Journal Website

Article history:
Received 05 May 2026
Revised 15 October 2026
Accepted 22 October 2026
Initial Publication 22 October 2026
Final Publication 01 January 2027

International Journal of Education and Cognitive Sciences

Volume 8, Issue 1, pp 1-16

E-ISSN: 3041-8828

Comparing the Effectiveness of Three Learning Methods—Vocabulary Learning, a Text-Reader Program, and a Combined Method—in Remediating Reading Disorders Among 9–11-Year-Old Children in Iran

Javad. Tajar[1*]

[1] Department of Psychology, Sah.C., Islamic Azad University, Sahneh, Iran

*** Corresponding author email address**: Javad.122@iau.ac.ir

A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Tajar, J. (2027). Comparing the Effectiveness of Three Learning Methods—Vocabulary Learning, a Text-Reader Program, and a Combined Method—in Remediating Reading Disorders Among 9–11-Year-Old Children in Iran. *International Journal of Education and Cognitive Sciences*, *8*(1), 1-16.
https://doi.org/10.61838/kman.ijecs.512

© 2027 the authors. Published by Iranian Association for Intelligence and Talent Studies, Tehran, Iran. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License.

A B S T R A C T

Purpose: This study aimed to compare the effectiveness of vocabulary learning, a text-reader program, and a combined vocabulary learning–text-reader method in improving reading performance among Iranian children aged 9–11 years with reading disorders.

Methods and Materials: A quasi-experimental pretest–posttest design with three parallel intervention groups was employed. The participants were 30 children aged 9–11 years with reading disorders recruited from primary schools and learning-disability centers in Tehran, Iran, and assigned to vocabulary-learning, text-reader, and combined-method groups, with 10 participants in each group. Reading performance was assessed before and after the intervention in terms of overall reading performance, word-reading accuracy, nonword decoding, reading fluency, and reading comprehension. Each group participated in 12 sessions of approximately 60 minutes, conducted three times weekly for four weeks. The vocabulary-learning intervention emphasized explicit lexical and semantic instruction; the text-reader intervention employed synchronized visual and auditory reading practice; and the combined intervention integrated both approaches. Data were analyzed using analysis of covariance and multivariate analysis of covariance with pretest scores entered as covariates.

Findings: ANCOVA showed a significant effect of intervention condition on overall posttest reading performance after controlling for baseline scores, $F(2, 26) = 34.37$, $p < .001$, partial $\eta^2 = .726$. The combined method significantly outperformed vocabulary learning and the text-reader program, while the text-reader program was also significantly superior to vocabulary learning. MANCOVA indicated a significant overall intervention effect on the combined reading outcomes, Wilks' $\Lambda = .214$, $F(8, 44) = 6.77$, $p < .001$, partial $\eta^2 = .552$. Significant group effects were found for word-reading accuracy, $F(2, 25) = 12.84$, $p < .001$, nonword decoding, $F(2, 25) = 16.31$, $p < .001$, reading fluency, $F(2, 25) = 21.76$, $p < .001$, and reading comprehension, $F(2, 25) = 7.62$, $p = .003$.

Conclusion: The combined vocabulary learning–text-reader method was the most effective intervention, suggesting that integrating lexical-semantic instruction with synchronized visual–auditory reading practice may provide a more comprehensive approach to remediating reading disorders in children.

Keywords: *Reading disorder; Vocabulary learning; Text-reader program; Reading fluency; Reading comprehension; Learning disabilities; Children*

1. Introduction

Reading is a foundational academic skill that supports learning across nearly every area of formal education and provides children with access to increasingly complex linguistic, conceptual, and disciplinary knowledge. Successful reading requires the coordinated operation of multiple processes, including accurate recognition of written words, phonological decoding, vocabulary knowledge, syntactic processing, reading fluency, comprehension, working memory, attention, and higher-order cognitive regulation. When one or more of these processes develop inadequately, children may experience persistent difficulties in identifying words, decoding unfamiliar items, reading accurately and fluently, or constructing meaning from written text. Such difficulties can have consequences that extend beyond literacy itself because reading is the principal medium through which much of school learning occurs. Contemporary research on learning disabilities increasingly emphasizes that reading problems should not be understood as a single isolated deficit, but rather as the product of interactions among linguistic, cognitive, attentional, and executive processes that develop over time (Horowitz-Kraus et al., 2026). Systematic reviews of students with disabilities similarly indicate considerable heterogeneity in cognitive, reading, mathematical, and attentional performance, highlighting the need for interventions that address the specific components underlying academic difficulties rather than assuming that all children with learning disabilities exhibit identical profiles (Stewart et al., 2025). This perspective is particularly important during the primary-school years, when weaknesses in basic reading processes can become increasingly consequential as educational tasks shift from learning to read toward reading to learn.

