

Effectiveness of Phonological Awareness Training for Students with Dyslexia in Kuwaiti Schools

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ABSTRACT:

Dyslexia affects approximately 6.3% of primary school students in Kuwait, and Arabic diglossia (the linguistic distance between Spoken Kuwaiti Arabic and Modern Standard Arabic) together with an opaque orthography intensifies phonological awareness (PA) deficits. This quasi-experimental study evaluated a 12-week explicit PA training program (36 sessions of 45 minutes, three per week) delivered in small groups with progressive syllable-to-phoneme scaffolding, multisensory activities, and diglossia-sensitive adaptations. Thirty students with dyslexia (Grades 4–5, aged 9–11 years) in Kuwaiti public schools were assigned to an experimental group ($n = 15$) or a control group ($n = 15$) following the standard curriculum. Pre- and post-assessments used Arabic-adapted versions of the Comprehensive Test of Phonological Processing-2 and the Woodcock-Johnson IV Tests of Achievement. The experimental group showed large gains in PA ($d = 1.92$) and reading proficiency ($d = 2.12$), including phoneme-level skills, word reading accuracy, and pseudo-word decoding ($ps < .001$), while controls changed negligibly. Interviews ($n = 20$) indicated improved fluency and confidence. The findings support the phonological deficit hypothesis in diglossic orthographies. Limitations include the small sample and the absence of long-term follow-up. Implications include integrating explicit PA instruction into the curriculum and teacher professional development.

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1. Introduction

Dyslexia is a specific learning disability characterized by persistent difficulties in accurate and fluent word recognition, decoding, and spelling, despite normal intelligence, adequate instruction, and absence of sensory impairments (American Psychiatric Association, 2022). Globally, dyslexia affects 5–10% of

school-aged children, with significant implications for academic achievement, self-esteem, and long-term socioeconomic outcomes (Snowling, 2020). In Arabic-speaking countries, these challenges are compounded by the unique linguistic features of Arabic, particularly its diglossic nature and opaque orthography (Abu-Rabia, 2020; Taha, 2020).

Arabic diglossia refers to the coexistence of two distinct varieties: Modern Standard Arabic (MSA), the formal written and educational medium, and Spoken Arabic Vernacular (in Kuwait, Kuwaiti Arabic [KA]), the oral variety used in daily communication (Ferguson, 1959; Holes, 2004; Saiegh-Haddad, 2017, 2025). This linguistic distance manifests in substantial phonological, lexical, and syntactic differences such as vowel patterns, consonant clusters, and stress placement that create a barrier for young learners. Kuwaiti children enter school proficient only in KA, yet literacy instruction is conducted exclusively in MSA, delaying the development of phonemic awareness critical for decoding (Al-Sulaim & Marinis, 2017; Saiegh-Haddad & Schiff, 2025). For dyslexic children, who already exhibit core phonological deficits, this diglossic mismatch exacerbates difficulties in establishing reliable grapheme-phoneme correspondences, leading to persistent reading failure and widened achievement gaps (Asadi et al., 2020; Layes et al., 2021).

In Kuwait, national estimates indicate dyslexia prevalence at approximately 6.3% among primary to secondary students, rising to over 20% in vulnerable groups such as young offenders (Aladwani & Al Shaye, 2012; Al-Mutairi & Al-Ansari, 2008). Current Kuwaiti Ministry of Education curricula emphasize whole-language approaches, focusing on comprehension, vocabulary, and text exposure in MSA, with limited explicit instruction in phonological skills or systematic phonics (Ministry of Education, Kuwait, 2023). These practices, while promoting general literacy, do not adequately address phonological deficits central to dyslexia, nor do they incorporate diglossia-sensitive strategies to bridge vernacular and formal varieties. Consequently, many dyslexic students remain unidentified or unsupported, as evidenced by low teacher awareness of early indicators and evidence-based interventions (Aladwani & Al Shaye, 2012).

