomento de la lectura. Los resultados muestran que la tasa media de diagnóstico de la dislexia es del 3.17% (3º EP) y del 4.88% (5º EP) y que los únicos factores que muestran diferencias significativas en tasa de diagnóstico son el tamaño (menor tasa de detección en centros grandes y mayor en centros pequeños) y el programa lingüístico del centro (menor tasa de detección en programas bilingües en inglés que en programas monolingües).

Palabras clave: dislexia; detección de la dislexia; dislexia en educación primaria; programas bilingües en inglés.

ABSTRACT

Studies on the prevalence of dyslexia in Spain have established a range between 11.8% (Gallego et al., 2011) and 3.2% (Jiménez et al., 2009) of dyslexic individuals, and have shown that the detection of dyslexia is influenced by age, diagnostic protocols, coexistence with other difficulties, gender, individual characteristics, and economic and social factors. However, no studies have analysed the effect of some factors on the detection of dyslexia within the school environment. Based on data from the regional census of the Department of Education of the Government of Navarre for the academic year 2021-2022, this study analyses a sample of more than 13,500 students in the 3rd and 5th year of Primary Education in 209 schools. Using an empirical quantitative descriptive research design, this study compared the diagnostic rate depending on 5 factors: school type, context, size, linguistic programme, and participation in projects aimed at reading skills improvement. The results showed that the overall diagnosis rate for dyslexia is 3.17% (3rd year) and 4.88% (5th year) and that the only factors showing significant differences in diagnosis rate were size (lower detection rate in big schools and higher in small schools) and the linguistic programme of the school (lower detection rate in bilingual programmes in English than in monolingual programmes).

Key Words: dyslexia; dyslexia detection; dyslexia in primary education; bilingual programmes in English.

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Introduction

Dyslexia has been reported to be the most common specific learning disorder among school aged population (Stanley & Petscher, 2017). Characterized by difficulties with the development of literacy related skills despite conventional instruction, dyslexia may seriously hinder the learning process of primary school children.

Within the last decades, research in linguistics, education and neuroscience has shed light on the neural, biological and language-specific mechanisms underlying dyslexia, providing a solid theoretical framework and recommendations for support and intervention (Goswami, 2002; Harding et al., 2023; Lyon et al., 2001, 2003; Sanfilippo et al., 2020; Shaywitz et al., 1999; Shaywitz & Shaywitz, 2020; Snowling et al., 2020). These findings collectively suggest that the academic success of children with dyslexia heavily depends on accurate diagnosis and timely support. In particular, a formal recognition of dyslexia enables access to the educational and remedial activities and aids provided by the special educational services and academic accommodations, which may help dyslexic children to achieve the learning outcomes and competences expected at each educational stage (Sanfilippo et al., 2020). However, it is not infrequent that dyslexia remains undetected or misdiagnosed at the school level, and, consequently, dyslexic students do not get special educational support.

Indeed, the global prevalence of developmental dyslexia among school-aged population demonstrates significant variations in reported rates across countries ranging from 5% to approximately 20% (Dyslexia Compass, 2022; International Dyslexia Association [IDA], 2020). Big discrepancies in rates reported by official institutions and organizations worldwide have been mainly attributed to factors related to assessment procedures, such as the criteria used for diagnostic testing and cut-off points (Ferrer et al., 2015; Goswami, 2002; Lyon et al., 2001; Sadusky et al., 2022; Snowling et al., 2020). Furthermore, demographic and contextual factors, such as the age of participants, and school's characteristics have also been noted to influence the identification of dyslexia (Fluss et al., 2009; Vellutino et al., 2004; Yeung et al., 2022; Youman & Mather, 2019; Zablotsky & Black, 2020).

In the specific case of Spain, official statistics estimate that there are approximately 12.6% of children with special educational needs in primary education, of which 3.39%[2] would be dyslexic at the most (Subdirección General de Estadística y Estudios [SGEE], 2023). The three available studies on the prevalence of dyslexia in the Spanish school-aged population (Gallego et al., 2011; Jiménez et al., 2009; Sevilla et al., 2021) also present disparities in the reported rates ranging from 3.2% to 11.8%. That variation is due to differences in diagnostic tests, criteria and sample selection.

[2] The statistics report of the Ministry of Education (SGEE, 2023) presents aggregated data for children with all special needs and also the number of children with each of these needs. Dyslexia is not presented alone but grouped with impairments in writing and arithmetic abilities. Consequently, this percentage is the maximum possible rate and not the real rate of children with dyslexia.

The disparity of results underscores the need to explore further factors that might exert some influence on the detection of dyslexia in order to prevent underdiagnosis or misdiagnosis. This study tries to contribute to that line of research by exploring the detection rate of dyslexia in a province of Spain, and whether certain school characteristics (school type, school context, linguistic programme and participation in projects aimed at improving reading skills) might affect detection rate.

Dyslexia prevalence

A close look at the worldwide statistics on the prevalence of developmental dyslexia demonstrates high variations across countries. For example, the International Dyslexia Association (IDA, 2020) claims that there is around 5% of students worldwide with impairment in reading and language processing. However, they warn that the number of people in the world who are struggling with some aspects of reading and, consequently, are likely to be dyslexic is much higher and could reach up to 20%. In line with the latter hypothesis, the US National Institute of Health establishes the upper estimate for adult population with dyslexia at 17% and the lower one at 5% (Dyslexia Compass, 2022). The European Dyslexia Association (EDA, 2020) estimations are lower establishing a range from 9-12% with 2-4% of the population seriously affected by it.

Those prevalence rates variations can be partially explained by three kinds of factors:

- related to assessment procedures such as criteria used for diagnostic testing and cut-off points;
- related to age of diagnosis;
- related to school's characteristics such as socioeconomic status, contexts or linguistic programme.

