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Disentangling Phonemic Awareness in Developmental Dyslexia: Implications for Assessment and Intervention

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Abstract

This study explores phonemic awareness in developmental dyslexia with the aim of proposing effective strategies to help researchers as well as teachers better assess phonemic awareness in children with developmental dyslexia in Taiz city, Yemen. To this end, 20 dyslexic students enrolled in government and private schools were recruited for this study. The quantitative data were collected through a test adapted from Arabic Dyslexia Assessment Test (ADAT) and Arabic Reading Test (ART) to assess the subjects' phonemic awareness skills. In addition to the statistical analysis, the subjects' common errors pertaining to phonemic awareness skills were also analysed. Based on the results, implications for intervention were proposed to help teachers consider the individual differences pertaining to phonemic awareness skills, and better support children with poor phonemic awareness. The study concludes with some implications and insights into phonemic awareness assessment and intervention in primary schools in Taiz city.

Keywords: developmental dyslexia, phonemic awareness, assessment, intervention

Introduction

Dyslexia is one of several types of learning disabilities that occur in children who experience extreme difficulty in learning to decode and spell printed words (Salkind, 2008). It affects about 5%-15% of the population, and is generally characterised by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties are, in part, neurologically based (S. Shaywitz& B. Shaywitz, 2005). Other consequences may include impaired reading comprehension and reduced reading experience that can impede the overall growth of vocabulary and background knowledge (Lyon et al., 2003).

In the literature, it has been documented that language disorders can be either acquired or developmental (Harley, 2001). Developmental language disorders occur in the initial stages of language development, and mostly "have idiopathic origin"(Murdoch, 1990. p.1). Acquired language disorders on the other hand are apparent due to a brain damage cerebral lesion (Murdoch, 1990). Thus, two cases of reading disability have been distinguished. If the disability is resulted from acquired cerebral lesion, then it is known as "acquired dyslexia"/ "alexia"; if it is a result of no cerebral lesion or any problem of vision, then it is described as "developmental dyslexia" (Beaton, 2004; Mather& Wendling, 2012; Murdoch, 1990).

Developmental dyslexia is diagnosed in children who are unable to achieve the expected level of reading skills for their age in the absence of other cognitive dysfunctions, such as poor vision or neurological deficit (Stanovich, 1988b; Vellutino, 1979, as cited in Joanisse& Manis, 2000). It has been considered as a form of reading difficulty that arises from the atypical learning during the typical stages of development (Molfese et al., 2006). It does not stem from inadequate classroom teaching, sensory impairment, or low socioeconomic status (Salkind, 2008). Generally speaking, reading processing is considered as a complex multi-stage process that requires complex cognitive skills (Elhoweriset al., 2017; Freud, 1953). It is well documented that 20% to 30% of children find reading a challenging task that they need to master in life (Mather& Wendling, 2012). It seriously affects the child academic performance as they struggle to read school-related subjects (Elhoweris et al., 2017). It involves identification of letters and letter combinations (graphemes), their subsequent conversion to sounds, which are then combined to give the whole word pronunciation, and eventually its meaning.

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One emerging area of research that has attracted a growing interest among researchers is the significant role of phonemic awareness in the development of language abilities, particularly reading ability in children with dyslexia. Much research has examined the impact of phonemic awareness on learning to read in children with dyslexia (e.g. Beaton, 2004; Elhoweris et al., 2017; Ramus et al., 2003; Robbins& Kenny, 2007). The current study aims to contribute to our understanding of phonemic awareness in developmental dyslexia through exploring its skills in primary school dyslexic students in Taiz city.

In the literature, phonemic awareness has been considered as a narrow aspect of phonological awareness, as phonological awareness includes several skills besides phonemic awareness which is considered the most complex skill of all phonological awareness skills (Elhoweris et al., 2017; Mather& Wendling, 2012). Phonemic awareness has been referred to as" a sensitivity to phonemes"(Robbins& Kenny, 2007, p.19). It is the ability to recognise and manipulate individual sounds in spoken words, and it can be broken down into various skills including blending sounds, segmenting sounds, manipulating sounds, deleting sounds, isolating sounds and substituting sounds that significantly contribute to reading and spelling development in young children (Adams, 1998; Elhoweris et al., 2017; Robbins& Kenny, 2007).

Concerning the phonemic skills, blending sounds is crucial for decoding words (Adams et al., 1998; Robbins& Kenny, 2007). Phoneme blending is identified as the ability of combining individual phonemes into a word. Normally developing children are therefore able to blend discrete sounds into single words, which enables them to read words accurately. Thus, dyslexic children need to master this skill for the purpose of developing their reading abilities (Adams et al., 1998; Elhoweris et al., 2017; Robbins& Kenny, 2007).

Phoneme segmentation, in contrast, involves separating the individual sounds in spoken words. When the child is able to segment the spoken words into their distinguishable sounds, he would certainly be able to spell these words out (Adams et al., 1998; Robbins& Kenny, 2007). The child therefore needs to give more attention to the space being between the sounds of a spoken word (where the sound begins and ends). Phoneme segmentation is therefore likely to be more difficult than phoneme blending, although they are closely related skills. Overall, phoneme blending and phoneme segmentation are foundational skills for later literacy development, as both skills have a considerably remarkable impact on reading and spelling abilities (Adams et al., 1998; Robbins& Kenny, 2007).

Shedding some light on phoneme manipulation, it requires two phonemic sub-skills, sound deletion and sound substitution (Robbins& Kenny, 2007). This skill is likely to be easy on CVC words even for struggling children. Thus, it is plausible to indicate that the more complex syllable structure the word has, the more challenging the phoneme manipulation task will be. Hence, dyslexic children are more able to delete /s/ in *sun* than /s/ sound in *nest* (Robbins& Kenny, 2007).

Concerning phoneme substitution, it is recognised as the ability to replace one sound for another in a spoken word. It is crucially linked to the sound patterns not the spelling patterns (Robbins& Kenny, 2007). It is a challenging phonemic skill required for learning to read, because even skilled readers are used to dealing with spelling patterns rather than discrete sounds. For example, asking students to substitute the sound/əʊ/ for /æ/ in the spoken word *cat*, they would certainly, as Robbins and Kenny (2007) suggested, came up with the word *cot* instead of *coat* as they are associating the sound with its corresponding letter. As Adams et al. (1998) suggested, phoneme manipulation involves other phonemic skills such as phoneme deletion, phoneme blending, phoneme isolation and phoneme substitution, and that is why much training in manipulating sounds might contribute to increasing phonemic awareness in dyslexic children.

