

Methodological approach to the diagnosis of dyslexia in Algerian schools

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Abstract

Dyslexia is a specific reading learning disorder that constitutes an obstacle to the academic progress of some students. Despite a growing awareness of this condition, particularly in the last decade, the diagnostic process within the Algerian school environment remains complex and often incomplete. Indeed, diagnosing this disorder requires a rigorous longitudinal methodological approach. This article seeks to highlight the different stages that must be addressed in any diagnostic approach. To this end, one hundred students enrolled in 3rd grade classes in two primary schools were consulted and subjected to a set of tests. The results based on the inclusion and exclusion criteria show that some students clearly have a dyslexic profile. This diagnostic approach can help speech therapists to better understand dyslexia and the criteria that should be adopted for its diagnosis. Top of form

Keywords: Methodological approach; Dyslexia; Diagnosis; School environment.

1- Introduction

The transition from oral to written language represents a crucial stage in a child's language development. This complex process reflects the evolution of their linguistic and cognitive skills. When children enter the world of writing, they encounter new challenges, which require a deep understanding of the rules of language and the mechanisms of communication. This transition marks the beginning of a fascinating journey, where familiar speech sounds are transformed into written symbols, opening the door to a rich world of knowledge and expression.

Reading is crucial for children's overall development, providing cognitive, linguistic, social and emotional benefits. According to Fluss et al. (2009), it stimulates imagination and critical reasoning. Marin and Legros (2008) highlight its impact on understanding the world and managing emotions. Furthermore, reading is strongly linked to academic success, with children who read tending to perform better in school. Thus, reading goes far beyond a simple leisure activity, shaping a child's identity and preparing for their future.

Reading in children is a complex process that involves coordination between the eyes, ears, and brain. When the child reads, written symbols are captured by the eyes and then transmitted to the brain where they are processed and associated with sounds and meanings. This process takes place mainly in the visual cortex and the auditory cortex of the brain. Researchers such as Dehaene (2007) and Pinker (1994), have highlighted the importance of brain plasticity and the evolution of the human brain in learning to read in children. Some children identified as poor readers have a condition known as developmental dyslexia, defined as a neurodevelopmental and specific learning disorder with impairment in reading and written production by international classifications such as DSM-5 (APA, 2013) and ICD-11 (WHO, 2019;OMS,2022). This severe and long-lasting reading learning disorder persists despite normal intelligence and the absence of neurological, psychiatric pathologies, visual and auditory sensory deficits or serious socio-educational deficiencies (DSM-5). Regardless of the language (Peterson & Pennington, 2012), developmental dyslexia is universal and refers to reading difficulties in the accurate and fluent recognition of written words as well as their consequences on written comprehension and spelling (Conners & Olson, 1990; Ehri, 2000). Although developmental dyslexia is often referred to as a written language learning disorder in the broad sense of the term (APA, 2013; Elliott, 2020), the population of dyslexic readers is distinguished from other struggling readers by relatively preserved listening comprehension skills (Sleeman et al., 2022; Tunmer& Chapman, 2012). Indeed, dyslexic readers are characterized, above all, by difficulties in learning and automating the decoding of written words (Ziegler et al., 2020). This written word identification disorder is believed to be

based on an alteration in the development of grapho-phonemic conversion, which consists of linking the basic units of written language (letters or graphemes) to the basic units of spoken language (sounds or phonemes), as highlighted in several studies (Snowling & Hulme, 2012; Hulme et al., 2012). Thus, reading remains less fluent and requires a greater cognitive effort than that provided by normal-reading children (Shaywitz & Shaywitz, 2005; Sprenger-Charolles et al., 2006). On the anatomical-functional level, this reading disorder would be underpinned by the dysfunction of a vast circuit of interconnected neural networks (Kershner, 2016), resulting from connectivity abnormalities between the left posterior occipito-temporo-parietal brain areas (Blomert, 2011; Vandermosten et al., 2012). According to Boder's classification (cited in Bousquet, 2022), dyslexia is divided into three main types, each with distinct symptoms: phonological dyslexia, surface dyslexia, and mixed dyslexia. Phonological dyslexia involves a deficit in the assembly pathway, leading to difficulties in reading non-words and a tendency to guess words rather than decipher them. Surface dyslexia results from a visuo-attentional disorder affecting the ability to automate reading from the visual form of words, with frequent confusion between phonetically similar words. Mixed dyslexia combines difficulties in both pathways, resulting in laborious and often misunderstood reading, which can eventually lead to complete inability to read. Outside of this classification, other forms of dyslexia exist, such as motor dyslexia and visual-attentional dyslexia.