However, no empirical studies in Kuwait have systematically evaluated the efficacy of targeted phonological awareness (PA) interventions

within school settings, despite promising results from analogous programs in neighboring Arabic-speaking countries (Elbeheri, Everatt, et al., 2022; Layes et al., 2021; Mohamed et al., 2024).

This absence of localized, rigorous evidence represents a critical research gap, hindering the development of culturally appropriate remediation strategies aligned with Kuwait's educational context and Vision 2035 goals for inclusive human capital development.

The primary objective of this quasi-experimental study was to examine the effectiveness of a 12-week explicit PA training program designed with progressive scaffolding and diglossia-sensitive adaptations in improving phonological awareness and reading proficiency among Kuwaiti primary students with dyslexia, compared to standard classroom instruction.

A secondary objective was to explore qualitative perceptions of the intervention's impact on student engagement and confidence. We hypothesized that the experimental group would demonstrate significantly greater gains, with large effect sizes, thereby providing foundational evidence for scalable, evidence-based practices in Kuwaiti schools.

1.1 Research Questions

This study is guided by the following research questions, derived from the objectives and hypothesis:

1. **Primary Research Question:** To what extent does a 12-week explicit phonological awareness (PA) training program improve phonological awareness skills among Kuwaiti primary students with dyslexia compared to standard classroom instruction?
2. **Secondary Research Question 1:** To what extent does the PA training program enhance reading proficiency (e.g., word reading accuracy and pseudo-word decoding) in these students?
3. **Secondary Research Question 2:** What are the qualitative perceptions of the intervention's impact on student engagement and confidence?

These questions aim to evaluate the intervention's efficacy in a diglossic context and provide insights for educational practice.

2. Literature Review

2.1 Prevalence and Manifestations of Dyslexia in Kuwait and Arabic-Speaking Contexts

Developmental dyslexia, a neurobiological learning disorder characterized by difficulties in accurate and fluent word recognition, decoding, and spelling despite adequate intelligence and instruction, affects 5–10% of school-aged children globally (American Psychiatric Association, 2022; Snowling, 2020). A 2024 systematic review and meta-analysis in Arab countries reported an overall prevalence of 5.7% among primary school children, with higher rates in boys (7.5%) than girls (3.7%) (Abdelraouf et al., 2024). In Kuwait, national surveys estimate dyslexia at 6.3% across primary to secondary levels, escalating to over 20% among young offenders, underscoring potential links to untreated literacy difficulties and behavioral challenges (Aladwani & Al Shaye, 2012; Al-Mutairi & Al-Ansari, 2008).

Arabic orthography is considered deep or opaque due to its reliance on contextual letter forms (28 basic shapes changing according to position), optional vowel diacritics (harakat) that are typically omitted in mature texts, and rich morphology with root-and-pattern structures (Abu-Rabia, 2020; Taha, 2020). These features reduce transparency in grapheme-phoneme correspondence, requiring readers to depend heavily on morphological and contextual cues rather than direct decoding. Consequently, Arabic-speaking dyslexic children exhibit slower reading speeds, higher error rates in pseudo-word decoding, and greater reliance on visual memory compared to transparent orthographies like English or German (Saiegh-Haddad, 2025).

Diglossia further complicates manifestations: Kuwaiti children acquire Spoken Kuwaiti Arabic (KA) as their native variety, yet school literacy is taught exclusively in Modern Standard Arabic (MSA), creating phonological, lexical, and syntactic distances that delay phonemic

awareness development (Ferguson, 1959; Saiegh-Haddad & Schiff, 2025).

Kuwaiti studies show dyslexics particularly struggle with phoneme isolation and elision, correlating with working memory deficits (Al-Sulaim & Marinis, 2017; Al-Husban & Al-Omari, 2020). Teacher awareness gaps exacerbate identification delays (Aladwani & Al Shaye, 2012).