The current study addresses the strengthening of links between research and education. The most widely accepted hypothesis is that dyslexics have processing deficits in the phonemic component of language (Catts, 1996). Specifically, dyslexics may have difficulty recognising the phonemic structure of spoken language and thus have trouble learning about the way in which spellings map onto words' sounds in alphabetic writing systems. Dyslexics' phonemic problems also extend to remembering words and to producing them quickly and accurately.

As a result, many theories have been postulated to account for the nature of dyslexia. One of the most common theories is the phonological deficit theory. This theory reports not only the reading and spelling disabilities but also phonological deficits including phonemic ones, naming disorders, grammatical impairments, and attention problems (Vender, 2017). Phonemic awareness in dyslexic children has been investigated by several previous studies (e.g. Adams et al., 1998; Elhoweris et al., 2017; Lacono& Cupples, 2004; Ramus et al., 2003; Reid, 2009). The current study seeks to explore phonemic awareness in developmental dyslexia with the aim of proposing effective strategies to help researchers as well as teachers better assess phonemic awareness in children with developmental dyslexia in Taiz city, Yemen.

1.1. Research Problem

In recent decades, researchers have conducted numerous studies on poor phonemic awareness in dyslexic children, though there is still no standard for identifying phonological deficits that significantly characterise dyslexia in Arabic speaking children reading in Arabic. Nonetheless, the knowledge of learning difficulties is clearly growing (Kirby, et al., 2005). Unfortunately, lack of knowledge concerning dyslexia and its underlying causes among the teachers definitely results in no proper understanding for the needs of dyslexic children. Accordingly, this study will explore phonemic awareness for the purpose of increasing teacher's awareness of this issue by providing precise description and analysis of the phonemic skills of the children examined in this study. If dyslexics are properly diagnosed and treated, and if the teacher is successfully informed and supportive, no child will dread going to school and having a reading test.

Overall, since educational opportunity, particularly in the area of phonology, may interact with dyslexia to either reduce or exacerbate its severity (Salkind, 2008), there is a serious need to an intensive reading program that includes a liberal dose of phonics. In addition, what is really needed is to develop some strategies to better assess and promote phonemic awareness for children with developmental dyslexia. Thus, elaborating and examining phonemic awareness as a key factor of dyslexia is what this study will be devoted to in order to increase awareness of such a phenomenon, which increasingly appears among primary school students.

1.2. Research Questions

This study seeks to address the following key questions:

1. What phonemic awareness skills are most affected in primary school students with developmental dyslexia in Taiz city?
2. What are the specific strategies that teachers and speech-language pathologists can use to assess and promote phonemic awareness in primary school students with developmental dyslexia?

Methods

2.1. Subjects

Twenty-five dyslexic primary school students were selected for the current study. They consisted of 15 girls and 10 boys with a mean age of 10 years. They were all in grade 4, and they were taught Arabic language course for 5 periods per week. They all had a history of reading difficulties with no sensory deficits or any other neurological disorders**.** To verify the selection of the subjects, the researcher initially intended to meet the participating teachers to identify reading and spelling difficulties observed in the tests assigned to the students throughout the first semester. Students who had studied at more than one school were excluded. The subjects recruited for this study were then tested using items from the Arabic Reading Test (ART) developed by Abou El-Ella et al. (2003). We noted that the subjects had no significant difference with respect to the test. Five students were excluded on the basis of their performance on the tasks assigned, thereby the sample was reduced to 20 subjects (n=20). In this respect, the subjects were selected on the basis of their history of reading and spelling difficulties, and their performance on both the school monthly tests and the tasks assigned to them by the researcher.

2.2. Materials

The test instrument employed in the current study was adapted from Arabic Dyslexia Assessment Test (ADAT) developed by Aboras et al. (2008), with a reported reliability of (0.85), and an ART for assessment of dyslexia in Egyptian children developed by Abou El-Ella et al. (2003), with a reported reliability of (0.913). The parts that permit the assessment of phonemic awareness in both tests were then used with some modification on the basis of a comprehensive review of literature pertaining to phonemic awareness skills clearly presented in Elhoweris et al. (2017) and Vender (2017). The items of the test were importantly adapted for the local linguistic appropriateness. In sum, the test contained more content to be an effective mean to fit the purpose of the current study and achieve the given aim.

All the items of the test instrument were written in Modern Standard Arabic (MSA) without diacritics being above or below the words. The items were intentionally triconsonantal, and hence long words were not included in the test herein implemented. Thus, future researchers could adapt the test to include longer words (multi-consonantal). Time limit was also carefully set.

Validity: Prior to the application of the test, it was applied on 20 children as a pilot study to ascertain its clarity and its age appropriateness as well as a time limit set. Some modification was made, accordingly.

Reliability: To establish the test internal consistency reliability, the test was reviewed by two university professors who indicated that the items used in the test are appropriate. Reliability of the test was proved by using the internal consistency. More specifically, based on Cronbach's Alpha measurement, the test was found to have an alpha coefficient reliability index of (0.75), which was found to be appropriate for this study.

2.3. Procedures

The test included 8 tasks to assess phonemic awareness skills and subskills. To minimise the risk of external factors during the application of the test, it was administered to each subject individually for at least half an hour with each to do it. The tasks, although ordered randomly, were constantly administered to the subjects as follows:

1.Phoneme Segmentation

For the assessment of this skill, the subjects were asked to segment ten single words into their compositional phonemes. The time recorded was 120 seconds. Three training items were required.

2.Phoneme Isolation

This task assessed three subskills including isolation of initial phoneme, isolation of middle phoneme, and isolation of final phoneme. To assess each subskill, the subjects were asked to isolate the intended phoneme in 10 words. Immediate answer was required for the proper performance in this task. There were five training items to make certain that the subjects' responses were isolated phonemes not CV sub-syllabic unit like/ mu:/ which was found more accessible. All the intended phonemes in this task were consonantal.

3.Phoneme Blending

For the purpose of assessing this skill, the subjects had to blend ten combinations of sounds to form single words. The subjects had to attentively listen to the phonemes sounded out by the examiner. The application of this task took 120 seconds. The sounds were repeated twice with a short pause separating them when necessary. Three training items were also there.

4.Phoneme Deletion

This task was applied in three stages including deletion of initial phoneme, deletion of middle phoneme, deletion of final phoneme. Each stage involved ten words orally presented to the subject in isolation. The student was asked to repeat the word after deleting the intended sounds. Five seconds was recorded for each word. If the subject was late repeating the word, the examiner immediately moved to the next one, and more than 5 consecutive mistakes resulted in the discontinuation of the task.