Regarding the first factor, both the criteria used for diagnostic testing and the cut-off points vary significantly across countries making comparisons difficult. Normally, the diagnostic criteria to identify dyslexia are those defined by the DSM-5 Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association [APA], 2013). They establish that a specific learning disorder with impairment in reading can be diagnosed when the reading skills are substantially and quantifiably below those expected for age (1.5 SD below the mean) despite normal intellectual, visual, auditory abilities and cannot be explained by inadequate instruction, lack of proficiency in the language of instruction or other mental or neurological disorders. However, there is disagreement with that proposed cut-off point. For instance, Ferrer et al. (2015) state that the difference in scores vary across school year, and children with dyslexia might demonstrate only 1 SD in the last years of schooling, so he proposed lowering the cut-off point to that figure. Others, like Lyon et al. (2001), have gone even further claiming that poor readers who do not meet the criteria for specific learning difficulties with impairment in reading should also be included within the group of learning disabilities. The lack of agreement on those cut-off points may result in variations in assessment practices across school practitioners and specialists, leading to different diagnostic outcomes deriving in over- or under-diagnosis. In addition, the specifics of each country legislation about special education, and the individual preferences of practitioners and researchers that "may not appropriately align with the contextual demands of their own environment" (Sadusky et al., 2022, p. 143) seem to lead to discrepancy in diagnostic outcomes.

Furthermore, the criteria used for diagnostic testing appear to be sensitive to the characteristics of the writing system. Thus, it is well established that reading deficits are moderated by orthographic depth (Diamanti et al., 2018; Goswami, 2002; Landerl et al., 1997; Re et al., 2011; Snowling et al., 2020; Youman & Mather, 2019) Consequently, the criteria used for dyslexia identification in one language may not be equally reliable in another. For instance, English is a language characterized by the high level of opacity of its orthographic system. Phoneme-grapheme conversion rules are

inconsistent, and the application of these rules for decoding rarely results in a correct pronunciation. Children with dyslexia, due to their difficulties with fluent word recognition, heavily rely on these rules when translating printed words into speech. Therefore, their decoding deficits in English become evident in a standardized assessment of word and non-word reading and spelling abilities. This makes accuracy-criterion widely used in English-speaking countries (Landerl & Wimmer, 2008). In contrast, it might not be as effective for languages with transparent orthographies like Spanish, Greek or German, whose writing systems allow unequivocal pronunciation of most words and non-words by applying simple orthographic rules. As a result, dyslexic children manage to compensate partially for their difficulties with word recognition by relying heavily on grapheme-phoneme conversion rules and can reach close to a perfect mastery of the phonemic level of speech (Landerl & Wimmer, 2008; Parrila et al., 2020; Re et al., 2011; Sánchez Doménech, 2022). Consequently, their impairment in reading can be concealed, especially at the later stages of reading acquisition. Given this variety across languages, reading tests aimed at measuring reading fluency both at word level and text level become particularly important for the correct identification of dyslexia.

The second factor which might interfere with dyslexia identification is related to the age of diagnosis. Thus, the evaluation of 6–7-year-old students may lead to confusing outcomes because low scores on diagnostic literacy assessment at early ages do not necessarily confirm the presence of dyslexia as they may also indicate that the acquisition of reading mechanisms has not finished due to poor reading experience. However, the educational reality is that sometimes difficulties with reading at early stages are mistakenly identified as dyslexia. The importance of distinguishing at early stages between dyslexia (reading difficulties caused primarily by cognitive and biological deficits) and poor reading skills (reading difficulties caused primarily by inadequate instruction and other experiential factors) has been noted by Vellutino et al. (2004). The authors emphasized the relevance of this issue for the evaluation and assessment of dyslexic pupils by practitioners and researchers. Empirical confirmation was presented by Gallego et al. (2011), who found higher incidence of reading delay among 2nd year pupils in comparison to 4th and 6th year students. Although those pupils were identified as dyslexics by the reading efficiency tests, the authors recognized that a great part of the reading difficulties detected at early ages were temporary and could not be attributed to phonological deficit. Similar findings have been presented by Sevilla et al. (2021), who detected a significant drop in dyslexia rates from the 2nd to the 3rd year of Primary Education (from 19.36% to 8.29%). In line with the conclusions of Gallego et al. (2011), Sevilla et al. (2021) also noticed that a great part of these early reading difficulties identified as dyslexia typically disappear with reading experience without any special intervention.

Finally, research has pointed to three schools' characteristics that seem to influence the detection of developmental disabilities. The first is related to the socio-economic status (SES) of the school population. A direct relationship between SES and reading underachievement has been confirmed in several studies (Diuk et al., 2019; Fluss et al., 2009; Romeo et al., 2018; Vanderauwera et al., 2019) which have reported more children with reading difficulties in families with low and below average economic status. Among other reasons, it is believed that low SES may be associated with suboptimal home educational opportunities which may contribute to reading difficulties among children (Diuk et al., 2019).

The second characteristic is school contexts (rural or urban). The possible effect of urbanicity on the prevalence of learning difficulties was examined by Zablotsky and Black (2020). The authors concluded that children living in rural areas were more likely to be diagnosed with learning disabilities than children living in urban areas. They linked it to poor parental and social financial resources. However, differences in prevalence in developmental disabilities between urban and rural contexts were only for behavioural disabilities (ADHD) and mental health issues.

