

Standardizing a Test to Diagnose Phonological Awareness and Its Relationship to Dyslexia in Algerian Children: An Approach in Light of Cognitive Psycholinguistics

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Received date 2025-11-01

Acceptance date 2025-12-30

Abstract:

The current study aims to demonstrate the close and significant relationship between the level of phonological awareness and reading difficulties among fourth-grade primary school students (without regard to gender) in the Algerian capital. The current study was conducted on a sample of 100 individuals of both sexes with reading difficulties. They were selected in accordance with the diagnostic criteria for developmental dyslexia from fourth-grade primary school in Algiers. Statistical analysis of the results revealed a significant correlation between the level of phonological awareness and dyslexia. The study concluded that phonological awareness is closely related to dyslexia, as it is considered the primary (but not the only) cause of dyslexia.

Keywords:

Phonological awareness, dyslexia, assessment test of Arabic phonological awareness, Algerian environment, cognitive psychology

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Introduction:

In recent years, significant progress has been made in the field of dyslexia research. Many scholars agree that phonological awareness plays a crucial role in reading development and constitutes one of the most influential factors in dyslexia. This awareness involves the ability to distinguish between sounds particularly similar ones and to recall and recognize them within words, such as /h/, /dʒ/, /x/ or /f/, /q/ or /s/, /ʃ/, /z/. These aspects typically pose challenges for children with dyslexia (Torgesen & Burgess, 1998).

The phonological approach has thus emerged as one of the key frameworks for explaining developmental dyslexia. Empirical findings indicate that dyslexia stems primarily from deficits in phonological processing, as children with dyslexia consistently perform poorly on tasks requiring phonological analysis of words, syllables, and sentences (Ellis, 1994).

Accordingly, numerous studies emphasize the importance of early screening and diagnosis for children with reading difficulties. Early identification is essential to minimize potential academic harm resulting from undiagnosed dyslexia, which may lead to longterm academic failure. Accurate diagnosis can enhance the prospects for academic success in children with dyslexia, who often demonstrate average or aboveaverage abilities in areas such as mathematics.

Early detection enables educators and specialists to identify children with reading difficulties during the initial stages of learning, allowing for targeted intervention to strengthen their phonological awareness skills. Phonological awareness beyond simple letter-sound correspondence or articulation represents a metalinguistic ability that precedes formal reading and writing skills and forms one of the core components of phonological processing.

The relationship between phonological awareness and dyslexia can thus be understood across three primary dimensions:

Causal, wherein deficits in phonological awareness lead to reading difficulties;

Predictive, as early levels of phonological awareness serve as indicators of future reading proficiency; and

Remedial, in which interventions aimed at enhancing phonological skills can effectively mitigate dyslexic symptoms.

Hence, the necessity of early phonological intervention becomes evident as a critical step toward supporting children's reading development and preventing longterm literacy challenges.

Research Problem

Reading constitutes the foundational skill from which a learner's entire educational journey begins. Consequently, the educational system has always prioritized reading instruction from the earliest stages of schooling. Nevertheless, empirical classroom observations reveal that many children struggle with reading, often due to insufficient phonological awareness. This metalinguistic skill, with its diverse components, serves as the cornerstone for acquiring reading competencies. Prior studies and theoretical models in

reading research have consistently emphasized its critical role in literacy development (Hammoudi, 2006, pp. 300–306).

Since the 1970s, scientific research has revolutionized our understanding of reading. It is no longer viewed merely as a visual perception and comprehension process but rather as a complex languagebased activity. Oral language competence alone does not guarantee success in reading acquisition; beginner readers must recognize that spoken words can be segmented into smaller units and that these units can be represented in written form.

Hence, phonological awareness skillsunderstanding that language consists of words, syllables, and sounds that can be recombined in multiple waysare fundamentally tied to early reading success. Studies have shown that both reading and writing depend heavily on oral language skills and that many early reading difficulties arise from weaknesses in this domain. Research further indicates that children who received training in phonological awareness activities demonstrated significantly greater progress in reading compared to their peers who did not receive such instruction (Delpech, George, & Nok, *La conscience phonologique: test, éducation et rééducation*, 2001).

It is worth noting that spoken language has a neurobiological basis and develops according to a universal pattern across cultures, whereas written language does not. This distinction underscores the significance of recent research on dyslexia, which emphasizes metaphonological abilities as a crucial factor in both learning to read and understanding reading disorders. These studies confirm that difficulties related to phonological awareness are among the most salient indicators of dyslexia, as children with such deficits perform noticeably worse than their typically developing peers on tasks requiring metaphonological competence, such as phonemegrapheme spelling. This condition is commonly referred to as deep dyslexia and can be interpreted within Seymour's (1996) Alphabetic Strategy framework for reading acquisition.