5. Phoneme Addition

For the assessment of this phonemic skill, the subjects were asked to add phonemes to ten single words with no initial phoneme. Then, they were asked to read them. The time recorded was 120 seconds. Training items were required.

6. Phoneme Manipulation

To assess the subjects' abilities of manipulating phonemes, they were given ten words and asked to replace one phoneme for another phoneme, and then read the words. Accurate reading of the word was required; otherwise, no mark was recorded for the subject.

7.Rhyme Production

To assess the subjects' abilities of producing rhyme, they were asked to complete ten rhyme sets irrespective of meaning. The time was ten seconds for making each rhyme set. If the subject made more than 5 consecutive mistakes, the examiner immediately moved to the next task concerning with rhyme detection.

8.Rhyme Detection

To assess the subjects' ability of detecting rhyme, ten sets of words were administered to the subject each of which consisted of three single words that rhyme except for one. Upon hearing the words of each set, the subject had to detect the odd word in terms of rhyme. Each set was repeated twice when necessary. Immediate answer was significantly required. The task was only applied after making sure that the subject understood how to perform it properly. Thus, three training items were required with feedback provided by the examiner.

2.4. Data Analysis

The study used descriptive statistics for the analysis of quantitative data concerning the students' scores in different phonemic tasks. The data analysis was carried out using SPSS version 0.26 (2019) to obtain the mean scores and standard deviations.

Results Analysis

This section deals with the most impressive results of the research. It provides data that numerically prove how phonemic awareness may appear in primary school students with developmental dyslexia. Descriptive statistics of the students' scores is presented.

3.1. Phoneme Segmentation

Table (1) presents the descriptive statistics analysis of the subjects' scores in phoneme segmentation task using frequencies and percentages.

Table 1

Descriptive Statistics Analysis of Phoneme Segmentation

Level	Frequency	Percent
Very Weak	16	80
Weak	4	20
Total	**20**	**100**

As Table (1) shows, 2 levels of the subjects' performance are provided, "very weak" and "weak". Sixteen students (80%) are very weak, and 4 students (20%) are weak at phoneme segmentation. Based on the data presented in Table (1), all the subjects performed very poorly in the task assigned to assess phoneme segmentation skill, which indicates that phoneme segmentation is an overall phonemic disability in the subjects examined in this study.

3.2. Isolation of Initial Phoneme

Table (2) presents the descriptive statistics analysis of the subjects' scores in isolation of initial phoneme task using frequencies and percentages.

Table 2

Descriptive Statistics Analysis of Isolation of Initial Phoneme

Level	Frequency	Percent
Weak	3	15
Good	10	50
Very Good	3	15
Excellent	4	20
Total	**20**	**100**

As Table (2) shows, 4 levels of the subjects' performance are identified. Ten students (50%) are good, 4 students (20%) are excellent, 3 students (15%) are weak, and 3 students (15%) are very good at isolation of initial phoneme skill. The results show that a small proportion of the subjects (15%) performed poorly in the task assigned to assess isolation of initial phoneme skill. Therefore, it is not appropriate to generalise that the dyslexic subjects examined in this study struggle with this skill based on this limited data.

3.3. Isolation of Middle Phoneme

Table (3) presents the descriptive statistics analysis of the subjects' scores in isolation of middle phoneme task using frequencies and percentages.

Table 3

Descriptive Statistics Analysis of Isolation of Middle Phoneme

Level	Frequency	Percent
Very Weak	11	55
Weak	8	40
Good	1	5
Total	**20**	**100**

Table (3) illustrates the difficulty with isolation of middle phoneme skill in primary school students with dyslexia. The data provided indicate that 11 students (55%) are very weak, 8 students (40%) are weak, and 1 student (5%) is excellent at isolation of middle phoneme skill.

3.4. Isolation of Final Phoneme

Table (4) presents the descriptive statistics analysis of the subjects' scores in isolation of final phoneme skill on the basis of frequencies and percentages.

Table 4

Descriptive Statistics Analysis of Isolation of Final Phoneme

Level	Frequency	Percent
Very Weak	2	10
Weak	8	40

Good	6	30
Very Good	4	20
Total	**20**	**100**

As shown in Table (4), 4 levels of the subjects' performance are provided. Eight students (40%) are weak, 6 students (30%) are good, 4 students (20%) are very good, and 2 students (10%) are very weak at isolation of final phoneme skill. The data indicates that isolation of final phoneme skill do not appear to be a problem for the dyslexic subjects examined in the current study, as (50%) of the subjects performed well in the assigned task concerning the assessment of this skill.

3.5. Phoneme Blending

The descriptive statistics analysis of the subjects' scores in phoneme blending task using frequencies and percentages is identified in Table (5).

Table 5

Descriptive Statistics Analysis of Phoneme Blending

Level	Frequency	Percentage
Very Weak	16	80
Weak	4	20
Total	**20**	**100**

Table (5) shows that at phoneme blending, 2 levels of performance are identified. Sixteen students (80%) are very weak, and 4 students (20%) are weak at phoneme blending skill. The data presented in Table (5) indicate that all the subjects examined in the current study have difficulty in blending phonemes.

3.6. Deletion of Initial Phoneme

Table (6) presents the descriptive statistics analysis of the subjects' scores in deletion of initial phoneme skill using frequencies and percentages.

Table 6

Descriptive Statistics Analysis of Deletion of Initial Phoneme

Level	Frequency	Percent
Weak	8	40
Good	6	30
Very Good	4	20
Excellent	2	10
Total	**20**	**100**

As Table (6) shows, 4 levels of the subjects' performance are identified. Eight students (40%) are weak, 6 subjects (30%) are good, 4 students (20%) are very good, and 2 students (10%) are excellent at deletion of initial phoneme skill. According to the data provided in Table (6), deletion of initial phoneme is not a difficulty for the subjects examined in this study, as (60%) of them demonstrated an adequate performance in the assigned task.

3.7. Deletion of Middle Phoneme

Table (7) presents the descriptive statistics analysis of the subjects' scores in deletion of middle phoneme task.

Table 7

Descriptive Statistics Analysis of Deletion of Middle Phoneme

Level	Frequency	Percent
Very Weak	10	50
Weak	6	30
Good	4	20
Total	**20**	**100**

Table (7) shows that at deletion of middle phoneme, 3 levels of performance are identified. Ten students (50%) are very weak, 6 students (30%) are weak, and 4 students (20%) are good at deletion of middle phoneme skill. Based on the data provided, deletion of middle phoneme is an area of deficit in the dyslexic subjects examined in this study, as the majority of the subjects (80%) performed poorly in the assigned task.