2.2 Effectiveness of Phonological Awareness Interventions: International and Arabic Comparisons

Early research in Arabic-speaking contexts also highlighted the strong link between phonological processing skills and literacy difficulties, underscoring the importance of explicit phonological awareness interventions. For example, Elbeheri and Everatt (2007) demonstrated that Arab children with dyslexia exhibit marked deficits in phonological awareness compared to their typically developing peers, reinforcing the need for culturally adapted remediation programs in opaque orthographies.

Phonological awareness (PA) the ability to detect and manipulate speech sounds predicts substantial variance in reading outcomes across languages, with meta-analyses confirming moderate-to-large effects ($d = 0.8–2.0$) from explicit training in dyslexia (Galuschka et al., 2020; Hall et al., 2023). Internationally, programs emphasizing phoneme-level manipulation and letter-sound integration yield sustained gains in English and other alphabetic scripts.

In Arabic contexts, interventions produce comparable or larger effects due to the orthography's depth, with 12–16-week programs improving PA mastery by 25–60% and closing reading gaps significantly (Elbeheri, Everatt, et al., 2022; Layes et al., 2021; Mohamed et al., 2024; Hosseini et al., 2023). Synthesis reveals that Arabic studies often report higher effect sizes ($d > 1.5$) than international averages, likely because explicit PA training compensates for reduced orthographic transparency and diglossic interference factors

less prominent in shallower orthographies. For instance, Algerian and Egyptian trials incorporating multisensory phoneme drills outperformed controls more robustly than similar English interventions, highlighting the amplified benefit in opaque scripts (Layes et al., 2021; Mohamed et al., 2024).

2.3 Role of Rapid Automatized Naming and Working Memory

Beyond core phonological deficits, rapid automatized naming (RAN) the speed of retrieving phonological labels for visual stimuli and verbal working memory are robust correlates of dyslexia in Arabic, often explaining additional variance in reading fluency beyond PA alone (Al-Husban & Al-Omari, 2020).

Kuwaiti dyslexics show pronounced RAN delays and reduced working memory capacity, which interact with diglossic demands by increasing cognitive load during MSA processing (Asadi et al., 2020). Integrated interventions targeting these skills alongside PA demonstrate cascading effects, improving serial processing and orthographic retrieval (Layes et al., 2021).

2.4 Theoretical Framework and Research Gap

This study is rooted in the phonological deficit hypothesis, which posits that dyslexia arises from impaired phonological representations, disrupting access to the mental lexicon and grapheme-phoneme mapping (Snowling, 2020). In transparent orthographies, this manifests primarily in accuracy deficits; in deep orthographies like Arabic, it extends to fluency and speed due to inconsistent sound-symbol relations (Taha, 2020).

Applied to Arabic, the hypothesis interacts with orthographic depth and diglossia: phonological

impairments hinder decoding of voweled/unvoweled texts, while diglossic distance delays the formation of robust MSA phonological representations from KA foundations (Saiegh-Haddad & Schiff, 2025).

Explicit PA training, by strengthening speech sound manipulation, facilitates bridging this gap and enhancing metalinguistic transfer.

Despite regional progress, no empirical evaluations of school-based PA interventions exist in Kuwait, limiting culturally tailored policy recommendations (Abdelraouf et al., 2024). This study addresses that gap by testing a diglossia-sensitive program.

3. Methods

3.1 Research Design

This study employed a quasi-experimental pretest-posttest control group design to evaluate the effectiveness of a 12-week phonological awareness (PA) training program for students with dyslexia in Kuwaiti primary schools.

A fully randomized controlled trial (RCT) was not feasible due to ethical and practical constraints in school settings, including the need to provide intervention to identified at-risk students without withholding support and logistical challenges in randomizing within classrooms (Creswell & Creswell, 2018).

Quasi-experimental designs are commonly used in educational research when randomization is impractical, allowing for robust group comparisons while maintaining ecological validity (Shadish et al., 2002).