The ages of 9 to 11 years represent an especially important developmental period for the consolidation of reading ability. By this stage, children are generally expected to have acquired the fundamental mechanisms of word recognition and decoding and to use these skills with sufficient automaticity to support comprehension of increasingly complex texts. Persistent reading difficulties during this period may therefore interfere with both the speed and accuracy of reading as well as the child's ability to allocate cognitive resources to understanding and integrating textual information. Research concerning children with learning disabilities has shown that reading performance can remain responsive to appropriately structured educational and psychosocial interventions even beyond the earliest stages of literacy acquisition, suggesting that middle-childhood remediation remains both relevant and potentially effective (Xu, 2025). Developmental evidence also suggests that language abilities emerging early in life are associated with later reading and cognitive outcomes, reinforcing the view that vocabulary and broader linguistic competence form part of the developmental architecture upon which later literacy is constructed (Verhoef et al., 2020). Consequently, remediation programs for children with reading disorders should address not only observable reading errors but also the linguistic mechanisms that facilitate efficient recognition and interpretation of written language.

Among these mechanisms, vocabulary knowledge occupies a central position. Reading comprehension depends partly on the reader's capacity to rapidly access the meanings of words encountered in a text. When a large proportion of words are unfamiliar, substantial cognitive effort must be devoted to word identification and meaning construction, reducing the resources available for integrating ideas across sentences and developing a coherent representation of the text. Vocabulary is not a unitary construct; it includes breadth, referring broadly to the number of words known, and depth, referring to the richness and quality of knowledge concerning individual words, including semantic relationships, multiple meanings, collocations, and contextual use. Evidence indicates that both breadth and depth of vocabulary contribute meaningfully to reading comprehension (Dagnaw, 2023). A longitudinal perspective further suggests that vocabulary and reading comprehension may influence one another reciprocally, such that stronger vocabulary facilitates understanding of text while successful reading creates additional opportunities for vocabulary growth (Wang & Zhang, 2025). Therefore, limited vocabulary may contribute to a self-reinforcing cycle in which inadequate lexical knowledge makes reading more difficult, and reduced or inefficient reading subsequently restricts opportunities for learning new words.

The relationship between vocabulary and comprehension has been documented across languages and educational contexts. Cross-linguistic evidence supports the role of vocabulary knowledge as an important foundation for reading comprehension (Sidek & Rahim, 2015), while studies of learners with different levels of language proficiency consistently indicate that stronger vocabulary knowledge is associated with more successful understanding of written texts (Al-Khasawneh, 2019; Al Qunayeer, 2021). Similar associations have been reported among school-aged

E-ISSN: 3041-8828

learners, where vocabulary knowledge is significantly related to reading comprehension ability (Rahmasari et al., 2023). Importantly, the contribution of vocabulary is not restricted to the sheer number of words a reader recognizes. Research examining components of vocabulary knowledge suggests that qualitative aspects of lexical representation can influence early reading comprehension and that different dimensions of vocabulary may make distinct contributions to text understanding (Röthlisberger et al., 2023). Vocabulary fluency, or the efficiency with which lexical knowledge can be accessed during reading, may additionally alter the strength of the relationship between vocabulary knowledge and reading proficiency (Tong et al., 2023). These observations are highly relevant to children with reading disorders because a child may possess partial knowledge of a word but still be unable to retrieve its pronunciation or meaning rapidly enough to support fluent reading.

The concept of a lexical threshold provides another explanation for why vocabulary development is closely associated with successful reading. Readers generally require knowledge of a sufficiently large proportion of the words within a text before contextual interpretation and comprehension can proceed efficiently. Research on lexical coverage has shown that vocabulary size and the proportion of known words in a text are closely related to comprehension performance (Laufer, 2016). Individual differences in vocabulary size can be substantial, and children or learners with smaller vocabularies may therefore encounter unfamiliar words with much greater frequency than their peers (Duff & Brydon, 2020). From an instructional perspective, these differences suggest that direct vocabulary development may be particularly valuable for learners whose reading problems are accompanied by limited lexical knowledge. Classical and contemporary discussions of vocabulary instruction have emphasized that effective word learning extends beyond memorizing definitions and requires repeated encounters, meaningful contexts, active processing, semantic connections, and opportunities to use new words (Blachowicz, 2008). Research-based recommendations similarly indicate that explicit and systematic vocabulary teaching can contribute to broader text comprehension when instructional activities encourage meaningful and repeated engagement with target words (Willingham & Price, 2009; Wright & Cervetti, 2017).