Field observations have revealed two major issues. First, there is a shortage of standardized assessment tools used by speech and language therapists (orthophonists) to diagnose phonological awareness disorders in Arabic reading, particularly within the Algerian urban context. Second, many children continue to experience reading difficulties of a phonological nature despite progressing through several school years. This strongly suggests that phonological awareness constitutes the core competence for reading acquisition, and any deficit in this domain directly affects reading performance.

Furthermore, most currently available diagnostic and assessment tools for phonological awareness or phonological competence are in French or English, and are therefore not suitable for Algerian children for several reasons. These include fundamental differences between the Arabic writing system and those of IndoEuropean languagesin alphabetic structure, representation of consonants and vowels, and orthographic rulesas well as broader cultural and linguistic distinctions. Even though a few Arabiclanguage attempts exist, they are, to the best of our knowledge, not yet standardized.

This methodological and empirical gap has prompted us to ask a crucial question: What are the scientific and methodological steps required to standardize an effective Arabiclanguage phonological awareness assessment tool that aligns with the linguistic

structure of Arabic and the sociolinguistic context of Algerian children? (Elbeheri, Everatt, Mahfoudhi, Al Malki, & Al Shabibi, 2011).

Based on these considerations, it was natural to formulate the following central research question:

What is the most scientifically valid and effective approach to standardizing a phonological awareness assessment tool in Arabic, adapted to the characteristics of the Algerian context?

In this regard, we ask more specifically:

What scientific and methodological steps can be followed to develop and validate a phonological awareness test in Arabic that enables the early detection of reading difficulties among Algerian children with dyslexia (deep dyslexia), particularly within the Algiers region?

Hypothesis

The standardization of an Arabic language phonological awareness assessment tool, specifically designed for Algerian children with dyslexia, will contribute to improving the diagnostic accuracy and guiding appropriate intervention strategies by speech and language therapists (orthophonists).

Objectives of the Study

This study aims to:

Standardize and promote the use of a scientifically validated and effective diagnostic tool adapted from a master's thesis in cognitive psycholinguistics as a foundation for developing reliable assessment instruments that support orthophonists in diagnosing and treating phonological awareness disorders among Algerian children in Arabic.

Highlight the importance of phonological ability as a fundamental prerequisite for the acquisition of reading skills in children.

Demonstrate a strong, statistically significant correlation between phonological awareness and dyslexia by comparing reading scores and phonological performance between normal readers and children with reading difficulties in the Algerian context.

Significance of the Study

The importance of this research lies in its focus on the correlational relationship between phonological awareness and dyslexia, through the standardization of an evaluative test that was previously adapted into Arabic within a master's thesis in cognitive psycholinguistics (Louani, Yamina).

Given the absence of a reliable and scientifically validated tool capable of assessing phonological awareness and its impact on reading acquisition among fourth grade primary pupils in Arabic, this study seeks to provide a culturally and linguistically appropriate assessment instrument specifically designed for Algerian children in the Algiers region.

A series of studies has shown that both dyslexic and normal readers exhibit similar abilities when asked to visually recall and reproduce unfamiliar written words for instance, sequences of Hebrew letters after brief exposure, even though they did not understand the language. The same task was also administered to children learning to read and write Hebrew for comparison purposes. The key finding was that dyslexic children performed comparably to their peers, despite significant linguistic differences between Arabic and Hebrew.

This result suggests that when visual symbols (pseudowords) lack any linguistic or phonological association, visual memory performance does not differ significantly between dyslexic and typical readers.

According to Liberman and Shankweiler (1997), poor readers experience marked difficulty in segmenting written and spoken words into discrete phonemic units. This makes it challenging for them to recognize words using alphabetic scanning and phoneme blending commonly referred to as phonological encoding. Their difficulty with phonemic segmentation is thus a manifestation of a broader phonological encoding deficit, reflected in weak or impoverished mental representations of sounds and word forms. This aligns with Shaywitz's (1997) assertion that a phonological deficit constitutes the primary source of reading difficulties experienced by dyslexic children when segmenting written words into phonemic units.

This process transforming linear written symbols (graphemes) into their corresponding sound patterns (phonemes) operates through two distinct cognitive pathways, as proposed by the Dual Route Theory.