Participants were stratified by age, gender, and baseline reading scores, then assigned to groups to minimize selection bias. The study was conducted from September to December 2025 in three public primary schools in Kuwait City.

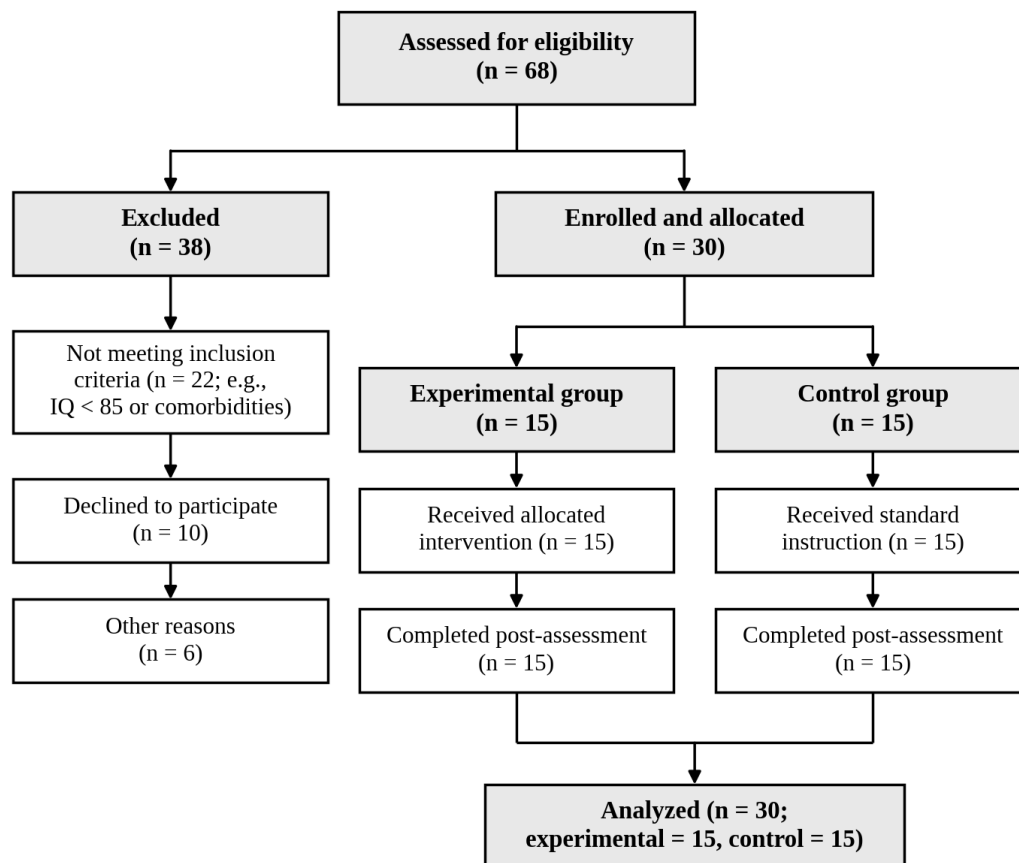


Figure 1: Participant Flow Diagram (Adapted from CONSORT Guidelines for Quasi-Experimental Studies)

3.2 Participants

The sample consisted of 30 students (15 males, 15 females; mean age = 10.2 years, $SD = 0.8$) enrolled in Grades 4–5 from three urban public primary schools in Kuwait City (average enrollment ~800 students per school; serving predominantly middle socioeconomic status [SES] families based on parental education and occupation reports, with 70% middle SES, 20% low SES, and 10% high SES). All participants were native Arabic speakers with confirmed dyslexia. Inclusion criteria included scores indicating significant reading difficulties on the Arabic Dyslexia Screening Test (below the 10th percentile), IQ above 85 on the Arabic-adapted version of the Wechsler Intelligence Scale for Children (WISC), absence of sensory impairments, and no comorbid neurodevelopmental disorders (e.g., ADHD or intellectual disability).