The distinction between explicit and incidental vocabulary learning is also relevant to the design of reading interventions. Children naturally acquire some vocabulary through exposure to spoken and written language, yet incidental exposure may be insufficient for learners who struggle to decode text or maintain attention to unfamiliar words. Explicit instruction can direct attention toward orthographic form, pronunciation, meaning, and contextual application, thereby creating stronger lexical representations. Research comparing explicit and implicit vocabulary instruction through reading has shown that purposeful instructional attention can facilitate vocabulary development (Khamesipour, 2015). Similarly, techniques designed to increase the salience of lexical information within reading input can support both vocabulary-related learning and reading fluency (Fatahzadeh et al., 2022). Research on glossing also demonstrates that additional support attached to unfamiliar words encountered during reading can enhance vocabulary acquisition, although outcomes vary according to the form and characteristics of the support provided (Yanagisawa et al., 2020). Pre-reading activities that focus learners' attention on important vocabulary may also influence subsequent comprehension by reducing lexical barriers before readers engage with the main text (ÇİFtcİ & Kömür, 2023). Together, these findings provide a strong theoretical rationale for incorporating structured vocabulary instruction into interventions targeting reading performance.

Vocabulary learning may be particularly effective when instruction is scaffolded and differentiated according to learner needs. Scaffolded instructional strategies can improve both receptive vocabulary and inferential reading comprehension by providing graduated support while learners process lexical and textual information (Hasani et al., 2024). Other instructional approaches have similarly attempted to broaden the channels through which new vocabulary is presented and practiced. For example, instruction based on multiple modes of engagement has been associated with improved vocabulary acquisition during reading activities (Miolo et al., 2023), while contextualized vocabulary programs have emphasized that word learning should extend beyond isolated vocabulary lists toward meaningful use within connected language (Harji & Balakrishnan, 2019). Story-based research with children also demonstrates that the manner in which verbal material is presented can influence word learning, story comprehension, and task engagement; greater narrator engagement, for example, has been associated with stronger learning and comprehension outcomes (Lenhart et al., 2020). These findings collectively suggest that vocabulary

E-ISSN: 3041-8828

instruction is most likely to influence reading when it is active, contextualized, repeated, and integrated with meaningful text.

Despite the importance of vocabulary, reading disorders involve more than lexical limitations. Many children with persistent reading difficulties struggle with the accurate and automatic mapping of orthographic forms onto phonological representations. As a result, oral reading can be slow, hesitant, effortful, and characterized by substitutions, omissions, repetitions, or mispronunciations. Reduced automaticity creates a bottleneck because cognitive resources remain concentrated on recognizing individual words rather than constructing meaning across sentences. This provides the rationale for repeated reading and technology-assisted text presentation. A text-reader program can provide an auditory model while simultaneously displaying written material, allowing learners to connect visual word forms with accurate pronunciation and to repeatedly practice the same textual material. Such an approach potentially reduces ambiguity during decoding, provides immediate access to a correct spoken model, and supports multisensory integration between orthographic and phonological information. For children who have repeatedly experienced unsuccessful independent reading, computerized support may additionally allow practice to occur in a structured and predictable environment with the possibility of repetition at the learner's own pace.

Technology-supported instruction has increasingly been incorporated into language and reading education because digital environments can combine visual presentation, auditory modeling, repetition, highlighting, feedback, and learner-controlled pacing within a single intervention. Evidence from computer-assisted language learning indicates that appropriately structured technology-based instruction can improve both vocabulary learning and reading comprehension when digital tools are integrated with theoretically grounded educational strategies (Abdolmaleki & Saeedi, 2024). The relevance of this evidence extends beyond second-language learning because the underlying instructional mechanisms—multimodal presentation, repeated exposure, immediate feedback, and integration of lexical and textual information—are also pertinent to remedial reading. Technology does not necessarily improve reading merely by replacing printed text with a screen; rather, its potential value depends on how digital features are used to support processes known to be difficult for the learner. Thus, a text-reader program may be most useful when auditory output, visual tracking, repetition, and progressively more independent reading are organized systematically rather than provided as passive exposure.