Operational Definitions

Phonological Awareness:

According to Morais (1994), phonological awareness represents a conscious and deliberate cognitive understanding of the structural properties of spoken language. It reflects the ability to manipulate and process the minimal linguistic units (phonemes) through specific operations such as segmentation, blending, and substitution.

Phonological Ability:

This refers to the individual's capacity to apply phonological awareness skills in processing the sound structures of spoken language encompassing phonemes, syllables, and other verbal characteristics.

Dyslexia:

Dyslexia, or reading disorder, is a specific and persistent learning difficulty characterized by the child's inability to recognize written symbols with the expected accuracy and fluency, and to achieve an adequate level of reading comprehension. This occurs in the absence of sensory (visual), psychological, or environmental deficits, and under normal schooling conditions.

Children identified as dyslexic typically demonstrate low reading performance relative to their age-matched peers, based on the following criteria:

Low scores on the reading test developed by Ghallab.

Teachers' evaluations of classroom performance.

Low grades obtained in reading assessments.

Methodology and Procedures

Research Method

The present study adopts a descriptive correlational approach, focusing primarily on identifying the relationship between phonological awareness and reading ability through the standardization of a phonological awareness test previously adapted by the same researcher in a master's thesis.

In addition, the comparative method was employed to examine differences in phonological ability levels among good, average, and poor readers, while controlling for the age variable but not the gender variable.

Scope and Limitations of the Study

The limitations of this study are closely tied to the specific characteristics of the research sample and variables under investigationnamely, phonological awareness, dyslexia, and fourthgrade pupils in various primary schools across Algiers. The study did not control for the gender variable, as its findings aim to be generalized to all Algerian schools.

Furthermore, the current research focuses on the correlational relationship between phonological awareness and reading skills, with the primary objective of standardizing the phonological awareness test adapted to the Arabic language by the same researcher.

Study Sample and Its Characteristics

The study population consisted of fourthgrade pupils from different primary schools in Algiers who exhibit reading difficulties, as excluding the first three years of primary education is essential for accurately diagnosing dyslexia.

The sample was divided into three groups based on reading performance:

Good Readers (Bons Lecteurs)

Average Readers (Moyens Lecteurs)

Poor Readers (Mauvais Lecteurs)

All participants were fourthgrade pupils, with a total of 300 children (both genders) selected to ensure adequate representation of the statistical population. Their ages ranged between 9 and 12 years (10–12 years for poor readers).

The sample classification was based on the following criteria:

Application of the Reading Test developed by Ghallab (as part of a master's thesis).

Academic performance, particularly in reading.

Teachers' evaluations, categorized as good, average, or poor.

To ensure balance and comparability, the researcher maintained an equal distribution across groups 100 children in each group.

Research Instruments

1. Ghallab Reading Test (1997–1998)

Developed specifically for the Algerian context, this test considers the linguistic features of Arabic. It includes several components designed to assess multiple reading aspects: phonemes, syllables, words, sentences, and a reading passage entitled “The Vacation” (Le texte de la vacance).

(Source: Kezadri, 1998)

2. Phonological Awareness Test (Louani, 2006–2007)

This test was adapted and standardized in Arabic by the same researcher as part of a Master’s thesis in Psycholinguistics. It is derived from the original Phonological Awareness Test by Daminene Delpech (Delpech, George, & Nok, 1997).

Assessment of Reading Level

Each participant’s reading level on the text “The Vacation” (Ghallab Test) was computed using the following formula:

This percentage-based score is widely recognized in the field for evaluating reading accuracy.

The researcher assessed responses based on four types of reading errors, while also recording reading time for each child:

Omission

Reversal

Addition

Substitution

These error types collectively provide a reliable indicator of phonological processing efficiency and reading accuracy in Arabic-speaking children.

Phonological Awareness Test

The phonological awareness score for each participant was calculated through the application of the adapted Phonological Awareness Test, developed by the same researcher within the framework of her Master’s dissertation (Louani, 2006–2007).

The test consists of three main sections, each comprising several tasks designed to assess different aspects of phonological processing:

1. Short-Term Memory Section

This section aims to evaluate the child’s ability to temporarily retain verbal and auditory information. It includes the following subtests:

Retention of Rhythms: A series of 21 rhythmic patterns scored as (1) for correct or (D) for incorrect responses.

Sentence Retention: Involving 14 sentences, with one point awarded per correct answer.

Number Retention: Consisting of two number series, scored similarly (1 or D).

2. Word Segmentation Section

This part assesses the participant's ability to segment words into smaller phonological units and includes two main tasks:

Syllabic Segmentation: Includes an example, a trial, and a test phase. Responses are scored from 0 to 3 points according to accuracy.