The third factor signalled is the linguistic programmes offered by the school (bilingual or monolingual). Thus, bilingual and monolingual education may operate differently when identifying students at risk for dyslexia. Some studies (Bialystok et al., 2005; Hoff, 2021; Youman & Mather, 2019) noted that in bilingual contexts the teachers often lack information about what should be expected from a bilingual young learner, and there is a general tendency to expect lower results in

comparison to their monolingual peers. As Bialystok et al. (2005) indicated learning difficulties associated with dyslexia can sometimes be overlooked because it is mistakenly assumed that those difficulties are due to a language-acquisition related problem and if dyslexic kids knew the target language better, the difficulties they show in handling it in print would disappear. This may result in the delay and sometimes under-identification of children with reading impairments in bilingual education programmes.

On the other hand, there are other studies (e.g. Bialystok et al., 2005; Kroll & Bialystok, 2013; Lallier et al., 2018; Lallier & Carreiras, 2018; Vender et al., 2021) that confirm that bilingualism presents cognitive advantages for dyslexic children that help them to mitigate dyslexia effects and improve reading abilities. Thus, Kroll and Bialystok (2013) claim that these specific ways of brain functioning at cognitive and linguistic levels allow bilinguals to outperform their monolingual peers. According to the authors, this could be explained by the fact that both bilinguals and advanced second language learners activate information of both languages in parallel when processing each language. This idea is highly important because it could mean that compensatory mechanisms are more efficient in bilingual learners and, consequently, the significant academic underachievement required to be referred for a diagnostic assessment may not occur. However, up to date and to the best of the authors' knowledge, no studies have compared whether bilingual schools report lower rates of children with dyslexia in comparison to monolingual schools.

The great discrepancy in dyslexia rates across studies and countries, the inconsistency in the assessment procedures and the scarcity of research analysing the factors that might influence the detection of dyslexia pose a huge challenge in estimating the real number of school-aged population affected by dyslexia both worldwide and at a national level, for example, in Spain.

Dyslexia prevalence in school-aged population in Spain

Spain, as many other countries, follows the criteria of DSM-5 of learning achievement for the identification and diagnosis of dyslexia. During the 2021–2022 academic year, 352,619 children were reported to have special educational needs in Primary Education (SGEE, 2023). This constitutes 12.6% of the total number of enrolled students, and the number has been increasing at a steady pace of around 0.5% per year. From the 15 different groups of children with special educational needs, the majority (26%) need educational support and/or curricular accommodations due to impairments in reading, spelling, writing or maths, which can occur simultaneously or separately. In more than 80% of the cases, the affected skills are reading and/or writing (Fletcher et al., 2018). In other words, the majority of these children suffer from dyslexia or a specific learning disorder with impairment in reading (APA, 2013). These percentages indicate that, based on the statistics reported in 2021-22 by the Ministry of Education (SGEE, 2023), the total number of children enrolled in Primary Education who may suffer from dyslexia should not be higher than 3.39%, which is quite lower than the expected rate for dyslexia reported worldwide (IDA, 2020; EDA, 2020) and different to the rates reported by some of the three studies about dyslexia detection in Spain (Gallego et al., 2011; Jiménez et al., 2009; Sevilla et al., 2021).

Jiménez et al. (2009) compared a curricular achievement criterion (reading speed and accuracy) based on the evaluation and assessment of the school teachers to the results of a psychometric criterion (IQ scores on a nonverbal intelligence test and Dyslexia Assessment Battery PROLEC (Cuetos Vega, 2014). Their sample included more than 1,000 children aged 7-12 from three public and one charter school in the Canary Islands. The teachers identified 5.9% children with Specific Learning Disorder with Impairment in Reading, while the test identified 3.2%. This study evidenced that teachers identified more children with impairments in reading characterized by slow and choppy reading, problems with reading comprehension and associated spelling difficulties than psycholinguistic assessment tests.

Gallego et al. (2011) explored the dyslexia rates of a sample of 1,894 children from the 2nd, 4th and 6th year of Primary Education in all public and charter schools in Murcia. The reading efficiency test TECLE (Cuadro et al., 2009) was used and, based on the results, a group of children who presented reading difficulties was separated and tested again in reading speed and accuracy for words and pseudowords and in orthographic knowledge (decision tasks on words presenting inconsistent phoneme-to-grapheme item). Eighty-three per cent of children struggling with reading had phonological and/or orthographical deficits. The distribution per year was not homogenous with the highest rate reported for the 2nd year of Primary Education (15.2%) and the lowest (9.3%) for the 4th year. The authors mentioned the former was not totally reliable because the process of acquisition of phonological mechanisms had not finished at this age and those difficulties could disappear with reading experience without further intervention. Consequently, the authors concluded that the overall prevalence of dyslexia in their study was 11.8%, which is higher than in Jimenez et al.'s (2009) study. The difference could be explained by the selection criteria: teachers' criterion versus reading efficiency test. Thus, in the Gallego et al.'s study, the tests were applied to the total number of students, while in the previous study only to the group identified by the teachers, which was only 27.9% (n=293) of the total sample (n=1,050). In addition, in that study, the reported results, 3.2%, referred to the children who presented difficulties in reading exclusively, and the authors warned that the total number of children who presented difficulties both in reading and writing was somewhat higher (8.9%).

Sevilla et al. (2021) examined 13,406 children (95% from 7-12 years old) enrolled in 100 public and 7 charter schools in Madrid. All children were administered a digital test designed by the authors to detect risk of dyslexia. The test consisted of 32 items and took about 15 minutes. Seven point fifty-five per cent of the children were identified as individuals with reading difficulties. The distribution varied greatly depending on school year with the highest peak at 19.4% in the 2nd year of Primary Education after which it started decreasing to the lowest threshold of 3.77% in the last year of Primary School. The significant drop in numbers after the 2nd of Primary Education corroborates previous findings and confirms that difficulties with reading at early stages can be solved with reading experience without any intervention. Nevertheless, two important limitations of this study were that the children were not randomly chosen and could be pre-selected by the schools, and the schools selected for the study were mostly public so the rate could be influenced by socioeconomic factors associated to limited financial, educational and social resources.