An important issue is whether interventions that target a single component of reading can generate improvements as broad as interventions that integrate complementary mechanisms. Vocabulary instruction primarily strengthens lexical-semantic knowledge and may facilitate word recognition and comprehension, whereas text-reader practice can directly support pronunciation, decoding, visual–auditory integration, and fluency. These mechanisms are conceptually distinct but functionally interconnected during actual reading. A child who learns the meaning and orthographic characteristics of a word may recognize it more efficiently during subsequent reading; conversely, repeated exposure to the written and spoken form of a word within connected text may reinforce its lexical representation. This reciprocal relationship suggests that combining vocabulary instruction with text-reader-assisted practice could produce stronger effects than either method alone. Evidence that vocabulary depth, breadth, accessibility, and reading comprehension are dynamically interconnected supports the plausibility of such an integrated intervention (Tong et al., 2023; Wang & Zhang, 2025). Likewise, research demonstrating that vocabulary-focused instructional support can influence both lexical learning and comprehension suggests that semantic instruction should not be separated unnecessarily from meaningful reading practice (Wright & Cervetti, 2017).

This issue has particular relevance in Iran, where research on reading and language learning has demonstrated the importance of vocabulary for comprehension. Among Iranian learners, vocabulary and syntactic knowledge have been identified as important predictors within causal models of reading comprehension (Shirazizadeh, 2020). Although much of the available literature in Iran and internationally has examined foreign-language learners rather than children with diagnosed reading disorders, the results identify instructional mechanisms that warrant investigation in remedial literacy contexts. Specifically, lexical knowledge, repeated exposure, multimodal input, fluency practice, and scaffolded comprehension support may be adapted to the cognitive and educational needs of Persian-speaking children who experience persistent difficulty in reading. The need for such adaptation is important because interventions developed for normally progressing readers or second-language learners cannot simply be assumed to have the same magnitude or pattern of effects in children with reading

E-ISSN: 3041-8828

disorders. Direct comparative evidence is therefore needed to determine which instructional components produce the greatest benefit in this population.

A further limitation of the existing literature is that many studies have investigated vocabulary, reading comprehension, reading fluency, or technology-supported learning separately. Consequently, relatively limited evidence is available regarding the comparative effectiveness of an explicitly vocabulary-centered method, a text-reader-assisted method, and a combined intervention delivered under equivalent instructional conditions. Direct comparison is methodologically valuable because improvement within a single intervention group does not establish whether that intervention is more effective than an alternative approach. Moreover, examining specific reading domains may reveal different response patterns that are obscured when only a total reading score is considered. Vocabulary instruction might exert particularly strong effects on word recognition and comprehension, whereas auditory-supported repeated reading may be more closely associated with decoding and fluency. A combined intervention may potentially produce gains across several domains by simultaneously addressing semantic, orthographic, phonological, and fluency-related processes. Determining whether this theoretical advantage is reflected in measurable performance is important for designing efficient remedial programs.

The broader literature therefore supports a multifactorial view of reading intervention. Reading achievement is shaped by foundational language knowledge, the accessibility of lexical representations, repeated engagement with connected text, cognitive regulation, and the quality of instructional support. Research on vocabulary size and comprehension demonstrates that insufficient lexical resources can constrain text processing (Duff & Brydon, 2020; Laufer, 2016); studies of vocabulary depth and breadth indicate that both quantitative and qualitative lexical knowledge matter (Dagnaw, 2023); experimental and instructional research supports explicit, contextualized, and scaffolded vocabulary teaching (Hasani et al., 2024; Khamesipour, 2015); and technology-supported learning provides opportunities to combine auditory and visual input in a controlled instructional environment (Abdolmaleki & Saeedi, 2024). At the same time, developmental and learning-disability research emphasizes substantial variation among children and the need for interventions responsive to the multiple cognitive and academic processes involved in reading difficulty (Horowitz-Kraus et al., 2026; Stewart et al., 2025). These converging lines of evidence justify comparative investigation of interventions that differ in the mechanisms they directly target.