3.8. Deletion of Final Phoneme

The descriptive statistics analysis on the basis of frequencies and percentages is identified in Table (8).

Table 8
Descriptive Statistics Analysis of Deletion of Final Phoneme

Level	Frequency	Percent
Very Weak	3	15
Weak	2	10
Good	7	35
Very Good	5	25
Excellent	3	15
Total	**20**	**100**

As Table (8) shows, 5 levels of the subjects' performance in deletion of final phoneme skill are identified. Seven students (35%) are good, 5 students (25%) are very good, 3 students (15%) are very weak, 3 students (15%) are excellent, and 2 students (10%) are weak at deletion of final phoneme skill. Based on the data provided in Table (8), deletion of final phoneme is not considered a difficult skill for primary school students with dyslexia, as most of the subjects (85%) performed the task successfully.

3.9. Phoneme Addition

The descriptive statistics analysis of the subjects' scores in isolation of initial phoneme task using frequencies and percentages is indicated in Table (9).

Table 9
Descriptive Statistics Analysis of Phoneme Addition

Level	Frequency	Percent
Very Weak	16	80
Weak	2	10
Good	2	10
Total	**20**	**100**

As Table (9) shows, 3 levels of the subjects' performance at phoneme addition skill are identified. Sixteen students (80%) are very weak, 2 students (10%) are weak, and 2 students (10%) are good at phoneme addition skill. The results show that a large proportion of the subjects (90%) performed poorly in the task assigned to assess phoneme addition skill. Therefore, it is appropriate to generalise that the subjects examined in this study struggle with this skill.

3.10. Phoneme Manipulation

Table (10) illustrates the descriptive statistics analysis of the subjects' scores in phoneme manipulation task using frequencies and percentages.

Table 10
Descriptive Statistics Analysis of Phoneme Manipulation

Level	Frequency	Percent
Very Weak	16	80
Weak	4	20
Total	**20**	**100**

Table (10) shows that 16 students (80%) are very weak, and 4 students (20%) are weak at phoneme manipulation skill. The data provided indicate that phoneme manipulation is difficult for the dyslexic subjects examined in this study, as all the subjects performed rather poorly in the task.

3.11. Rhyme Production

The descriptive statistics analysis of the subjects' scores in rhyme production task using frequencies and percentages is provided in Table (11).

Table 11
Descriptive Statistics Analysis of Rhyme Production

Level	Frequency	Percent
Very Weak	15	75
Weak	4	20
Good	1	5
Total	**20**	**100**

As Table (11) shows, 3 levels of the subjects' performance are identified based on the frequencies and percentages calculated. Fifteen subjects (75%) are very weak, 4 subjects (20%) are weak, and 1 subject (5%) is good at rhyme production skill. Since 19 subjects (95%) performed poorly in the task assigned to assess this skill, rhyme production is considered an overall disability in the subjects examined in this study.

3.12. Rhyme Detection

The descriptive statistics analysis of the subjects' scores in rhyme detection task using frequencies and percentages is provided in Table (12).

Table 12
Descriptive Statistics Analysis of Rhyme Detection

Level	Frequency	Percent
Very Weak	14	70
Weak	4	20
Good	2	10
Total	**20**	**100**

As Table (12) indicates, 14 subjects (70%) are very weak, 4 subjects (20%) are weak, and 2 subjects (10%) are good at rhyme detection. The data presented demonstrate that the subjects experience severe difficulty in rhyme detection, as 90% of the subjects performed poorly in the task.

3.13.Phonemic Awareness Assessment

Table (13) provides a summary of the descriptive statistics of phonemic awareness skills assessment results using means, standard deviations, and percentages. It shows the subjects' mean scores that occur within (3.40) and (1.20), standard deviations of (1.27) and (0.410), and percentages within (68%) and (24%).

Table 13
Results of Phonemic Awareness Assessment

Phonemic Awareness Skills	N	Mean	Percent	Std. Deviation
Phoneme Segmentation	20	1.20	24.0	0.410
Phoneme Blending	20	1.20	24.0	0.410
Deletion of Initial Phoneme	20	3.00	60.0	1.026
Deletion of Middle Phoneme	20	1.70	34.0	0.801
Deletion of Final Phoneme	20	3.15	63.0	1.268
Isolation of Initial Phoneme	20	3.40	68.0	0.995
Isolation of Middle Phoneme	20	1.50	30.0	0.607
Isolation of Final Phoneme	20	2.60	52.0	0.940
Phoneme Addition	20	1.30	26.0	0.657
Phoneme Manipulation	20	1.20	24.0	0.410
Rhyme Production	20	1.40	28.0	0.681
Rhyme Detection	20	1.30	26.0	0.571

Note: for the evaluation of the student's mastery of phonemic skills, a mean score of ≥2.5(≥50%) was taken to indicate that the students master the phonological awareness skill. A mean score below 2.5 (<50%) crucially indicate this skill is an area of deficit.

As shown in Table (13), the subjects' scores in phonological awareness skills are as follows phoneme segmentation (M = 1.20; % = 24.0), phoneme blending (M = 1.20; % = 24.0), deletion of middle phoneme (M = 1.70; % = 34.0), isolation of middle phoneme (M = 1.50; % = 30.0), phoneme addition (M = 1.30; % = 26.0), phoneme manipulation (M = 1.20; % = 24.0), rhyme production (M = 1.40; % = 28.0), rhyme detection (M = 1.30; % = 26.0). The scores already pointed at fell below 2.5 (<50%) indicating that the students had severe difficulties in 11 phonological skills out of 15 skills pertaining to phonological awareness as shown in Table (13). On the other hand, the students' mean scores in other phonological skills are >2.5 (>50%) indicating that the students master four phonological skills including deletion of initial phoneme (M = 3.00; % = 60.0), deletion of final phoneme (M = 3.15; % = 63.0), isolation of initial phoneme (M = 3.40; % =68.0), and isolation of final phoneme (M = 2.6; % = 52.0) (See Table 13).

Discussions and Implications

4.1. Discussion of the Results

The principal goal of the current study is to disentangle phonemic awareness in developmental dyslexia. It specifically aims to provide data that help to answer the following key questions:1. What phonemic awareness skills are most affected in primary school students with developmental dyslexia in Taiz city? 2.What are the specific strategies that teachers and speech-language pathologists can use to assess and promote phonemic awareness in primary school students with developmental dyslexia

The first question seeks to identify how phonemic awareness may appear in primary school students with developmental dyslexia. The results statistically indicate that dyslexic children perform poorly in most of the subtests assigned to assess phonemic awareness skills in this study. This result is consistent with several previous studies that highlight the effective role of phonemic awareness in learning to read and spell (see Adams et al., 1998; Cupples& Lacono, 2004; Elhoweris et al., 2017; Eviatar& Ibrahim, 2014; Ramus et al., 2003; Vender, 2017). To discuss this question properly, the subjects' errors concerning their performance in the test used to assess phonemic awareness skills are initially discussed.