Phonemic Segmentation: Follows the same procedure and scoring scale (0–3 points).

3. Phonological Awareness Section

This section contains eight tasks, each measuring a specific dimension of phonological awareness:

Rhyme Judgment (Jugement de rime) – includes an example, a trial, and an actual test, scored from 0 to 3 points.

Odd Word Out (Mot qui rime) – same procedure and scoring method.

Rhyme with Target Word (Rime avec mot cible) – scored on the same scale (0–3).

Same Word Ending (Même fin mot cible) – scored 0 for incorrect and 1–3 for correct responses.

Syllable Deletion (Suppression de la syllabe) – scored 0–3 points.

Initial Syllable Deletion (Suppression de la syllabe initiale) – scored 0–3 points.

Final Syllable Deletion (Suppression de la syllabe finale) – scored 0–3 points.

Middle Syllable Deletion (Suppression de la syllabe moyenne) – scored 0–3 points.

Replacing the Initial Phoneme (Remplacer le premier phonème) – scored 0–3 points, with vowel markings (diacritics) not considered.

Missing Sound Identification (Le son manquant) – same scoring system (0–3), including an example, a trial, and a test.

Methodological Note on Linguistic Adaptation

Although the original version of the test contained eight phonological items, one item initial phoneme deletion was not applicable in Arabic.

In the French version, this task is feasible because deleting the initial consonant (consonne) results in a pronounceable word beginning with a vowel (voyelle).

However, in Arabic, this is phonologically impossible, as the language adheres to the rule that:

“A word cannot begin with a consonant cluster nor end with a vowel sound.”

Therefore, this item was excluded to preserve the linguistic validity of the Arabic adaptation.

Participant Classification Criteria

Participants were classified according to their reading performance scores, obtained through the Reading Test (“Holiday Text”) developed by Ghallab during the preliminary (pilot) phase of the study.

After computing the mean and standard deviation of reading scores, participants in the main study were categorized based on a 2 standard deviation threshold:

Participants scoring below 2 SD were classified as dyslexic readers.

Those between 1 and 2 SD were classified as average readers.

Those above 1 SD were classified as good readers.

(Reference: Gregoire & Pierart, 1994)

Psychometric Properties of the Phonological Awareness Test

The primary aim of the test is not to measure phonological awareness per se, but to explore the correlational relationship between phonological awareness and reading difficulties among fourthgrade pupils in Algiers.

The main objective was to differentiate between distinct groups of readers: good, average, and poor by identifying statistically significant differences in their performance levels.

It is important to note that, to date, no standardized Arabic test measuring phonological awareness exists for the Algerian context.

This tool, therefore, fills a critical gap in the assessment of reading-related phonological abilities.

In a previous, large-scale study conducted as part of the researcher’s Master’s dissertation, the same test was adapted to Arabic, and both validity and reliability were established.

Consequently, this same instrument was standardized and applied in the current study.

A summary table (not shown here) presents the correlation between reading scores and phonological awareness scores among the study participants following the standardization of the instrument.

Individuals	Ages	Phonological Awareness Scores
1	9.1	9.12
2	9.7	6.90
3	9.5	5.87
4	10.3	4.33
5	10.2	11.10
6	9.1	5.75
7	9.5	8.9
8	11	4.83
9	11.1	9.16
10	11.3	5.33
11	10.5	11.4
12	12	10.14
13	9.7	7.7
14	10.1	8.24
15	11.3	10.5
16	12	4.63
17	11.7	6.70
18	9.5	9.14
19	10.2	13.07
20	9.1	3.66
21	10.3	12.50
22	11.1	9.18
23	9.1	7.83
24	9.11	12.42
25	12	3.5
26	12	11.07
27	10.7	14.3
28	11.3	7.9
29	10.8	6.12
30	9.1	13.2

Descriptive Statistics

Statistical Measure	Value
Total Sum	321.03
Mean (M)	7.22
Correlation Coefficient (r)	0.11
Sample Size (N)	30

The data presented in Table 1 displays phonological awareness scores for 30 participants ranging in age from 9.1 to 12.0 years. The mean phonological awareness score was 7.22 (SD = not provided), indicating moderate performance across the sample. The correlation coefficient between age and phonological awareness scores was 0.11, suggesting a weak positive relationship between chronological age and phonological awareness performance among the participants examined in this study.

Discussion and Interpretation of Results

Based on the findings presented throughout this research, the study hypotheses were effectively confirmed. The central hypothesis stating that there exists a significant relationship between phonological awareness and reading acquisition among children with reading disorders has been validated.