Given the scarcity of research on dyslexia rates in Spain, the different rates reported even within the same study, and their limitations, this empirical quantitative descriptive study tries to contribute to this line of research by examining Primary Education dyslexia rates in Navarre (Spain), and whether detection rate depends on age and three previously analysed school characteristics: school type (public or charter), contexts (urban/rural), and programme (bilingual or monolingual). Two further school characteristics, which have not been explored by research, were also included trying to elucidate their importance for dyslexia detection rates: school size (big, small or medium) and participation of the school in innovation programmes aimed at reading skills improvement. Consequently, the following questions guided this research:

- What is the overall dyslexia rate for the school-aged population in Navarre? Are there differences across age groups?
- What is the effect on dyslexia rate of the following factors?
    - School type (public / charter)
    - School contexts (rural / urban)
    - School size (big / small / medium)
    - Linguistic programme (Bilingual programmes in English, PAI/ Not PAI)
    - Participation in projects aimed at reading skills improvement.

Method

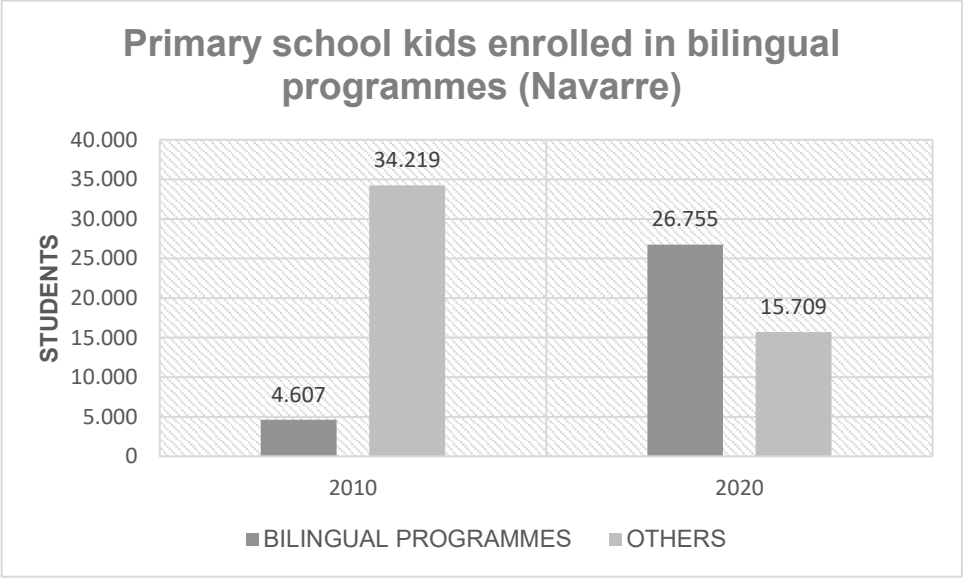
Context

Navarre's education system offers four programmes for the primary education stage called Models A, B, G and D. Model A and G are taught mainly in Spanish, but the former includes Basque (the co-official language in part of the community) as a second language (Departamento de Educación, 2023b). Model B and D are taught mainly in Basque. In the former, students also have Spanish as a subject and a vehicular language in one or more subjects, and in the latter only as a subject. Within the education offer in Navarre, Model D is becoming the mainstream education in the Basque-speaking areas in the north of the region and Model B is residual.

Some of those models also offer bilingual sections in English, called PAI programmes (Programas de Aprendizaje en inglés/English Teaching Programmes or PAI for short), with a sharp increase in enrolment rates throughout the last decade (see Fig. 1). They are English-Spanish immersion programmes based on the CLIL methodology with around 50% of instruction in English. The distribution of hours of instruction in L1 and L2 is regulated by the Government, which has established from 8 to 12 hours of instruction in English (Navarra, C.D.E, 2016). The courses that are to be taught in English are Social Sciences and Natural Sciences. Other courses like Mathematics, Plastics, Music, Reading, Religion or PE are optional. This type of bilingual education is normally referred to as partial immersion, in contrast to total immersion where 100% of the curriculum is taught in English, such as British schools for example (for more details see Hickey & De Mejía, 2016).

Figure 1

Growth in the number of students in bilingual primary education in Navarre



Note: Compiled by authors based on the data on the Education department of Navarre's website, 2023a

Sample

The sample for this study consists of 13.531 students, 549 of them are children diagnosed with specific learning disorder with impairment in reading, in the 3rd and 5th year of Primary education. The students in the 3rd year were from 206 public and charter schools and the students in the 5th year from 209 schools in the 2021-2022 academic year.

The 3rd and the 5th year of Primary Education were selected for the study because the former corresponds to the last year of the first stage of Primary Education when the acquisition of reading skills is considered to be completed, and the latter to analyse if dyslexia rate decreases with age as reported in previous national studies (Gallego et al., 2011; Sevilla et al., 2021).

The following five school characteristics were considered to examine any possible association with dyslexia rates (Table 1):

- School type: public versus charter, which are schools partially financed by the Spanish Government. This factor was included because there is a popular belief that children from low socioeconomic backgrounds are more likely to attend public schools than charter or private ones. However, the distribution of socioeconomic diversity within schools of both types may vary significantly based on geographic location, neighbourhood and schools' education project, and may not correspond closely to specific SES. Nevertheless, due to the general belief that charter schools may cater better for the specific needs of students, it seems worth exploring whether that is indeed the case and whether school type (public or charter) affects detection rate;

- Contexts: urban, which included locations with population over 10.000 citizens, or rural which comprised locations with fewer than 10.000 inhabitants excluding the suburbs of cities which were also considered urban;

- Size: big schools if they had more than 76 students per school year, medium, if they had between 26 and 75 students, and, small, if they had fewer than 25 pupils;

- Linguistic programmes where students were enrolled: PAI or not PAI;

- Participation in innovation programmes aimed at reading skills improvement, or lack of participation.