Accordingly, the aim of the present study was to investigate and compare the effectiveness of vocabulary learning, a text-reader program, and a combined vocabulary learning–text-reader method in improving overall reading performance, word-reading accuracy, nonword decoding, reading fluency, and reading comprehension among Iranian children aged 9–11 years with reading disorders.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a quasi-experimental pretest–posttest design with three parallel intervention groups to compare the effectiveness of vocabulary learning, a text-reader program, and a combined vocabulary learning–text-reader method in improving reading performance among children with reading disorders. The study population consisted of children aged 9–11 years with identified reading difficulties who were enrolled in primary schools and learning-disability centers in Tehran, Iran. Participants were recruited through purposive sampling following an initial screening process conducted in collaboration with school counselors, teachers, and learning-disability specialists. Children initially identified as experiencing persistent difficulty in accurate and fluent reading were evaluated to determine their eligibility for participation. A total of 30 eligible children were included in the study and allocated to three intervention groups of 10 participants each: the vocabulary-learning group, the text-reader program group, and the combined-method group. Eligibility criteria included being between 9 and 11 years of age, enrollment in primary school, Persian as the principal language of education, performance indicative of a reading disorder on the standardized reading assessment, normal or corrected-to-normal vision and hearing, and the absence of intellectual disability, major neurological disorders, severe sensory impairment, or a previously diagnosed psychiatric condition that could substantially interfere with reading performance or participation in the intervention. Children receiving another structured reading-remediation intervention during the study period were excluded to minimize contamination of treatment effects. Participants were also excluded if they were absent from more than two intervention sessions or failed to complete the posttest assessment. Following completion of baseline assessments, the 30 participants were

E-ISSN: 3041-8828

assigned as evenly as possible to the three intervention conditions while considering age, sex, school grade, and baseline reading performance to reduce systematic differences among groups. All three groups received an equal number and duration of instructional sessions, thereby controlling for differences in intervention exposure. The interventions were conducted in quiet educational settings with appropriate lighting and minimal environmental distraction. Pretest assessments were administered before the first intervention session, and posttest assessments were conducted after completion of the final session under comparable testing conditions. The study procedures were explained to the children's parents or legal guardians, written informed consent was obtained from them, and verbal assent was obtained from the children. Participants and their families were informed that participation was voluntary, that their information would remain confidential, and that they could withdraw from the study at any stage without adverse consequences.

2.2. Data Collection Tools

Reading performance and the severity of reading difficulties were evaluated using a standardized Persian reading and dyslexia assessment appropriate for Iranian primary-school children. The assessment covered the principal components of reading that are commonly impaired in developmental reading disorders, including word recognition, word-reading accuracy, nonword or pseudoword reading, reading fluency, phonological processing, and reading comprehension. Word-reading tasks were used to evaluate the child's ability to recognize and accurately pronounce familiar written words, whereas nonword-reading items assessed phonological decoding independently of previously acquired lexical knowledge. Reading fluency was evaluated according to the number of words read accurately within the specified time and the frequency of reading errors. Text-reading and comprehension tasks required participants to read developmentally appropriate passages and answer questions assessing their understanding of explicitly stated information, semantic relationships, and the overall meaning of the text. Error patterns, including substitutions, omissions, additions, repetitions, hesitations, and incorrect pronunciations, were recorded during the assessment. The same standardized administration procedures and scoring criteria were applied at pretest and posttest, and testing was conducted individually in a quiet environment to reduce the influence of distraction and peer-related factors. In addition to the primary reading assessment, a demographic and educational information form was completed by the children's parents or guardians to obtain information concerning age, sex, school grade, previous educational difficulties, history of grade repetition, previous use of remedial educational services, sensory problems, and relevant developmental or educational history. Available school records and specialist reports were also reviewed when necessary to confirm that reading difficulties were persistent and were not better explained by inadequate educational exposure, uncorrected sensory impairment, or general intellectual difficulties. To increase consistency of measurement, all assessments were conducted according to identical instructions, and the evaluator recorded both quantitative scores and observable reading errors. The principal outcome variables were changes in overall reading performance and the major domains of reading accuracy, decoding, fluency, and comprehension from pretest to posttest.

2.3. Interventions

The vocabulary-learning intervention was designed to improve reading performance by strengthening lexical knowledge, rapid word recognition, semantic access, orthographic familiarity, and the ability to derive word meaning from linguistic context. Children assigned to this condition participated in 12 sessions of approximately 60 minutes, conducted three times per week over four consecutive weeks. Each session followed a consistent instructional sequence beginning with a brief review of words practiced during the preceding session, followed by explicit teaching of a new set of age-appropriate Persian words selected from primary-school reading materials and texts matched to the participants' educational level. Instruction emphasized accurate pronunciation, syllabic and phonemic structure, orthographic form, meaning, synonyms and antonyms when appropriate, word families, and the use of each target word within meaningful sentences. Children were first exposed to the written and spoken forms of the target words and were subsequently asked to read the words aloud, segment them into meaningful or phonological units, identify their meanings, match words with definitions or contextual examples, and construct oral or written sentences using the target vocabulary. Repeated exposure was incorporated throughout the sessions to promote automatic recognition, and previously taught vocabulary was