The importance of early detection of dyslexia at school, as highlighted by the work of Scanlon et al. (2008) and Shaywitz et al. (2008), cannot be overlooked. Early diagnosis followed by appropriate intervention can significantly improve the long-term academic success of the children concerned. However, the problem of diagnosing dyslexia in Algerian schools remains a major obstacle to the implementation of preventive measures and effective therapeutic programs to alleviate this disorder; in fact, a survey conducted by Ouzzani and Sam (2021) among speech therapy practitioners shows a lack of valid dyslexia assessment tools adapted to our culture, with a disinterest in assessing visual-attentional abilities; for Amrani (2009), Algeria is lagging behind in this area: "we are unaware of the very existence of this disorder". Boukhelif and Sidi Yakhlef (2021), highlight several shortcomings in Algerian schools and clinics, such as the absence of clinical and neurological examinations, and the absence of a local estimate of the prevalence of learning disabilities. The authors also highlight a lack of information for parents and teachers of potentially dyslexic students. Based on this observation, we will seek through this study to contribute to a better understanding of dyslexia, and the sine qua non approach to its diagnosis. This concern can be formulated as follows:

- What are the methodological steps that should be adopted in the diagnosis of dyslexia in Algerian schools?

We hope, through this work, to provide clarifications that will make it possible to clearly distinguish between reading learning difficulties that are transient in nature and concern the majority of students with difficulties and atypical students who present difficulties that are both severe and persistent, which affect a more restricted population with a specific neurodevelopmental profile.

2. Methodology and procedure

2.1 Method

This study is descriptive in nature, since we will carry out a quantitative and qualitative evaluation of students enrolled in primary school.

2.2 Survey population

To conduct this study, we visited three primary schools (as shown in Table 1), where we limited our population to a total of one hundred students enrolled in the 3rd year class, with an average age of 8 years. Note here that a minimum period of schooling of 24 months is a minimum to suspect dyslexia.

Table 1. Study location and population

Name of the school	Address	Total number of students consulted
Toubal Rabah	Draa Benkhedda- Tizi Ouzou	34
Ferih Mohamed	Draa Benkhedda- Tizi Ouzou	66

2.3 Investigation tools

Making a definitive diagnosis of dyslexia is the process of a longitudinal investigation, which includes inclusion and exclusion criteria, established on the basis of questionnaires addressed to the student's

immediate entourage, medical and psychological examinations, and material situation. This assessment of a transversal and longitudinal nature requires the use of several tools, as explained below.

2.3.1 Development of a questionnaire

In their presentation of the neuropsychological assessment of specific learning disorders, Mazeau and Pouhet (2014) integrate the DSM as a preliminary investigation tool for establishing the diagnosis. Based on this observation, we established a questionnaire taken from the diagnostic and statistical manual of mental disorders DSM-5 (APA, 2013) translated in Arabic by Al-Hammadi (2022), knowing that these criteria remain unchanged in the DSMV-TR (APA, 2022). The questionnaire consists of 7 main sections A, B, C, D relating to specific learning disabilities (SLD).

The additional sections, coded in the DSM5-TR, allow us to specify whether it is a disorder specific to reading (F81.0), writing (F81.81) or calculation (81.2). As summarized in Table 2.

During the first week of the study, we gave the questionnaire written in Arabic to the teachers of the above-mentioned primary classes. We collected the responses after one week or we carried out a rigorous analysis of the responses in order to identify students with reading learning difficulties who are potentially dyslexic.