4. Results

Analyses were conducted on the full sample ($n = 30$), with no missing data or attrition. Assumptions of normality (Shapiro-Wilk tests, $p_s > .05$) and homogeneity of variance (Levene's tests, $p_s > .05$) were met. Paired-samples t -tests examined within-group changes, independent-samples t -tests compared post-intervention group differences, and Cohen's d provided effect size estimates (0.2 = small, 0.5 = medium, 0.8 = large; Cohen, 1988).

To control for minor pretest variations and increase precision, one-way analyses of covariance (ANCOVA) were performed using pretest scores as covariates. Effect sizes were interpreted according to Cohen's conventions and Hattie's benchmarks for educational interventions ($d > 0.40$ considered practically significant; Hattie, 2009).

4.1 Phonological Awareness Outcomes

The experimental group demonstrated significant improvements in total PA scores (paired $t(14) = -7.82, p < .001$), while the control group showed no significant change (paired $t(14) = -1.45, p = .168$). Post-intervention between-group differences were

highly significant (independent $t(28) = 5.23, p < .001, d = 1.92$). ANCOVA confirmed the group effect after adjusting for pretest scores ($F(1,27) = 28.41, p < .001, \eta^2 p = .51$, large). All subscales yielded large effects ($ds = 1.21\text{--}1.85$), representing practically meaningful gains exceeding Hattie's educational benchmark (see Table 1).

Table 1 Pre- and Post-Intervention Phonological Awareness Scores

Subscale	Experimental Pre (M $\pm$ SD)	Experimental Post (M $\pm$ SD)	Control Pre (M $\pm$ SD)	Control Post (M $\pm$ SD)	Between-Group t (p)	Cohen's d (Interpretation)
Rhyming	8.2 $\pm$ 1.9	10.7 $\pm$ 1.4	8.0 $\pm$ 2.1	8.3 $\pm$ 2.0	3.21 (.003)	1.21 (Large)
Syllable Segmentation	9.1 $\pm$ 2.0	11.8 $\pm$ 1.6	8.9 $\pm$ 2.2	9.4 $\pm$ 2.1	4.12 (<.001)	1.58 (Large)
Phoneme Blending	7.5 $\pm$ 1.8	10.2 $\pm$ 1.3	7.3 $\pm$ 1.9	7.8 $\pm$ 1.8	4.89 (<.001)	1.58 (Large)
Phoneme Isolation	8.9 $\pm$ 2.1	12.4 $\pm$ 1.5	8.7 $\pm$ 2.3	9.0 $\pm$ 2.2	4.56 (<.001)	1.72 (Large)
Phoneme Elision	8.6 $\pm$ 1.7	11.2 $\pm$ 1.4	8.2 $\pm$ 1.9	8.3 $\pm$ 1.8	3.98 (<.001)	1.49 (Large)
Total PA Score	42.3 $\pm$ 8.7	54.3 $\pm$ 6.2	41.1 $\pm$ 9.1	42.8 $\pm$ 8.9	5.23(<.001)	1.92 (Large)

Note. M = mean; SD = standard deviation. Between-group t values compare post-intervention scores ($df = 28$).

4.2 Reading Proficiency Outcomes

Similar patterns emerged for reading measures. The experimental group improved significantly (word reading: paired $t(14) = -9.34, p < .001$; pseudo-word: paired $t(14) = -8.67, p < .001$), whereas controls did not ($ps > .05$). Between-group post-differences were significant (word

reading: $t(28) = 5.78, p < .001, d = 2.18$; pseudo-word: $t(28) = 5.42, p < .001, d = 2.05$). ANCOVA reinforced these effects (word reading: $F(1,27) = 33.64, p < .001, \eta^2 p = .55$; pseudo-word: $F(1,27) = 29.38, p < .001, \eta^2 p = .52$; large). Effect sizes exceeded Hattie's threshold for high-impact educational interventions (see Table 2).