E-ISSN: 3041-8828

systematically recycled across subsequent exercises. Short reading passages containing target words were used during the latter portion of each session so that children could apply acquired vocabulary knowledge to connected-text reading rather than learning words in isolation. Correct responses were reinforced immediately, whereas incorrect pronunciations or interpretations were corrected through modeling, guided repetition, and contextual explanation. Task difficulty gradually increased across sessions by moving from high-frequency and relatively transparent words toward less familiar and more complex vocabulary. The instructional content was standardized across participants in this group, while the amount of repetition was adjusted within the session according to each child's performance. No text-reading software or automated auditory presentation was used in this condition so that the specific effect of structured vocabulary instruction could be evaluated independently.

The text-reader program intervention was based on computer-assisted multisensory reading practice in which written Persian text was presented simultaneously with auditory modeling of correct pronunciation. Participants in this group completed 12 sessions of approximately 60 minutes, three times per week for four consecutive weeks, thereby receiving the same treatment duration and frequency as the vocabulary-learning group. During each session, age-appropriate words, sentences, and short passages were displayed on a computer or digital device using a text-reader program capable of presenting the written material while producing synchronized spoken output. The child initially listened to the computerized reading while visually following the corresponding word or sentence on the screen. Visual tracking was facilitated through synchronized highlighting or sequential emphasis on the portion of text being pronounced, thereby directing attention to the relationship between orthographic and phonological information. After listening to each segment, the participant was instructed to repeat the word or sentence, read it independently, and then reread it with progressively reduced auditory assistance. Exercises progressed from individual words and short sentences to connected passages as the intervention advanced. Particular attention was given to accurate decoding, appropriate pronunciation, reading rate, continuity of oral reading, and reduction of pauses, substitutions, omissions, and repetitions. When a reading error occurred, the child was encouraged to replay the relevant word or sentence, compare the modeled pronunciation with his or her own response, and attempt the item again. Repeated reading was incorporated to strengthen orthographic recognition and fluency, while comprehension questions were included after short passages to ensure that gains in mechanical reading were accompanied by attention to meaning. The instructor supervised all sessions, ensured appropriate use of the software, provided standardized guidance when necessary, and recorded participation and performance; however, explicit systematic vocabulary instruction of the type provided to the vocabulary-learning group was not included in this condition. In this manner, the intervention primarily targeted reading through synchronized visual and auditory exposure, repeated reading, guided decoding, and immediate access to a correct spoken model.

The combined intervention integrated the principal components of explicit vocabulary learning and text-reader-assisted reading within a unified instructional protocol. Participants in this group received 12 sessions of approximately 60 minutes, conducted three times per week for four consecutive weeks, maintaining the same total intervention exposure as the other two groups. Each session was divided into complementary instructional phases rather than doubling the intervention duration. During the first part of the session, approximately half of the instructional period was devoted to systematic vocabulary learning. Target words selected from the reading material were introduced through explicit instruction in pronunciation, orthographic structure, meaning, semantic relationships, word families, and contextual usage. Children practiced reading the words aloud, identifying their meanings, using them in sentences, and recognizing them in short contextual examples. During the second part of the session, the same vocabulary was embedded in sentences and age-appropriate passages presented through the text-reader program. Participants listened to the synchronized auditory model while visually tracking highlighted written text, repeated selected segments, and subsequently attempted independent oral reading without computerized support. The integration of the two approaches was intended to strengthen both lexical-semantic processing and phonological–orthographic mapping by allowing children to encounter newly learned words repeatedly in meaningful connected text with simultaneous visual and auditory support. Errors were addressed through immediate feedback, replay of the computerized model, guided pronunciation, and rereading. As the sessions progressed, auditory assistance was gradually reduced, text length and linguistic complexity increased, and greater emphasis was placed on independent

E-ISSN: 3041-8828

fluent reading and comprehension. Short comprehension questions and retelling activities were incorporated after passage reading to evaluate whether children could integrate accurate word recognition with understanding of the text. Target vocabulary from earlier sessions was systematically reviewed and embedded in subsequent passages to encourage retention and automaticity. Accordingly, the combined intervention retained the core mechanisms of both experimental methods while controlling the total duration of instructional exposure, allowing its effectiveness to be compared directly with vocabulary learning alone and text-reader-assisted practice alone.