Table 2. Diagnostic criteria for specific learning disorders in DSM5-TR

Section	Question	Answers		
		Yes	No	No answer
A	Difficulty learning/using academic skills, including the presence of at least one of the following symptoms for at least 6 months, despite measures being put in place			
	1. Inaccurate, slow or laborious word reading			
	2. Difficulty understanding the meaning of what is read			
	3. Difficulty calling out words			
	4. Difficulties in written expression			
	5. Difficulty mastering number sense, data or calculation			
	6. Difficulties with mathematical reasoning			
B	Academic skills are significantly below the level expected for age. This interferes significantly with academic performance or with activities of daily living.			
C	Difficulties begin during schooling, but may only manifest themselves when the demands exceed the person's capacities.			
D	Not better explained by intellectual disability, visual or hearing impairment, other neurological or mental disorders, psychosocial adversity, lack of mastery of the language of instruction or inadequate pedagogical instruction.			
Coding Note: Specify all academic and secondary skill domains that are impaired. When more than one of the domains is impaired, each should be coded individually according to the following specifications:				
315.00 (F81.0)	With reading deficit: - Accuracy of word reading - Rhythm and fluency of reading - Reading comprehension			
315.2 (F81.8)	With deficit in written expression: - Spelling accuracy - Accuracy in punctuation and grammar - Clarity or organization of written expression			
315.1 (F81.2)	With calculation deficit: - Number sense - Memorizing arithmetic facts - Exact or smooth calculation - Correct mathematical reasoning			

2.3.2 Sensory assessments

To ensure that reading difficulties were not due to hearing or visual impairments, we asked the parents of the participating children to carry out hearing and visual assessments (ENT assessment, Ophthalmological assessment).

2.3.3. Application of an IQ test

Based on the recommendations of the DSM5-TR, we applied the Raven progressive matrices, in its translated version to Arabic (Hamad, 2008). It is a nonverbal IQ test, to assess the intellectual abilities of students. This test is recognized for its reliability and its ability to measure logical reasoning and fluid intelligence (G-factor), independently of language skills. Developed by John C. Raven, this test is an internationally recognized tool for assessing nonverbal intelligence. First introduced in 1936 and modified in 1956, it uses a series of complex matrices where participants must complete diagrams or choose the missing figure to follow a given pattern. This test is designed to minimize the impact of cultural and linguistic factors on the results, making it suitable for various environments and cultures. The test consists of three sets (A, AB, B), each comprising 12 matrices. It can be administered to children, aged 5 1/2 to 11 1/2 years, to assess their overall mental activity.

2.3.4 Reading assessment

The DSM5-TR, recommends the diagnosis of SLD (Specific Learning Disability) based on a standardized test to the linguistic and cultural background of the subjects evaluated. In this sense we applied the Reading Test developed by Zeddami (2017). This test consists of 12 items. With two reading tables :

- The first table presents the percentile norms of the total scores of the test items for the study sample (number of correct responses).
- The second table concerns the total time spent reading.

After analyzing these tables, it is possible to determine the student's status regarding dyslexia (reading disorder) and to identify different levels of reading skills: difficulty in reading, average or normal level, good, and excellent in reading. These tables make it possible to precisely evaluate the performance of students and to diagnose reading disorders with greater precision.

3. Presentation of results

Below we will present the successive results of the questionnaire, Raven's test and reading test.