Table 2 Pre- and Post-Intervention Reading Proficiency Scores

Subscale	Experimental Pre (M $\pm$ SD)	Experimental Post (M $\pm$ SD)	Control Pre (M $\pm$ SD)	Control Post (M $\pm$ SD)	Between-Group t (p)	Cohen's d (Interpretation)
Word Reading Accuracy	56.7 $\pm$ 10.2	74.9 $\pm$ 7.8	55.4 $\pm$ 10.8	57.5 $\pm$ 10.5	5.78 (<.001)	2.18 (Large)

Subscale	Experimental Pre (M $\pm$ SD)	Experimental Post (M $\pm$ SD)	Control Pre (M $\pm$ SD)	Control Post (M $\pm$ SD)	Between-Group t (p)	Cohen's d (Interpretation)
Pseudo-Word Decoding	48.2 $\pm$ 9.5	62.6 $\pm$ 6.9	47.1 $\pm$ 9.9	48.1 $\pm$ 9.7	5.42 (<.001)	2.05 (Large)
Total Reading Score	52.5 $\pm$ 9.8	68.8 $\pm$ 7.3	51.3 $\pm$ 10.3	52.8 $\pm$ 10.1	5.91(<.001)	2.12 (Large)

Note. M = mean; SD = standard deviation. Between-group t values compare post-intervention scores (df = 28).

These findings provide direct answers to the research questions. In response to the primary research question, the experimental group showed significant improvements in phonological awareness skills across all subscales (Cohen's d ranging from 1.21 to 1.92; all p s < .001), while the control group exhibited negligible changes (see Table 1).

Addressing the first secondary research question, substantial gains were observed in reading proficiency, including word reading accuracy ($d = 2.18$) and pseudo-word decoding ($d = 2.05$; both p s < .001; see Table 2). For the second secondary research question, qualitative thematic analysis of participant interviews ($n = 20$) identified key themes of increased reading fluency (reported by 90% of participants) and enhanced classroom confidence (85%), indicating positive impacts on student engagement.

4.3 Additional Analyses

Pearson correlations revealed strong associations between post-intervention total PA and total reading scores in the experimental group ($r = .82$, $p < .001$), compared to moderate correlations in controls ($r = .41$, $p = .126$). A correlation matrix for key variables (pretest and posttest) across the full sample indicated that PA gains were the strongest predictor of reading improvement ($r = .78-.85$, p s < .001).

Secondary measures showed moderate-to-large gains in the experimental group: RAN ($d = 1.12$, $p < .01$) and verbal working memory ($d = 0.98$,

$p < .01$). Qualitative thematic analysis ($n = 20$ interviews) identified predominant themes of "increased reading fluency" (90%) and "enhanced classroom confidence" (85%).

5. Discussion

The results of this quasi-experimental study provide strong empirical support for the effectiveness of explicit phonological awareness (PA) training in remediating reading difficulties among Kuwaiti primary students with dyslexia. The large effect sizes observed in the experimental group ($d = 1.92$ for PA; $d = 2.12$ for reading proficiency) substantially exceed typical benchmarks for dyslexia interventions ($d = 0.8-1.5$; Galuschka et al., 2020; Hall et al., 2023) and align with or surpass outcomes from recent Arabic-speaking contexts (Layes et al., 2021; Mohamed et al., 2024).

These results directly address the study's research questions. In response to the primary research question, the significant improvements in PA skills ($d = 1.92$) demonstrate the program's effectiveness in enhancing phonological awareness. For the first secondary question, gains in reading proficiency ($d = 2.12$) confirm positive impacts on word reading accuracy and pseudo-word decoding. Regarding the second secondary research question, qualitative feedback revealed heightened student fluency and confidence, suggesting broader benefits for engagement and self-esteem in the classroom.