4.1.1. Errors Pertaining to Phonemic Awareness

This section discusses in detail the subjects' errors in the tasks assigned to assess phonemic awareness. It includes 10 subsections to discuss the subjects' errors in 10 categories of phonemic skills assessed for the purpose of this study.

4.1.1.1. Phoneme Segmentation

Table (14) shows the most common errors made by the subjects in phoneme segmentation task. Six examples are presented along with their phonetic transcription.

Table 14

Errors in Phoneme Segmentation

Examples	Target	Response
أغنام	أ-غ-ن-ا-م	أ-غ-ن-م
ʔɣna:m	ʔ-ɣ-n-a: -m	ʔ-ɣ-n-m
ليمون	ل-ي-م-و-ن	ل-م-ن
laymu:n	l-a-y-m-u: -n	l-m-n
تفاح	ت-ف-ا-ح	ت-ف-ح
tufa: ḥ	t-u-f- a: -ḥ	t-f-ḥ
موز	م-و-ز	م-ر-ز
mau:z	m-u: -z	m-r-z
فراولة	ف-ر-ا-و-ل-ة	ف-ر-ل
farawlaḥ	f-a-r-a-w-l-a-ḥ	f-r-l
برتقال	ب-ر-ت-ق-ا-ل	ب-ت-ق
burtuqa:l	b-u-r-t-u-q-a: -l	b-t-q

It is observed that the subjects experience difficulty in performing the task assigned to assess their ability in segmenting phonemes. The subjects' poor performance in the task seems to be attributed to the nature of Arabic orthographic system. Only long vowels are graphologically represented in Arabic. Short vowels, in contrast, are not represented by independent letters; rather diacritic marks are used to represent them. Thus, the subjects completely ignore vowels when segmenting a word into its compositional sounds. For example, the word "أشجار" *ʔʃga:r* is segmented as *ʔa-ʃa-ga-r*, and "ليمون" *lai:mu:n* as *la-ma-n*. Since the subjects cannot recognise long vowels, segmenting words with no long vowels are much easier for them. For example, the word "سمك"*samak* is segmented as *sa.ma.ka*. Furthermore, some children have difficulty recalling the sounds they hear, the thing which lead them to replace one sound for another, e.g. the word"موز" *maʊz* is segmented by some subjects as *ma-ra-z*.

What is importantly noted is that the subjects cannot recall more than 3 consonant sounds when segmenting multi-consonantal words. For example, the word "برتقال"*burtuqa:l* is segmented as *ba-ta-q*. In sum, when segmenting the words into phonemes, dyslexic children tend to substitute or delete sounds to compensate their disability of retaining the sounds presented to them. Therefore, it is possible to suggest that phoneme segmentation is a severe difficulty in dyslexic subjects examined in the current study. This supports the findings of previous studies (e.g. Elhoweris et al., 2017; Ramus et a., 2003; Sedivy, 2020; Vender, 2017), that reported the disability of dyslexic children in phoneme segmentation.

4.1.1.2. Phoneme Blending

Table (15) presents the data that show the subjects' common errors when blending phonemes into single words. The table includes two examples

Table 15

Errors in Phoneme Blending

Examples	Target Response	Actual Response
ش-َ-ر-َ -ا-ب	شراب	شرب
š-a-r-a:-b	šara:b	šarab
ق—ِ- ط- َ – ا-ر	قطار	مطر/قطر
q-i-ṭ-a:-r	qiṭa:r	qaṭar/maṭar

As shown in Table (15), the subjects have difficulty blending phonemes into single words. This also can be attributed to the nature of Arabic orthographic system, as only long vowels are graphologically represented, whereas short vowels are not. The subjects therefore tend to retain consonant sounds more effectively than vowel sounds, which can lead them to create new words that share the abstract root of the intended words. For example, the target response "شراب"*šarab* and the subject's response "شرب"*šarab* share the abstract root "ش-ر-ب" *š-r-b*. The subjects also may make use of the consonant sounds they are able to retain and respond with words quite similar to the intended ones, e.g. in blending the phonemes "قِ-طَ- ا-ر" *q-i-ṭ-a:-r*, some subjects blend these phoneme into "مطر"*maṭar*. In short, blending sounds into single words is difficult for the dyslexic subjects examined in this study.

4.1.1.3. Deletion of Initial Phoneme

Table (16) presents the subjects' errors in deletion of initial phoneme task. Three examples of monosyllabic, disyllabic and trisyllabic words are presented.

Table 16

Errors in Deletion of Initial Phoneme

Examples	Target Response	Actual Response
نور nu:r	ور u:r	ور u:r
ضفدع ḍifdaʕ	فدع fdaʕ	ضدع/دع daʕ/ḍadaʕ
سميرة sami:ra	ميرة mi:ra	سيرة si:ra

It is observed that it is quite easier for the subjects to identify and delete initial phonemes in monosyllabic words, e.g. "نور" *nu:r*, than in disyllabic or trisyllabic words, e.g "ضفدع"*ḍifdaʕ*, and "سميرة"*sami:ra* (see Table 16). Thus, it seems to be possible to suggest that the dyslexic subjects examined in this study experience no difficulty in deleting initial phonemes in monosyllabic words; however, the task becomes more difficult in disyllabic or trisyllabic words.

What is more important to mention is that most items included in this task were monosyllabic words, and therefore for the accurate findings regarding this task, it is recommended to include more disyllabic words, trisyllabic words, and polysyllabic words, as the data pertaining to this task was not sufficient to generalise that dyslexic children experience difficulty in deleting initial phoneme.

4.1.1.4. Deletion of Middle Phoneme

Table (17) shows the errors of the subjects in deletion of middle phoneme task. Three examples are presented, along with their phonetic transcription.

Table 17

Errors in Deletion of Middle Phoneme

Examples	Target Response	Actual Response
سمك samak	سك Sak	سم/مك mak/sam

عسل ʕasal	عل ʕal	عس/سل sal/ʕas
جزر jazar	جر jar	جز/زر jaz/zar

It is observed that the subjects have difficulty in recognising and deleting the middle sound. It seems that the subjects have a tendency to omit the initial or final sounds when they are asked to repeat the words while excluding the middle sounds (see Table 17). It is highly reasonable to say that the subjects struggle with perceiving and deleting the middle sound in verbally presented words, as majority of them do not perform the task successfully.