3.1. Questionnaire results

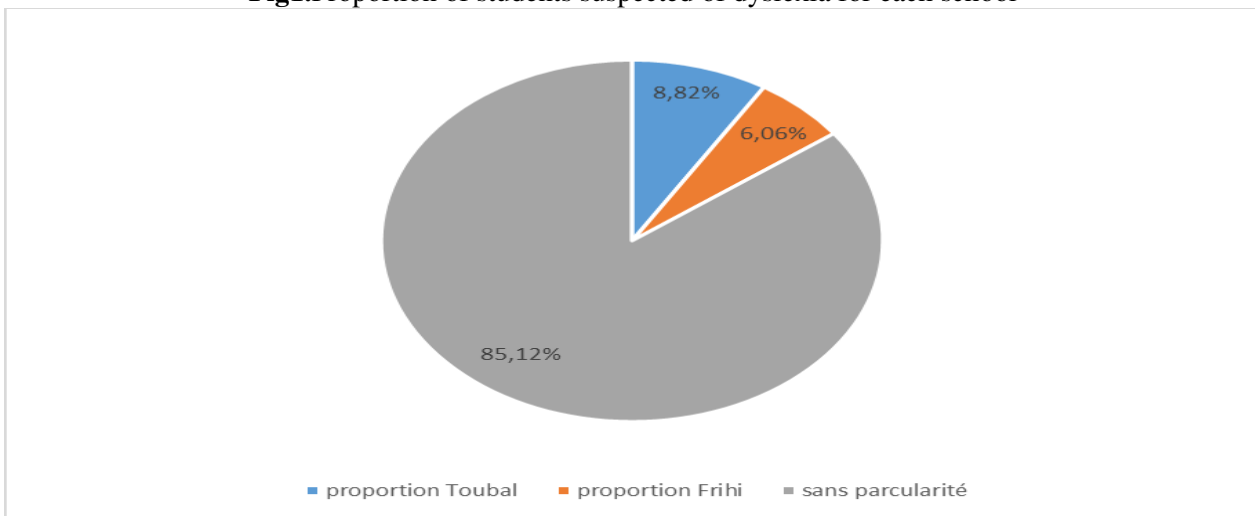
During the first week of the study, we gave the questionnaire to the teachers of the targeted classes. After a week, we collected their responses in order to analyze them in order to identify potentially dyslexic students. Table 3 shows the number of suspected students and their percentage by class.

Table 3. The results of the questionnaire

School	Classes	Number of students	Number of students suspected of dyslexia	Proportion Students suspected of dyslexia per class
Toubal R.	A	34	3	8.82%
Frihi M.	A	33	2	6.06%
Frihi M.	B	33	2	6.06%
Total		100	7	100%

We can make these proportions more visible by the statistical circle, presented in Figure 1.

Fig1.Proportion of students suspected of dyslexia for each school



As shown in Table 1 and the statistical circle, the proportion of potentially dyslexic subjects varies from 6.06% to 8.82%. This proportion is close to the estimates made in Europe (Dyslexia Compass, 2022) with an estimate of 5% to 12% or in the world of 5% to 10% (Wagner et al, 2020; Kunwar & Sapkota, 2022).

3.2. Results of sensory assessments

The return of medical consultations relating to ophthalmological and hearing examinations for the seven suspected students does not mention any deficit.

3.3. Raven's Test Results

Table 4 shows the results of the Raven test for the seven suspected students in terms of raw scores and estimated IQs.

Table 4.Raven's Test Results

School	Class	Pupil	Age	Score	IQ
Toubal R	A	G. A	9	29	75
Toubal R	A	S. S	9	29	75
Toubal R	A	S.Th	9	31	75
Frihi M	A	L. M	8	31	75
Frihi M	A	H. H	8	28	75
Frihi M	B	B. I	11	32	75
Frihi M	B	H. M	8	29	75

The results obtained from the Raven's Progressive Matrices test for the seven students show that each obtained an IQ of 75, corresponding to the 75th percentile. This means that the performance of these students is higher than that of 75% of children their age.

All students have a normal or average level of intelligence. These results indicate that, although these students may have specific difficulties in reading or writing, their general cognitive abilities, particularly adaptation to new situations and problem solving, are average (Factor G).

3.4. Reading test results

The application of the reading test allowed us to obtain the results mentioned in table5.

Table 5. Reading test results

School	Pupil	Class	Grouping points	Calculation of grouping points	Annotation points	Calculation of annotation points	Result
Toubal Rabah	G.A.	A	118	$2600 / 118 = 22.03$	109	$5300 / 109 = 48.62$	Phonological dyslexia
Toubal Rabah	S.S.	A	118	$1300 / 118 = 11.01$	109	$1500 / 109 = 13.76$	Phonological dyslexia
Toubal Rabah	Th.S.	A	118	$7100 / 118 = 60.16$	109	$8800 / 109 = 80.73$	Phonological dyslexia
Farihi Mohamed	L.M.	A	118	$800 / 118 = 6.77$	109	$2100 / 109 = 19.26$	Phonological dyslexia
Farihi Mohamed	H.H.	A	118	$7100 / 118 = 60.16$	109	$3800 / 109 = 34.86$	Surface dyslexia
Farihi Mohamed	B.I.	B	118	$6500 / 118 = 55.08$	109	$8400 / 109 = 77.06$	Phonological dyslexia
Farihi Mohamed	H.M.	B	118	$10000 / 118 = 84.74$	109	$9000 / 109 = 82.56$	Mixed dyslexia