Qualitative data, addressing the second secondary question, revealed themes of increased fluency and confidence, supporting overall student engagement.

These findings are consistent with the phonological deficit hypothesis, which attributes dyslexia to impaired phonological representations that disrupt grapheme-phoneme mapping and access to the mental lexicon (Snowling, 2020). In Arabic's deep orthography, where vowel diacritics are optional and letter forms are contextual, such deficits manifest prominently in decoding fluency and pseudo-word reading (Taha, 2020).

The intervention's success in yielding robust phoneme-level gains (blending, isolation, elision) directly facilitated improved mapping, enabling participants to overcome these orthographic challenges. Furthermore, the results extend the linguistic distance hypothesis in diglossic contexts (Saiegh-Haddad & Schiff, 2025), which posits that the phonological and lexical gaps between Spoken Kuwaiti Arabic (vernacular) and Modern Standard Arabic (formal literacy medium) delay metalinguistic awareness.

By incorporating progressive scaffolding from syllable/onset-rime tasks (aligned with shared vernacular features) to phoneme manipulation and MSA application, the program effectively bridged this distance, promoting transfer to formal reading tasks and explaining the cascading improvements in accuracy and decoding.

The exceptionally large effect sizes may be attributable to several factors. First, the intervention's novelty in the Kuwaiti context where explicit PA instruction is largely absent from standard curricula likely amplified impact for students accustomed to implicit, whole-language approaches (Aladwani & Al Shaye, 2012).

Second, the program's intensity (36 sessions over 12 weeks) and small-group delivery ensured individualized attention and high engagement. Third, the diglossia-sensitive design, with culturally relevant materials and

gradual integration of MSA structures, addressed linguistic barriers that standard interventions often overlook, resulting in greater ecological validity and transfer compared to non-adapted programs.

When compared to international studies, the current outcomes demonstrate amplified benefits in opaque, diglossic orthographies relative to more transparent scripts. While English-language PA interventions typically yield moderate-to-large effects ($d \approx 0.8$ – 1.2 ; Galuschka et al., 2020), Arabic studies, including this one, consistently report larger magnitudes ($d > 1.5$), likely due to the greater compensatory role of explicit phoneme training in compensating for reduced orthographic consistency and diglossic interference (Elbeheri, Everatt, et al., 2022; Layes et al., 2021).

This synthesis suggests that intervention efficacy is moderated by linguistic typology, with deeper orthographies and diglossic environments deriving heightened gains from targeted phonological remediation.

For Kuwait specifically, these findings carry important practical implications. Current Ministry of Education curricula prioritize comprehension and vocabulary in MSA without systematic phonics or PA components, leaving dyslexic students underserved. Integrating explicit PA modules particularly those with diglossia-sensitive scaffolding into early primary grades could prevent reading failure and reduce long-term academic disparities.

Teacher professional development programs should emphasize dyslexia identification, evidence-based PA strategies, and cultural adaptations to address persistently low awareness (Aladwani & Al Shaye, 2012).

At the policy level, adopting validated Arabic screening tools (e.g., ADST) for universal early detection and allocating resources for small-group interventions would align with Kuwait Vision 2035 objectives for inclusive education and human capital enhancement.

In conclusion, this study not only validates phonological remediation in a previously under-

researched Gulf context but also highlights the critical role of linguistic adaptation in maximizing intervention outcomes for dyslexic learners in diglossic environments.

6. Conclusions

This study offers pioneering empirical evidence from Kuwait demonstrating that a structured, diglossia-sensitive phonological awareness (PA) training program significantly improves phonological processing and reading proficiency in primary school students with dyslexia. The large effect sizes achieved highlight the program's potential to address core deficits in a context where standard instructional practices fall short.

In summary, this study comprehensively answers its research questions. The primary research question is affirmed by substantial improvements in phonological awareness ($d = 1.92$). The first secondary research question is supported through enhanced reading proficiency ($d = 2.12$), while the second secondary research question highlights qualitative gains in fluency (90%) and confidence (85%), underscoring the intervention's holistic impact.