2.4. Data Analysis

Data were analyzed using IBM SPSS Statistics. Prior to inferential analyses, the dataset was examined for completeness, coding errors, missing observations, and extreme values. Descriptive statistics, including mean, standard deviation, minimum, and maximum values, were calculated for continuous variables, while frequencies and percentages were used to summarize categorical demographic characteristics. Baseline comparability of the three intervention groups was examined with respect to age, educational characteristics, and pretest reading scores to determine whether meaningful initial differences were present. Assumptions required for parametric analyses were assessed before hypothesis testing. Normality of the distributions was evaluated using the Shapiro–Wilk test together with inspection of distributional characteristics, and homogeneity of variances was examined using Levene's test. Because the primary objective was to determine whether post-intervention reading performance differed among the three learning methods after accounting for participants' initial reading ability, analysis of covariance (ANCOVA) was used for the primary outcome, with the posttest reading score entered as the dependent variable, intervention condition as the fixed factor, and the corresponding pretest score as the covariate. The assumptions of ANCOVA, including linearity between the covariate and outcome and homogeneity of regression slopes across intervention groups, were evaluated before interpretation of the model. Where multiple related reading outcomes, such as reading accuracy, decoding, fluency, and comprehension, were analyzed simultaneously, multivariate analysis of covariance (MANCOVA) was used to evaluate the overall intervention effect while controlling for baseline scores. A statistically significant omnibus group effect was followed by adjusted pairwise comparisons to determine whether the vocabulary-learning, text-reader, and combined-method groups differed significantly from one another. Multiple comparisons were corrected using the Bonferroni procedure to control inflation of Type I error. In addition to statistical significance, effect sizes were reported using partial eta squared to indicate the magnitude of intervention effects and to facilitate interpretation of the practical importance of between-group differences. All statistical tests were two-tailed, and the level of statistical significance was set at $p < .05$.

3. Findings and Results

A total of 30 children aged 9–11 years completed the study and were included in the final statistical analyses. The participants were distributed equally across the vocabulary-learning group (n = 10), the text-reader program group (n = 10), and the combined-method group (n = 10). The mean age of the total sample was 10.03 ± 0.82 years. The mean ages of participants in the vocabulary-learning, text-reader, and combined-method groups were 10.00 ± 0.82, 10.10 ± 0.88, and 10.00 ± 0.82 years, respectively, indicating a highly comparable age distribution across the three intervention conditions. Of the 30 participants, 18 (60.0%) were boys and 12 (40.0%) were girls. The sex distribution was similar across the groups, with six boys and four girls in the vocabulary-learning group, six boys and four girls in the text-reader group, and six boys and four girls in the combined-method group. With respect to school grade, 9 participants (30.0%) were in the third grade, 12 (40.0%) were in the fourth grade, and 9 (30.0%) were in the fifth grade. The distribution of school grade was also comparable among the three intervention groups. No participant withdrew after beginning the intervention, and all 30 children completed the pretest, intervention sessions, and posttest assessments. Preliminary comparisons showed no statistically significant differences among the groups in age, sex distribution, grade level, or baseline reading performance ($p > .05$), suggesting that the intervention groups were sufficiently comparable before treatment. Examination of the dataset identified no substantial missing data or extreme values requiring exclusion. The distribution of the primary reading variables was approximately normal within the study groups, with Shapiro–Wilk tests producing nonsignificant results for the principal pretest and posttest scores ($p > .05$). Levene's tests were also nonsignificant for the major outcome variables, supporting the assumption of

E-ISSN: 3041-8828

homogeneity of variances. Furthermore, examination of the group-by-pretest interactions indicated that the homogeneity-of-regression-slopes assumption required for covariance analysis was satisfied ($p > .05$). These preliminary findings supported the application of parametric ANCOVA and MANCOVA procedures for evaluating the effects of the three instructional methods.

Table 1

Descriptive Statistics for Reading Outcomes at Pretest and Posttest Across the Three Intervention Groups

Reading outcome	Vocabulary learning Pretest M ± SD	Vocabulary learning Posttest M ± SD	Text-reader Pretest M ± SD	Text-reader Posttest M ± SD	Combined method Pretest M ± SD	Combined method Posttest M ± SD
Overall reading performance	51.30 ± 5.12	64.80 ± 5.34	50.90 ± 5.28	68.70 ± 4.95	51.10 ± 5.04	76.20 ± 4.42
Word-reading accuracy	12.40 ± 2.01	16.50 ± 1.84	12.30 ± 2.16	17.20 ± 1.69	12.50 ± 1.96	19.10 ± 1.52
Nonword decoding	9.20 ± 1.69	12.50 ± 1.58	9.10 ± 1.73	13.40 ± 1.43	9.20 ± 1.62	15.20 ± 1.32
Reading fluency	14.60 ± 2.27	18.10 ± 2.02	14.50 ± 2.32	20.00 ± 1.83	14.40 ± 2.22	22.50 ± 1.65
Reading comprehension	15.10 ± 1.91	17.70 ± 1.70	15.00 ± 1.89	18.10 ± 1.60	15.00 ± 1.83	19.40 ± 1.35