Table 1

Sample characteristics and their distribution

	Category	No. of schools	No. of pupils	No. of dyslexics	Dyslexia rate (%)		Category	No. of schools	No. of pupils	No. of dyslexics	Dyslexia rate (%)
3rd year of Primary Education	**Overall**	**206**	**6.475**	**205**	**3.17**	5th year of Primary Education	**Overall**	**209**	**7.056**	**344**	**4.88**
	School type						**School type**				
	Public	159	4.144	127	3.06		**Public**	162	4.531	213	4.7
	Charter	47	2.331	78	3.35		**Charter**	47	2.525	131	5.19
	Contexts						**Contexts**				
	Rural	128	2.255	76	3.37		**Rural**	130	2.407	127	5.28
	Urban	78	4.220	129	3.06		**Urban**	79	4.649	217	4.67
	School size						**School size**				
	Small	99	1.017	60	5.9		**Small**	102	1.108	79	7.13
	Medium	83	3.431	97	2.83		**Medium**	83	3.791	183	4.83
	Big	24	2.027	48	2.37		**Big**	24	2.157	82	3.8
	Linguistic programme						**Linguistic programme**				
	PAI	107	4.457	109	2.45		**PAI**	91	4.030	168	4.17
	Not PAI	99	2.018	96	4.75		**Not PAI**	118	3.026	176	5.82
	Quality marks for participation in innovation programmes aimed at reading skills improvement						**Quality marks for participation in innovation programmes aimed at reading skills improvement**				
	Yes	13	428	11	2.57		**Yes**	13	490	29	5.92
	No	193	6.047	194	3.21		**No**	196	6.566	315	4.8

Note: Compiled by authors

Instruments, procedure and data analysis

The data for this study were obtained from the Regional Census of the Department of Education of Navarre. This report contains information on school and pupil characteristics including schools' location, linguistic programmes, the total number of pupils at each level of education and the number of pupils diagnosed with dyslexia. The diagnosis is the result of the psycho-pedagogical evaluation issued by a school specialist, a private licensed psychologist, or both. The data from the Census undergo yearly updates and are used for allocation of special education resources between schools in accordance with the educational needs of their learners. Further details about the schools, such as the participation in innovation programmes that could have an impact on the acquisition of literacy skills were collected from the yearly reports available on the website of the Department of Education of Navarre.

The data collection and processing were carried out in accordance with the Personal Data Protection Law (España, Cortes Generales, 2018) through rigorous and appropriate procedures for confidentiality and anonymisation minimizing the risk of disclosure.

Inferential statistical analyses were performed using the SciPy package (Virtanen et al., 2020) from Python 3 (Van Rossum & Drake, 2009). Due to the binary nature of the variable of interest (dyslexic/non-dyslexic students), binomial tests were run to investigate if the variable was different to the expected value (overall dyslexia rate) considering the factors under study (age, school type,

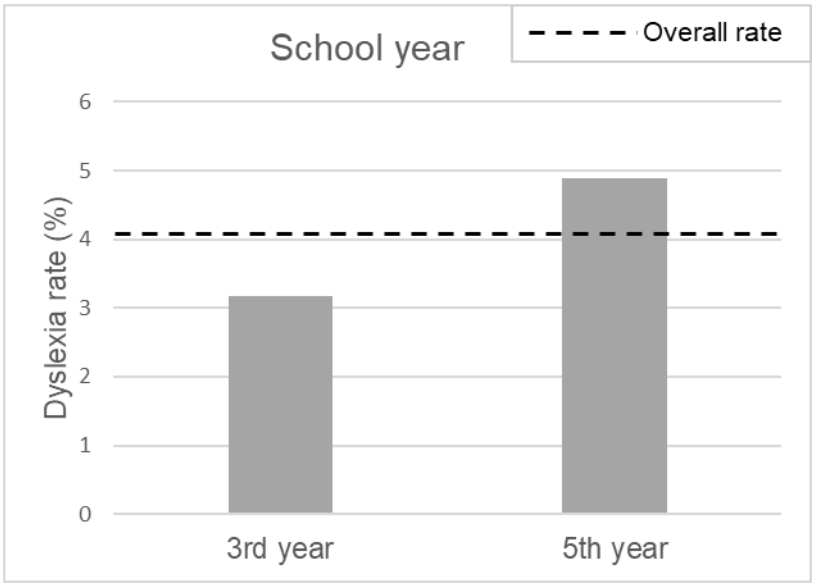
school size, school contexts, linguistic programme and participation in programmes aimed at improving reading) and comparing the overall and the expected rates.

Results

Overall dyslexia rate of the Primary School population in this study was 4.06% (Figure 2). The detection rate was lower (3.17%) in the 3rd year of Primary Education and higher (4.88%) in the 5th year. Both results were statistically significantly different to the overall rate according to a binomial test (p-value <.001 in both years) confirming that age is strongly associated with the diagnosis of dyslexia.