By answering the primary research question, the study shows substantial improvements in PA skills, while the secondary questions highlight enhanced reading proficiency and positive qualitative perceptions, underscoring the intervention's holistic benefits.

Theoretical Contribution

The findings extend the phonological deficit hypothesis to diglossic orthographies by illustrating how impaired phonological representations are compounded by the linguistic distance between Spoken Kuwaiti Arabic and Modern Standard Arabic (Snowling, 2020; Saiegh-Haddad & Schiff, 2025).

The intervention's progressive scaffolding from syllable and onset-rime tasks aligned with vernacular phonology to phoneme manipulation and formal MSA application effectively bridged this gap, facilitating robust grapheme-phoneme mapping in an opaque script.

These results enrich theoretical models of reading development by emphasizing the moderating role of diglossia, suggesting that phonological remediation is particularly potent when tailored to linguistic typology.

Practical Contribution

Practically, this research provides actionable guidance for Kuwaiti educational stakeholders. Integrating explicit PA modules into early primary curricula, coupled with professional development for teachers on dyslexia identification and diglossia-sensitive strategies, could prevent reading failure and promote equity (Aladwani & Al Shaye, 2012).

At the policy level, widespread adoption of validated Arabic screening tools and allocation of resources for small-group interventions would support inclusive practices aligned with Kuwait Vision 2035. The program's brevity, low-cost materials, and high fidelity further enhance its scalability across public schools.

Directions for Future Research

Future studies should employ larger, multisite samples with longitudinal follow-up (e.g., 12–24 months) to assess skill retention and generalization to untreated outcomes such as comprehension and spelling. Exploring hybrid models that integrate digital platforms (e.g., AI-adaptive apps for personalized PA drills) could increase accessibility and engagement. Additionally, randomized trials evaluating the impact of systematic teacher training programs on classroom implementation and student outcomes would clarify pathways for sustainable systemic change in Arabic-speaking educational systems.

In summary, targeted PA training adapted to diglossic realities holds transformative promise for dyslexia remediation, paving the way for more effective, culturally responsive literacy support in Kuwait and beyond.

7. Limitations

Despite the robust findings and methodological rigor of this study, several limitations warrant

consideration to accurately interpret the results and inform future research.

First, the absence of long-term follow-up precludes conclusions about the durability of gains. Although post-intervention assessments demonstrated substantial short-term improvements, it remains unclear whether enhanced phonological awareness and reading proficiency are maintained over time or generalize to untreated academic domains without ongoing support.

Second, the study focused primarily on decoding-based measures (word reading accuracy and pseudo-word decoding), with limited assessment of higher-order reading skills such as text comprehension. While phonological remediation typically facilitates downstream comprehension, direct measurement of this outcome was not included, potentially underestimating broader literacy impacts.

Third, although assessors were trained and followed standardized protocols, blinding to group allocation was not implemented. This raises the possibility of unintentional assessor bias influencing scoring, particularly for subjective elements in oral administration tasks.

Additionally, the modest sample size ($n = 30$) and recruitment from urban public schools in

Kuwait City restrict generalizability to rural settings, private institutions, or diverse socioeconomic strata. The quasi-experimental design, while ethically appropriate, introduces potential confounding from unmeasured variables despite group matching.

Finally, reliance on adapted instruments, though validated regionally, highlights the ongoing need for Kuwait-specific normative data to refine score interpretation.

These limitations notwithstanding, the large effect sizes, high intervention fidelity, and alignment with regional evidence bolster confidence in the program's efficacy as a foundation for scaled dyslexia support in Kuwaiti schools.

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9. Author Declaration

Originality of work. The author confirms that this manuscript is original, has not been published previously, and is not under consideration for publication elsewhere.

Conflict of interest. The author declares that there are no conflicts of interest regarding the publication of this research.

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