4.1.1.5. Deletion of Final Phoneme

Table (18) presents the subjects' common errors pertaining to the task assigned to assess their ability to delete final sounds in the words that they hear orally. The table includes examples of monosyllabic words and disyllabic words distinguished by the number of the consonant sounds included.

Table 18
Errors in Deletion of Final Phoneme

Examples	Target Response	Actual Response
فهد fahd	فه fah	فه fah
أسد ʔasad	أس ʔas	أس ʔas
ضفدع ḍifdʕ	ضفد ḍifd	فدع fdʕ

As the data in Table (18) show, the subjects have no difficulty in performing the task when dealing with monosyllabic and disyllabic words with three consonant sounds, e.g. "أسد" ʔ*asad* and "فهد" *fahd*. However, they experience difficulty in performing the task in monosyllabic words and disyllabic words with more than three consonant sounds, e.g. "ضفدع" *ḍifdʕ*. Overall, most of the subjects perform the task quite successfully, and thus deletion of final phoneme does not appear to be challenging for the dyslexic subjects examined in this study.

It is also appeared to be easier for the subjects to delete final sounds than initial sounds. This result is inconsistent with the finding of the previous study conducted by Elhoweris et al. (2017), which pointed out that dyslexic children had difficulty in deletion of final phoneme skill. This contradictory result may be due to the limited data provided in the current study, as most of the items included in the task assigned to the subject are triconsonantal words. Thus, with this limited data, this generalisation needs to be interpreted with caution.

4.1.1.6. Isolation of Initial Phoneme

Table (19) provides the data regarding the subjects' common errors in the task assigned to assess their ability to isolate initial phonemes. The table presents three examples that seem to be sufficient to discuss the subjects' performance in isolation of initial phoneme task.

Table 19
Errors in Isolation of Initial Phoneme

Examples	Target Response	Actual Response
ثريا θurayya:	/ث/ /θ/	/ث/ /θ/
تغريد taɣri:d	/ت/ /t/	/ت/ /t/
حديقة ḥadi:qah	/ح/ /ḥ/	/ح/ /ḥ/

It is well observed that the subjects experience no difficulty in isolating initial phonemes in the words presented to them orally. This supports the study conducted by Elhoweris et al. (2017), which reported the ability of dyslexic children to isolate initial phonemes.

4.1.1.7. Isolation of Middle Phoneme

Table (20) illustrates the subjects' most common errors in the task assigned to assess their ability to isolate middle phoneme. Three examples are presented to discuss the extent to which the subjects master isolation of middle phoneme task.

Table 20

Errors in Isolation of Middle Phoneme

Examples	Target Response	Actual Response
زيد zayd	/ي/ /y/	/ز/ /z/
شهد šahd	/ه/ /h/	/د/ /d/
رغد raɣad	/غ/ /ɣ/	/ر/ /ɾ/

Based on the data provided in Table (20), it is observed that the subjects show no difficulty in identifying and isolating the initial or final sounds. However, they experience difficulty in isolating middle ones. They have disabilities of detecting middle sounds in both triconsonantal and multi-consonantal words. As almost all the subjects fail to isolate the middle phoneme in the task assigned, it seems to be possible to generalise the disability of dyslexic children in isolating the middle phonemes in the task assigned to them.

4.1.1.8. Isolation of Final Phoneme

Table (21) illustrates the subjects' errors when performing the task assigned to assess their ability of isolating final phonemes. Three examples are presented to discuss the subjects' most common errors.

Table 21

Errors in Isolation of Final Phoneme

Examples	Target Response	Actual Response
بيت bayt	/ت/ /t/	/ت/ /t/
مسجد masjid	/د/ /d/	/د/ /d/
مستوصف mustawṣaf	/ف/ /f/	/ش/ /š/

The data show that the subjects do not exhibit any difficulty in isolating the final sound in monosyllabic and disyllabic words. Trisyllabic words, on the other hand, are challenging for the subjects to deal with in this task. In other words, the more syllables the word has, the more challenging the task will be for dyslexic subjects examined in the current study.

4.1.1.9. Phoneme Addition

Table (22) presents the data necessary to discuss the subjects' common errors in the task assigned to assess their ability of phoneme addition in word initial position. Two examples seem to be sufficient to be included in the table.

Table 22

Errors in Phoneme Addition

Examples	Target Response	Actual Response
كَتَبْ ktab	مكْتَبْ **m**aktab	بكْتَبْ **b**aktab
عْد ʕd	رعد **r**aʕd	تعد/معد **t**aʕd/**m**aʕd

It is observed that the subjects have difficulty in performing phoneme addition task. It seems that the subjects add phonemes to the orally presented words regardless of the meaning. It is also observed that the subjects cannot read the words after they add the phonemes. They tend to syllabicate the word rather than reading the whole word. In short, based on the data provided, the dyslexic subjects examined in the current study struggle with phoneme addition task. This supports the findings of previous studies (e.g. Elhoweris et al., 2017; Ramus et a., 2003; Vender, 2017).

4.1.1.10. Phoneme Manipulation

Table (23) provides the data regarding the subjects' common errors in isolation of initial phoneme task. The table presents three examples of monosyllabic words, that seem to be sufficient to comment on the subjects' performance in the task assigned to assess their ability of manipulating phonemes.

Table 23

Errors in Phoneme Manipulation

Examples	Target Response	Actual Response
ليث layθ	Any phoneme can be manipulated/ substituted	حيت ḥayt
صيف ṣayf		ريف ri:f
جوز jawz		حوز ḥawz

Based on the data provided, the subjects have difficulty in substituting one phoneme for another in the words presented by the examiner. It is also important to note that the subjects unintentionally suggest phonemes required to form new meaningful words, e.g."ريف" *ri:f.* They perform the task with no attention given to the meaning of the words they may form by substituting one phoneme for another. Generally, the subjects perform poorly in the task assigned to assess their ability to manipulate phoneme. This supports the findings of previous studies (e.g. Elhoweris, 2017; Ramus et al., 2003; Robbins& Kenny, 2007; Wilsenach, 2006; Wood et al., 2009), which reported that dyslexic children have severe difficulty in phoneme segmentation and phoneme manipulation.