Figure 2

Distribution of population with dyslexia in Primary Education in Navarre region in 2021-2022 academic year

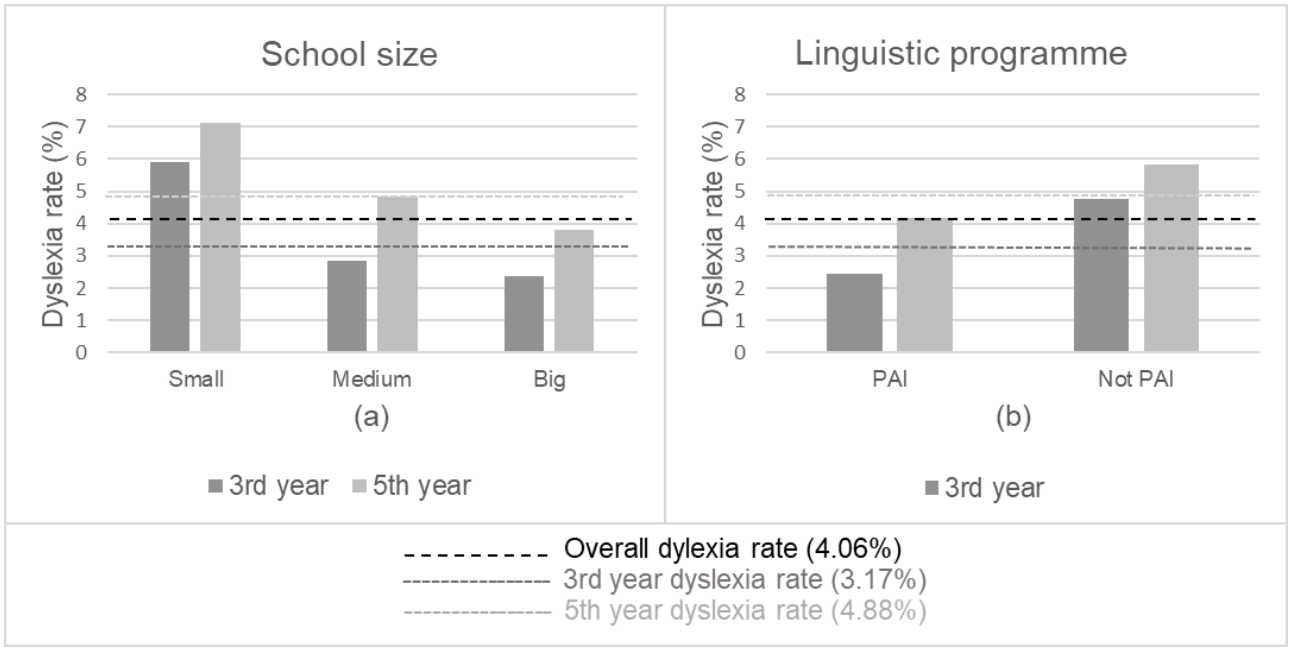


Note: Compiled by authors

When considering school characteristics, statistically significant differences with overall dyslexia rate were found only for two factors: school size and linguistic programme (Figure 3). No significant differences were observed for the rest of school characteristics: school type, school contexts and implementation of programmes aimed at reading skills improvement (Figure 4).

Figure 3

Distribution of population with dyslexia as per school size (a) and linguistic programme (b)



Note: Compiled by authors

Our data indicate that the first of those factors is strongly associated with detection rate (Small schools: 5.9% in the 3rd year of Primary and 7.13% in the 5th year versus big schools: 2.37% in the 3rd year and 3.8% in the 5th year). Statistically significant differences were found between the expected and the real rate of big and small schools in both years of primary education (p-value <.005 in the 3rd year and p-value <.001 in the 5th year). However, no significant differences were detected between the expected rate and the diagnostic rate of medium sized schools.

With regards to the linguistic programmes of the schools, the diagnostic rates were significantly lower in schools with partial immersion in English (PAI: 2.45% in the 3rd year and 4.17% in the 5th year versus Not PAI: 4.75% in the 3rd year and 5.82% in the 5th year). Thus, this factor showed a significant influence on dyslexia detection across Navarre schools (p-value <.001 in both years).

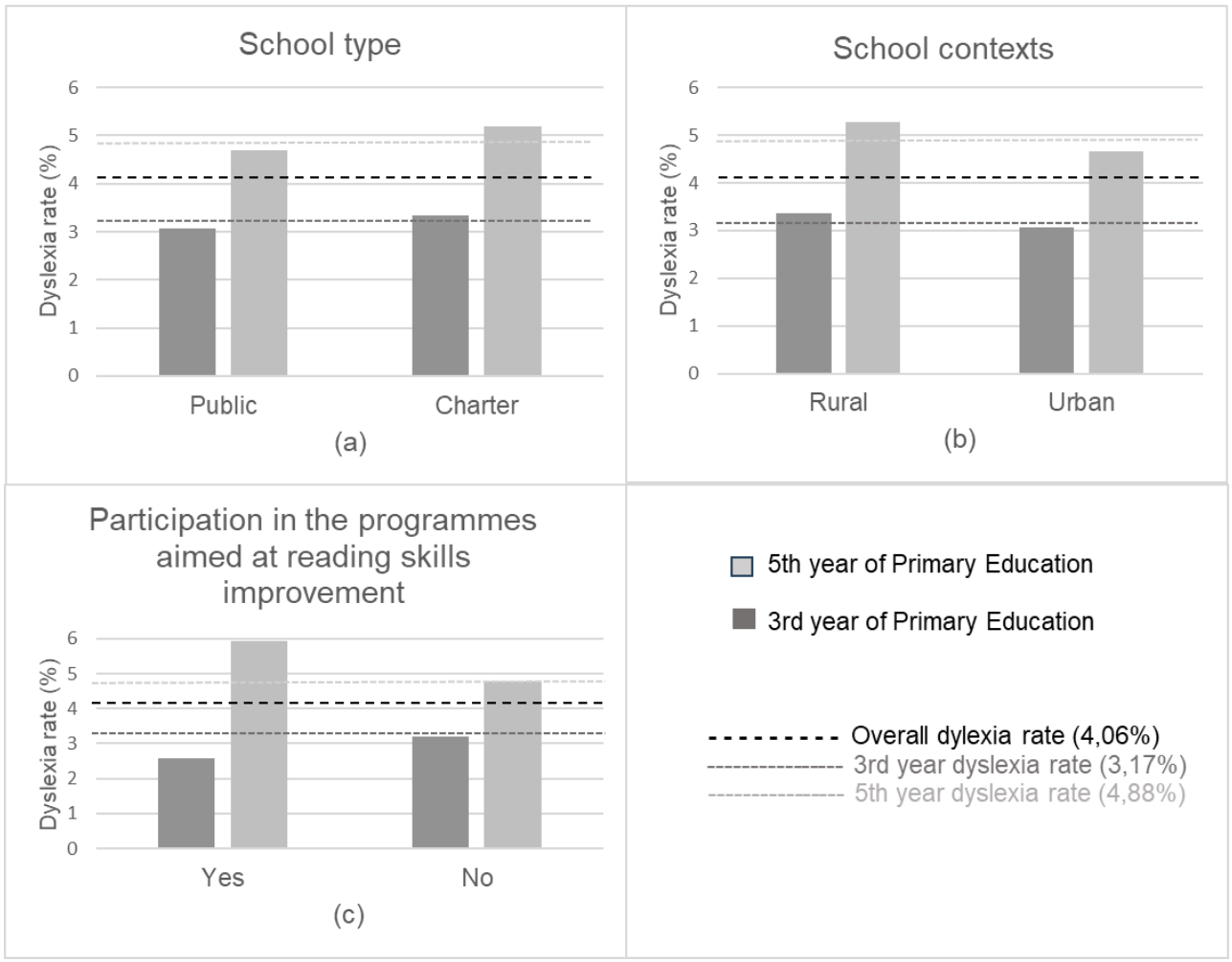
In relation to school type, the results showed that public schools identified slightly fewer dyslexic children than charter ones (public schools: 3.06% in the 3rd year and 4.7% in the 5th year versus charter schools: 3.35% in the 3rd year and 5.19% in the 5th year). However, the differences with the expected rate in both cases were not statistically significant which indicates that both types of schools diagnose similarly.