The results obtained from the reading test applied to the seven students, confirm the presence of dyslexia with its two types. The results show a notable prevalence of phonological dyslexia among the students tested, with some cases of surface and mixed dyslexia. At Toubal Rabah school, in class A, student G.A., obtained high scores in grouping (118 points) and annotation (109 points), which indicates phonological dyslexia with standardized scores of 22.03 and 48.62 respectively. Student S.S. also showed signs of phonological dyslexia with scores of 11.01 and 13.76 in grouping and annotation. As for student Th.S., she obtained very high scores in grouping (60.16) and annotation (80.73), indicating severe phonological dyslexia.

At Farihi Mohamed School, in class A, student L.M. scored low in grouping (6.77) and annotation (19.26), indicating phonological dyslexia. On the other hand, student H.H. showed surface dyslexia with scores of 60.16 in grouping and 34.86 in annotation. In class B of the same school, student B.I. showed signs of phonological dyslexia with scores of 55.08 in grouping and 77.06 in annotation. Student H.M; scored very high in grouping (84.74) and annotation (82.56), indicating mixed dyslexia.

4-Discussion

The problem raised at the beginning of this work highlights several aspects that complicate the screening and management of dyslexia in Algeria. First, there is a lack of clarity regarding the very definition of dyslexia and other dys disorders, which leads to a lack of standardized diagnostic tools adapted to the Algerian context. In addition, the lack of knowledge of the methodological approach, particularly with regard to the inclusion and exclusion criteria, makes it difficult to accurately identify dyslexic children. The results of our study show that the majority of diagnosed students suffer from phonological dyslexia, representing 71% of cases, while surface and mixed dyslexia are less common.

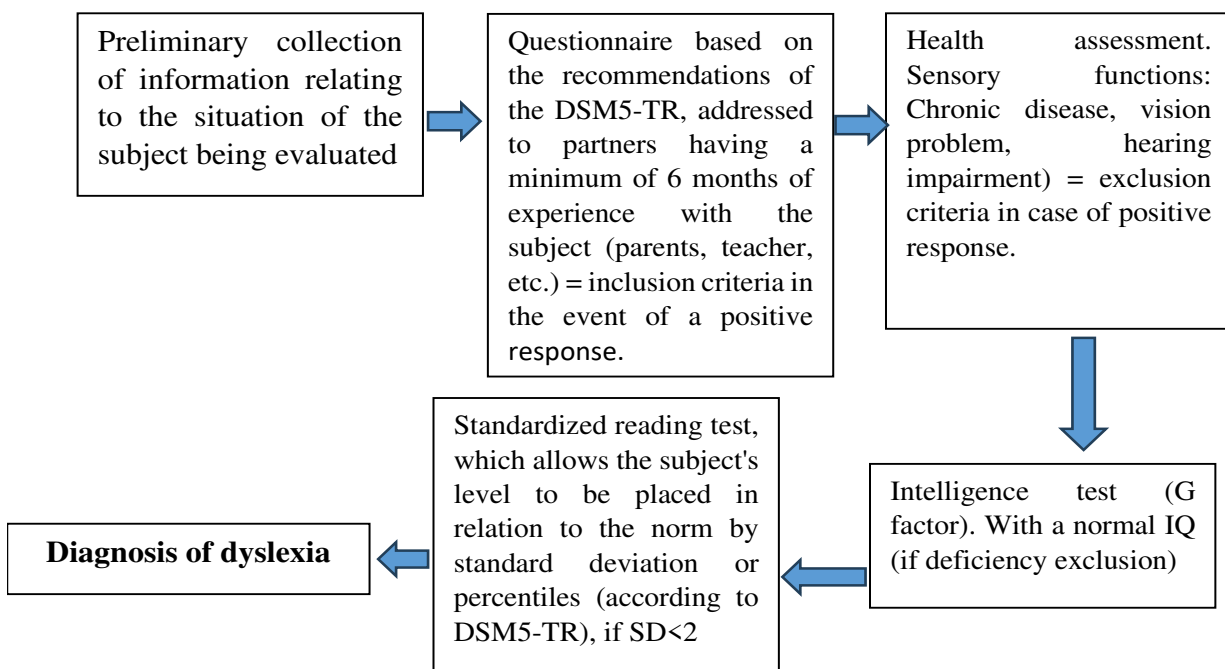
Children with phonological dyslexia have difficulty associating sounds with letters and have decoding problems, which affects their reading fluency. They struggle to establish phoneme-grapheme correspondences, an essential element for mastering the Arabic language, which is based on a transparent orthographic structure compared to English for example, (Huneety et al., 2023). This transparency and exclusive relationship between grapheme and phoneme may explain the high percentage of this type of dyslexia. On the other hand, children with surface dyslexia tend to succeed in phonetic reading by assembly, but have difficulties with common words, the orthographic irregularity of a different nature in Arabic from that observed in English remains an aggravating factor in this case (Friedmann & Haddad-Hanna, 2014), which results in laborious language reading, with a redundancy of errors for words of the same root composition. As for children with mixed dyslexia, they show difficulties both at the phonological level and at the word recognition level, making their learning more complex. The predominance of phonological dyslexia can be attributed to the linguistic characteristics of Arabic and the teaching methods used, which often favor phonetic reading. This situation complicates the learning of dyslexic children, because current