Given that the subjects experience severe difficulties in performing most of the tasks assigned to assess phonemic awareness, it is plausible to suggest that phonemic awareness is impaired in dyslexic subjects examined in this study. This is in accordance with the findings of previous studies (e.g. Elhoweris et al., 2017; Ramus et al.,2003; Shaywitz, 1996; Vender, 2017; Wilsenach, 2006), which confirmed the poor phonemic awareness in dyslexic children.

4.1.1.11. Rhyme production

Table (24) shows the subjects' errors in the task assigned to assess their ability of producing rhyme. Two examples of incomplete rhyme sets are presented.

Table 24

Errors in Rhyme Production

Examples	Target Response	Actual Response
_____-مساء-سماء masaʔ- samaʔ___	Any word that completes the rhyme set (e.g. "نداء " nidaʔ)	ليل/شمس šams/layl
____-أحمر- أخضر ʔahmar-ʔxḍar-___	Any word that completes the rhyme set (e.g. "أصفر" ʔṣfar)	أزرق ʔzraq

From the data provided in Table (24), it is observed that the subjects think of the possible logical connection between the last word they hear and the one they will produce regardless of the intended rhyme. They therefore tend to use familiar words regardless of the intended rhyme for instance, "سماء" *samaʔ*, "مساء" *masaʔ*, "ليل" *layl* / "شمس" *šams*. What is also interestingly noticed is that dyslexic children perform the tasks concerning rhyming semantically rather than phonetically. In other words, they produce words that belong to the same word category of the last word they hear. For example, "أحمر" *ʔhma:r,* "أخضر " *ʔxḍar*, and "أزرق" *ʔẓraq* . In addition to this, all the subjects take more time than required in performing the task used to assess their ability in rhyme production. Thus, word rhyming difficulty is a key manifestation exhibited by the dyslexic subjects examined in

this study. This supports the findings of previous studies (e.g. Elhoweris et al., 2017; Mather & Wendling, 2012; Vender, 2017) that confirmed the poor performance of dyslexic children in rhyme production task.

4.1.1.12. Rhyme Detection

Table (25) illustrates the subjects' errors in the task assigned to assess rhyme detection. Two examples of rhyme sets with odd words in terms of rhyme are presented.

Table 25

Errors in Rhyme Detection

Examples	Target Response	Actual Response
يد- فم - خد	فم	يد
yad- fam- xad	fam	yad
حزام - حذاء - رداء	حزام	رداء
ḥizam-hi:ðʔ-ridaʔ	ḥizam	ridaʔ

Based on the data provided, it appears that the subjects tend to choose the last word even if it is not the odd one in terms of rhyme. The subjects seem to have a problem remembering the words they have been already exposed to. Thus, it seems that short-term memory does not work well in dyslexic students as they are likely to remember the last word rather than the three words presented to them. Rhyme detection task seems to be difficult for the majority of the dyslexic children (90%) examined in this study (See Table 25).

4.2. Implications for Assessment

The second key question addresses implications for phonemic awareness assessment based on the results obtained and the observations noted during the application of the test instrument used in the present study. The suggested implications are also provided on the basis of some previous studies pertaining to the assessment of phonemic awareness in children with dyslexia.

The tests suggested to assess phonemic awareness in Arabic language are ART, ADAT, and Phonological Arabic Test (PAT)[3], the items of which can be modified for the local linguistic appropriateness. These tests consist of subtests assigned to assess the different phonemic awareness skills including phoneme segmentation, phoneme blending, phoneme isolation, phoneme deletion, and phoneme manipulation. Accordingly, it is plausible to assume that using a battery of tests assigned to assess these different phonemic awareness skills seem to be effective to provide a comprehensive picture of an individual's phonemic awareness abilities.

However, assessing phonemic awareness in individuals with developmental dyslexia can be challenging, as this population often exhibits a wide range of phonological processing difficulties. For this reason, several strategies that could be used to improve the assessment process have been suggested (Adams et al., 1998; Reid& Guise, 2017; Wanger et al., 1999). One of the most common strategies that can be used to assess phonemic awareness skills is informal test, which is less structured compared to formal or standarised one.

Informal assessment can take many forms including observations, performance-based tasks, checklists and interviews. Informal tests are used to identify areas where additional support may be needed. However, they are less reliable and valid than formal ones, as they may be subjected to the bias or any other errors that may affect the accuracy of the results. Thus, it has been suggested to use informal assessments in conjunction with formal/ standarised assessments to assess the child's phonemic awareness skills to ensure the accuracy of the results (Reid& Guise, 2017).

Other strategies used to assess phonemic awareness skills, as suggested by Wixson and Lipson (2012), include phoneme segmentation test, elision test, phoneme blending test, sound matching test, sound isolation test, phoneme deletion and substitution test and rhyme recognition test. These strategies seem to be effective in identifying and supporting students who struggle with phonemic awareness (Gunning, 2013; Wixson& Lipson, 2012). Thus, to assess students' phonemic awareness, it is suggested that teachers can use a combination of these strategies and record their responses.

Overall, phonemic awareness assessment is especially important for students with dyslexia, as it can help identify their specific difficulties with recognising sounds in a language. This assessment can provide valuable information that can then be used to develop targeted intervention to improve phonemic awareness skills, which are critical for reading development. Further, phonemic awareness assessment can also be used to monitor the

[3] See Almehrizi et al. (2020)

progress of students with developmental dyslexia over time. By regularly assessing phonemic skills, teachers can adjust instructional strategies as needed to meet the individuals needs of each student with developmental dyslexia, which can ultimately lead to and overall academic success.

Accordingly, the assessment of phonemic awareness skills in children with developmental dyslexia should be in a systematic and comprehensive manner. A combination of standardised tests and informal assessments therefore have been suggested. In addition, assessment of phonemic awareness should be tailored to the specific needs and abilities of the dyslexic students, and embedded in a comprehensive literacy program.

Tests used to assess phonemic awareness also need to be specific to the language in which the subjects read. For example, tasks that involve segmenting and blending consonant-vowel syllables may not be appropriate for languages that use logographic writing systems, such as Chinese while they can be effective in alphabetic languages like Arabic which phonetically maps graphemes onto phonemes. Thus, "good practice of phonemic awareness assessment requires a basic knowledge of the specific linguistic features of the language, the context and the culture of the individuals being assessed" (Elbeheri et al., 2006, p. 151).

4.3. Implications for Intervention

Another objective of this research is to suggest some teaching strategies to promote phonemic awareness, which seems to be critical for the development of reading and spelling skills in students with developmental dyslexia. This is what the research last key question is concerned with.