Regarding school contexts, dyslexia rates were quite similar, but slightly higher in rural schools in both years (3rd year: 3.37% in rural schools versus 3.06 in urban, and 5th year: 5.28% in rural versus 4.67% in urban). However, the difference with the expected rate did not reach statistical significance.

Finally, in relation to the last factor, whether dyslexia rates vary depending on schools' participation in programmes aimed at improving reading skills, our figures showed slight differences in rates (schools with quality marks: 2.6% in the 3rd year and 5.9% in the 5th year versus schools without quality marks: 3.21% in the 3rd year and 4.8% in the 5th year). However, those differences did not reach statistical significance when compared to the expected rate.

Figure 4

Distribution of population with dyslexia as per school type (a), school contexts (b) and schools with quality marks for participation in the projects aimed at reading skills improvement (c)



Note: Compiled by authors

Conclusion and Discussion

The main aim of this study was to analyse the detection rate of dyslexia in the school-aged population in Navarre and to analyse whether some of factors might exert some influence on that rate.

In relation to the first question of this study, the overall dyslexia rate of the Primary School population was 4.06%, which is similar to the prevalence rate reported by Jimenez et al. (2009). However, significant variations were found depending on the school year (3.17% in the 3rd and 4.88% in the 5th). These findings contradict previous national research results (Gallego et al. 2011; Sevilla et al. 2021) which had reported considerably higher dyslexia rates in the first years of Primary

Education than in the last ones. On the contrary, more cases were diagnosed in the 5th year than in the 3rd year in Navarre. This is an encouraging result as it might indicate that teachers might not be overestimating the number of cases among pupils whose acquisition of reading skills is still in progress. Nevertheless, this could also indicate that students are not diagnosed early enough in some cases.

In relation to the second question, which enquired about the factors that could facilitate or hinder the identification of children with dyslexia, our findings showed that two of the factors analysed, school size and linguistic programme, had a significant effect on the diagnosis of dyslexia with small schools identifying about twice more dyslexic cases than big schools and bilingual schools offering partial immersion in English identifying significantly fewer cases than traditional monolingual programmes. The other three factors analysed – school type, school contexts and participation in programmes aimed at reading skills improvement – did not seem to affect detection rates.

As concerns the first factor analysed, school type, our results show that public and charter schools diagnose similarly confirming the idea that dyslexia affects all population regardless of their socio-economic status (IDA, 2020). Indeed, children with dyslexia fall behind in literacy tasks not because of environmental conditions but because their impairment in reading is caused by a deficit in the brain's ability to process a wide range of language-related skills (Lyon et al., 2003). Numerous studies have discussed the effect of limited financial resources and literacy-poor family environments on academic underachievement and poor reading progress (Diuk et al., 2019; Fluss et al., 2009; Romeo et al., 2018; Vanderauwera et al., 2019; Yeung et al., 2022). Although a direct relationship between SES and low reading achievement has been confirmed, there is broad consensus that it was mainly attributed to environmental factors rather than neurobiological ones. For instance, Diuk et al. (2019) reported that a cognitive profile of children with reading difficulties from low SES was different from the profile of children with dyslexia in many aspects. Likewise, reading outcomes of children with well-developed phonological awareness skills were not sensitive to SES level. Consequently, it seems that less privileged backgrounds may aggravate dyslexic children learning experiences due to poor educational and emotional support and make it more resistant to intervention, but they are not the cause of it. Our results reinforce this idea showing that, although there seems to be a prevalence of lower SES children in public schools, that does not affect the dyslexia rates in our sample. These findings go in line with the idea that when reading difficulties are not neurologically-based, they typically disappear with age and reading experience. Additionally, our results might indicate that the population in both kinds of schools include various SES profiles, demystifying the relation between public schools and lower SES. These findings also question the popular belief that children with dyslexia will get more attention and be better catered for in charter schools. Since detection rates are quite similar in both types of schools, government will assign similar amount of special education resources regardless of school type. This outcome has important implications in terms of the accessibility to special educational services for children with dyslexia: thus, they seem to get similar opportunities to receive support and accommodation regardless of the type of school they attend, at least in Navarre.