During the preexperimental phase, children in Group (A), who were administered the adapted Phonological Awareness Test (developed by the same researcher), were exposed for the first time to phonological units. They successfully performed the required phonological processing tasks such as identification, deletion, counting, segmentation, and shortterm memory retention (for rhythms, sentences, and numbers).

Moreover, they demonstrated effective use of their mental lexical repository, often providing multiple words instead of one when asked to substitute an initial phoneme. This indicates their ability to retrieve and manipulate stored representations from longterm memory.

Additionally, participants achieved remarkably high accuracy rates in several subtests, such as:

Rhythm Retention: 96.95% correct responses

Number Retention: 100% correct responses

Rhyme Judgment: 96.29% correct responses

Initial Phoneme Substitution: 98.30% correct responses

Minor difficulties were observed in tasks requiring the deletion of middle syllables in threesyllable words, particularly among average readers within Group (A). However, these difficulties did not significantly affect overall performance, as the success rates remained high.

Furthermore, participants were able to identify consonants and discriminate between the initial, medial, and final positions of sounds within words, as well as distinguish between voiced and voiceless, tense and lax, and hard and soft phonemes. Such performance reflects strong and consistent auditory discrimination abilities.

In terms of identifying the initial consonant to be deleted, participants generally showed no significant difficulty.

Nevertheless, their oral reading performance still lacked fluency, prosody, and rhythm, and they frequently ignored punctuation and pause marks during reading.

Hence, despite being able to manipulate phonological units successfully, children with reading difficulties in this study failed to accurately decode written symbols or read text in a fluent and coherent manner. Their reading was often unclear, fragmented, and hard to interpret, especially in cases such as Jamal A. and Amal F.

Results for Group (B)

By contrast, the phonological awareness performance of Group (B) was considerably weaker.

In the shortterm memory section, results were particularly poor for rhythm retention, especially with sequences presented in the middle and final parts of the test.

This can be attributed to deficits in working memory, which hindered their ability to retain and reproduce rhythmic patterns correctly, especially longer ones.

Their correct response rate was only 37.61%.

In the sentence retention subtest, participants encountered clear difficulties. Some provided no answers, while others produced irrelevant or distorted words, often omitting or reversing elements of the original sentences.

The percentage of correct responses did not exceed 25%.

In the second section (word segmentation), all participants in this group exhibited serious difficulties. Some even split a single letter into two parts for example, when segmenting the word *ṣaḥrāwīyya* (صحراوية), they would isolate only *ṣ* (ص).

Their segmentation was generally random and inconsistent, regardless of syllable type (open, closed, long, or short).

Thus, they lacked control over the rules of syllabic segmentation, both in written and oral contexts.

It is worth noting that, according to primary school teachers interviewed by the researcher, word segmentation is introduced and taught in the first grade. However, despite this early exposure, many pupils still showed persistent weaknesses.

In the third section (phonological awareness), performance remained very weak, particularly in items such as rhyme judgment, targetword rhyme, same word ending, and syllable deletion.

Only in the remaining two items did participants show slightly better results, though still below the expected level.

Children achieved a slightly unusual level of success (compared to the other items) in the “missing sound” task, despite the fact that it is considered the easiest item in the test. Moreover, the words used in this task were short and very familiar to them.

Conclusion:

The mechanism of word recognition within the speech stream and the development of phonemic awarenessnamely, the ability to consciously process and manipulate the phonemic units of speechare crucial components in acquiring phonological awareness. A child who struggles with segmenting words, identifying rhymes, manipulating phonemes, or recognizing target words is, by necessity, likely to experience difficulties in learning to read.

The findings of this study revealed that children with reading disorders performed significantly lower than those in Group (A). This was confirmed through the application of the phonological awareness test adapted to the Arabic language on a larger sample of fourthgrade pupils in Algiers. Consequently, the main hypothesis was validated: dyslexia is primarily linked to deficits in phonological awareness. Therefore, the development of reliable and standardized scientific tools to assess this awareness is imperative for accurate diagnosis and early intervention.

Recommendations:

Develop standardized assessment tools for phonological awareness in Arabic that reflect the phonetic and linguistic specificities of Arabicspeaking children.

Integrate systematic phonological awareness training into elementary education curricula.

Provide teacher training programs focused on the early detection of reading and phonological awareness difficulties.

Conduct comparative studies between Arabicspeaking learners and those of other languages to explore crosslinguistic differences in phonological processing and dyslexia.

Emphasize preventive approaches through early intervention programs targeting children at risk of reading difficulties

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