Initially, since phonemic awareness not only pertains to the acquisition of reading skills, but also serves as an indicator of future success in the proficiency of reading and spelling skills, early training in phonics instruction might decrease the early reading and spelling difficulties in primary school students with poor phonemic awareness. Education institutions therefore should ensure that teachers at primary schools are aware of the viable teaching strategies necessary for the development of phonemic awareness in students with reading and spelling disabilities.

One of the most effective teaching approaches that has been suggested to improve the students' phonemic awareness is multi-sensory instruction (Adams et al., 1998; Birsh, 2011). It involves using multiple senses, sight, sound, and touch during the learning process. Manipulatives, such as blocks, beads, and other physical objects are used to help students visualise and understand even abstract concepts. Thus, multi-sensory instruction seems to be effective for teaching dyslexic students, who may struggle with traditional teaching methods. For example, teachers can use a combination of visual aids, verbal instructions and hands-on activities to help students better recognise letter sounds. Engaging multiple senses makes learning more memorable and effective.

One important issue that emerges from this study is that developing rhyming skill can significantly enhance dyslexic students' phonemic awareness. If dyslexic students develop this skill, other skills pertaining to phonological awareness develop in turn. By recognising the common sound at the end of two or more words, dyslexic students are able to develop their ability to distinguish individual sounds within words. This skill is important for learning to read and write, as it helps dyslexic students to understand the relationships between different words and sounds in a language. Supportive evidence comes from Jurenka (2005), who provided a practical guidance to educators on teaching phonemic awareness to young learners.

Accordingly, teachers should use some strategies to help dyslexic students fully master rhyming skill. The suggested strategy for teaching rhyming skill is rhyming games. Rhyming games is not an effective way not only to develop phonemic awareness, but also to promote vocabulary building and literacy skills in dyslexic children. They can be adapted to different age and skill levels. The most common rhyming games are *Rhming Bingo, Rhming Memory, Rhyming I Spy, Rhyming Time, and Rhyming Read-Alouds* (see Jurenk, 2005). Teacher could use any of these games that fit dyslexic students' learning level.

Another issue that emerges from this study is that the subjects experience difficulty in dealing with Arabic vowel sounds during performing the tasks assigned. They accordingly have trouble recognising onset-rime structure, which considerably contributes to reading development. Once dyslexic students become sensitive to the onset-rime boundary, some consideration is given to the vowel occurrence and phonemic similarities across words. Therefore, it is suggested to direct the children's attention to this structure for the purpose of developing their phonemic awareness which seems to be crucial for the development of their reading abilities (see Wood et al., 2009).

A third issue that emerges is that the subjects have poor decoding skills. Decoding is referred to as the ability to figure out how to read words by matching letters to the sounds they represent. Decoding skills are essential for reading fluently and accurately, because improving decoding skills can have a positive impact on phonemic awareness, which is critical for successful reading development (Adams et al., 1998). Accordingly, it has been suggested that dyslexic students may need to develop decoding skills for better phonemic awareness development.

There are several strategies teachers can use to help students develop their decoding skills. One common strategy is phonics instruction. It is mainly used to teach students how to decode words by recognising the sounds that correspond to each letter or letter combination. In Arabic orthographic system, short vowels have no corresponding letters; they, instead, are represented by diacritic marks above or below letters. As a result, teaching dyslexic Arabic students to read through grapheme to phoneme correspondences might be effective. However, other strategies should be used to give some attention to the irregularities that result from the short vowels.

Another strategy the teacher may use to teach phonics and decoding skills is explicit instruction. This strategy involves teachers to break down complex skills into smaller ones. Manageable steps and explicit instructions are primarily required. Such techniques may not be useful for decoding high-frequency words such as, و *wa*, في *fi*, and إلى *ila*. As a result, teachers have to help dyslexic students develop another strategy for decoding such words like sight word recognition.

More interestingly, integrating phonemic awareness training with reading instruction has been found to be the most effective approach to facilitate the development of reading skills in dyslexic students and normal ones. Thus, an intensive training program in phonics might be effective in improving phonemic awareness and decoding skills in Arabic students with/without dyslexia. A phoneme manipulation approach proposed by (Adams et al., 1998) seems to be effective in teaching phonemic awareness. This approach involves activities that require students to manipulate individual sounds in words, such as segmenting, blending, deleting, and substituting sounds. It can also be used in a variety of grade levels, from early elementary to upper grades, and adapted to meet the needs of individual students. In addition, this approach can be used in conjunction with other phonemic awareness activities, such as rhyming and syllable segmentation, to provide a comprehensive approach to phonemic awareness instruction. For more details about this approach and the suggested activities, see Adams et al. (1998).

In sum, teaching methods and curriculum design are undoubtedly important in understanding and addressing the students' disabilities pertaining to poor phonemic awareness. Thus, teachers should take a holistic approach to teaching phonemic awareness necessary for reading and spelling development, particularly to those with reading and spelling difficulties. By incorporating evidence-based practices, multi-sensory instruction, and the different components of decoding skills, and by providing differentiated instruction and positive reinforcement, teachers can help dyslexic students master phonemic awareness skills that are critical for learning to read. Furthermore, teachers should continually monitor and evaluate the effectiveness of their teaching practices and make adjustments as needed. This can help improve student learning outcomes and ensure that all students have access to high-quality learning.

Conclusions and Suggestions

This research primarily aims at disentangling phonemic awareness in developmental dyslexia by its skills and subskills among primary school dyslexic students in Taiz city. As was previously mentioned, the present study has confirmed the results of several previous studies that reported the crucial impact of phonemic awareness on reading and spelling development in dyslexic children. Some effective strategies have also been proposed to better assess and promote phonemic awareness for students with developmental dyslexia. However, this research has thrown up many limitations in need of further investigation.

First, the study mainly examine poor phonemic awareness as a factor that can impact the subjects' reading and spelling development. However, there seem to be other pedagogical factors that can affect their reading and spelling abilities such as school system and teachers' awareness of developmental disorders. The impact of such factors on reading and spelling disabilities in dyslexic children need to be further examined.

Second, during the development of this research, the idea that teaching speech rhythm could enhance phonemic awareness has been considered. However, this aspect was not examined in the current study. As a result, it would be compelling to investigate the impact of rhythm instruction on the advancement of reading and spelling skills in dyslexic children.

Finally, diglossia has been noticed in the subjects' performance in the reading and spelling tasks assigned in this study. Although several previous studies have examined the effect of this linguistic characteristic on reading

and spelling difficulties in dyslexic children reading in English and other languages, no study, to the best of my knowledge, has investigated the situation of diglossia in Arabic context. Further studies therefore should be carried out to explore whether diglossia may be contributing to reading and spelling difficulties in Arabic students with dyslexia.

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