Regarding school contexts, it seems to have no effect on dyslexia detection. These results are consistent with the results of Zablotsky and Black (2020), who reported that children living in rural areas were slightly more likely to be diagnosed with learning disabilities than children living in urban areas (8.1% versus 7.6% respectively), however, the difference was not significant. In addition, their sample was more heterogenous: they included children with difficulties in any aspect of academic learning, whereas, in our sample, only children with dyslexia have been considered.

In relation to the school size, our findings imply that small schools over-diagnose as compared to overall rate, and big schools underdiagnose in both years of primary education. However, no statistically significant differences with overall rate have been observed for medium-sized schools (2.83% in the 3rd year and 4.83% in the 5th year) suggesting that medium-sized schools identify dyslexia within the expected rates for each of the age groups (3.17% in the 3rd year and 4.88% in the 5th year). One possible explanation is that teachers' engagement and a lower ratio of pupils per

school and class become important factors when identifying children with learning difficulties. Indeed, small schools are characterized by close pupil-teacher interaction. As a result, the school is better informed about the family history and background, and the teachers have more possibilities to constantly monitor children's development and respond more quickly to arising problems. Consequently, our results seem to indicate that children with dyslexia are more likely to be identified, and receive accommodations and support, when attending small or medium size schools rather than big schools. Nevertheless, as no previous research has analysed the school size variable and our findings seem to offer an interesting theoretical contribution to understand one of the causes of disparities in identified cases of dyslexia, further investigation is needed to confirm or dispel these results and to discover the reasons of the high discrepancy in detection rates between big and small schools.

Considering the linguistic programmes of the schools, the diagnostic rates are significantly lower in schools with partial immersion in English. Thus, this factor seems to have a significant influence on dyslexia detection across Navarre schools. Two explanations could be suggested to clarify the association between the linguistic programmes and the detection of dyslexia. The first one is related to the evaluation and assessment of children in bilingual schools. Thus, teachers working in bilingual environments may have different criteria for evaluation and assessment, typically expecting lower results from young bilingual learners (Hoff, 2021; Youman & Mather, 2019). As a result, difficulties with reading are often attributed to the higher linguistic and academic demands of bilingual programmes, and therefore, may remain undiagnosed. Indeed, at early stages it could be difficult to identify "whether emergent bilinguals struggle with reading because of insufficient exposure to the L2 or the learning difficulties associated with reading and spelling have a neurological condition, such as dyslexia" (Youman & Mather, 2019, p. 2). The second possible explanation might be recent research in the field of bilingualism that has stated that bilingualism could mitigate dyslexia effects (Bialystok, 2007; Kroll & Bialystok, 2013; Lallier et al., 2018; Vender et al., 2021). The advantages of bilingual learners, even after 2 years of exposure to L2, have been detected at cognitive and linguistic level. Thus, Kroll and Bialystok (2013) claimed that the specific ways of brain fuctioning let bilinguals outperform their monolingual peers "on tasks that require ignoring irrelevant information, task switching, and resolving conflict" (p. 1). In addition, better performance of dyslexic bilinguals in comparison to their non-impaired peers has been also confirmed on literacy tasks strongly relying on phonological processing (Lallier et al., 2018; Vender et al., 2021). In light of these recent findings, it seems reasonable to expect that dyslexia rates could vary depending on the linguistic programme because the manifestation of dyslexia is also different in bilingual and monolingual children due to a higher degree of compensation in the former ones. However, further investigation is needed to examine the reasons underlying the significant changes in diagnostic rate detected in this study for both school size and linguistic programmes.

Finally, in relation to the last question enquiring about whether participation in programmes aimed at reading skills improvement affected dyslexia identification, our results showed slight differences in rates, which were lower in the 3rd year of Primary Education, although these differences were not significant. These findings point to a possible positive effect of these programmes, especially in the 5th year, when the dyslexia rate seems to be higher, so there seems to be more detection. Nevertheless, this last factor needs to be further analysed due to the small sample size (6.27% of the total number of schools with only 428 pupils in the 3rd year and 490 in the 5th year) and a lack of data about the characteristics of schools' innovation reading programmes, such as the age of entry into the programme. Further investigation is needed to better understand if the promotion of literacy engagement and reading culture results in better academic outcomes for dyslexic children.

Turning to limitations, it seems important to highlight that this study has not analysed the prevalence of dyslexia, but the diagnostic rate based on cases of dyslexia registered in the Regional Census of Education. This identification might be done by the school or a private psychologist when a learning difficulty is suspected, and a child meets the requirements to be tested for learning difficulties. Thus, no generalisations can be made regarding whether diagnosis is due to identification by the school or dyslexia has been identified by other means not related to the school contexts.

Furthermore, dyslexic pupils who manage to compensate for their impairment in reading with high capacities or other mechanisms are not included in these data because their overall academic performance is not significantly below their peers. Consequently, the real number of dyslexia cases might have been different if all the children had been tested for dyslexia. Further research should conduct in-site tests to identify all possible cases, regardless of compensation, and analyse school practices to understand variations in detection rates.

Our findings are of relevant importance for educational counselling. Understanding the influencing factors in the rate of dyslexia diagnosis is essential for developing effective strategies in educational settings, but more in-depth investigation is needed to understand better the influential variables and to design interventions to address the challenges they pose for diagnosing dyslexia. Awareness of those factors which influence the detection of dyslexia positively can help counsellors to maximise their efforts to try to notice dyslexic students in not so favourable contexts.

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