teaching strategies do not always meet their specific needs. These observations highlight the importance of developing diagnostic tools adapted to each type of dyslexia and adapting teaching strategies according to the disorders identified, in order to better meet the needs of dyslexic students in Algeria.

A diagnostic approach, based on a preliminary collection of information, followed by a set of exclusion and inclusion tests, based on the recommendations of the DSM5-TR, but also the methodological axis adopted by Mazeau and Pouhet (2014); provides an objective tool for diagnosing Dys disorders, which makes it possible to avoid cases of false diagnoses, marked by a proportion that exceeds the accepted norm, with all that this implies as a negative impact on the psychological and relational level; indeed, a fair and precise diagnosis at the very beginning of schooling, opens the way to appropriate speech therapy care, which will make it possible to respond to the nature of the specific needs of these subjects, to whom traditional methods are not sufficient.

As shown in figure 2, below, the diagnostic approach is a genuine investigative process, starting with a preliminary collection of information about the pupil's general living environment. The aim is to identify the physical and material conditions essential for schooling. The questionnaire, based on DSMV-TR recommendations, is used to identify deteriorated academic skills. Pupils with difficulties in this area need to be examined on a sensory level (vision-hearing), and on a cognitive level by means of an IQ test. In this respect, a non-verbal test saturated with the G factor is indicated. If previous tests show no abnormalities, a reading test adapted to the cultural and linguistic environment should be applied. A deficit of less than 2 standard deviations from the mean points to a diagnosis of developmental dyslexia.

Fig.2.Methodological approaches to diagnosing dyslexia



Conclusion

The problem of screening for dyslexia in Algeria is a major issue, to which we must respond as public health professionals; an appropriate and precise diagnosis is the guarantor of early screening with all that this implies in terms of care and prevention of possible failure and school exclusion.

The diagnostic approaches based on the DSM5-TR criteria, seem to us, in view of the results recorded, to be a good basis for screening and then diagnosing dyslexic subjects. The flagrant lack of diagnostic tools, standardized on the Algerian socio-cultural and linguistic environment, remains a real obstacle to visibility of this population, which we can clearly observe, by the absence of statistics on this subject; this seems to us a real obstacle to a real awareness, but also to any strategy or therapeutic approach on a national scale. We sincerely hope that similar research, on a larger scale, will contribute to a better understanding of these subjects.

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