As shown in Table 1, the three intervention groups demonstrated closely comparable reading scores before the intervention, whereas a clear divergence in performance emerged at posttest. The mean overall reading score in the vocabulary-learning group increased from 51.30 ± 5.12 at pretest to 64.80 ± 5.34 at posttest, corresponding to a mean raw improvement of 13.50 points. Participants receiving the text-reader intervention improved from 50.90 ± 5.28 to 68.70 ± 4.95, representing a mean increase of 17.80 points. The largest improvement was observed in the combined-method group, whose mean overall reading score increased from 51.10 ± 5.04 at baseline to 76.20 ± 4.42 after the intervention, corresponding to a mean gain of 25.10 points. A similar pattern was evident for each specific reading domain. In word-reading accuracy, the vocabulary-learning group increased from 12.40 ± 2.01 to 16.50 ± 1.84, the text-reader group increased from 12.30 ± 2.16 to 17.20 ± 1.69, and the combined group increased from 12.50 ± 1.96 to 19.10 ± 1.52. For nonword decoding, the respective pretest-to-posttest changes were 9.20 ± 1.69 to 12.50 ± 1.58 in the vocabulary group, 9.10 ± 1.73 to 13.40 ± 1.43 in the text-reader group, and 9.20 ± 1.62 to 15.20 ± 1.32 in the combined group. Reading fluency showed particularly pronounced improvement in the technology-assisted conditions, increasing from 14.50 ± 2.32 to 20.00 ± 1.83 in the text-reader group and from 14.40 ± 2.22 to 22.50 ± 1.65 in the combined-method group, compared with an increase from 14.60 ± 2.27 to 18.10 ± 2.02 in the vocabulary-learning group. Reading comprehension also improved in all groups, although the between-group differences were somewhat smaller than those observed for decoding and fluency. Overall, the descriptive findings suggested that each instructional method was associated with improvement in reading performance, but the combined method produced the greatest gains across all measured domains, followed by the text-reader program and then the vocabulary-learning intervention.

Table 2

ANCOVA Results for the Effect of Intervention Method on Overall Posttest Reading Performance

Source	Sum of squares	df	Mean square	F	p	Partial η^2
Pretest reading score	179.64	1	179.64	18.73	< .001	.419
Intervention group	659.27	2	329.64	34.37	< .001	.726
Error	249.38	26	9.59	—	—	—
Corrected total	1128.17	29	—	—	—	—

The ANCOVA results presented in Table 2 demonstrated a statistically significant effect of intervention condition on overall posttest reading performance after adjustment for baseline reading scores, $F(2, 26) = 34.37$, $p < .001$, partial $\eta^2 = .726$. The magnitude of the partial eta-squared coefficient indicated that approximately 72.6% of the explainable

E-ISSN: 3041-8828

variance in adjusted posttest reading performance was associated with intervention-group membership after controlling for initial reading ability, representing a very large treatment effect. Baseline reading performance was itself a significant covariate, $F(1, 26) = 18.73$, $p < .001$, partial $\eta^2 = .419$, indicating that pre-intervention reading ability remained meaningfully associated with post-intervention performance. Nevertheless, the significant intervention effect after statistical adjustment demonstrated that the observed differences among the groups could not be explained solely by minor variations in baseline performance. Adjusted posttest comparisons showed that the combined-method group achieved the highest estimated reading performance, followed by the text-reader program group and the vocabulary-learning group. Bonferroni-adjusted pairwise comparisons revealed that the combined method produced significantly better overall posttest reading performance than vocabulary learning alone (mean adjusted difference = 11.26, $p < .001$) and significantly better performance than the text-reader program alone (mean adjusted difference = 7.42, $p < .001$). The text-reader group also performed significantly better than the vocabulary-learning group (mean adjusted difference = 3.84, $p = .021$). Therefore, although all three groups showed improvement from pretest to posttest, the covariance analysis indicated a clear hierarchy of intervention effectiveness, with the combined method producing the greatest overall improvement, the text-reader program producing the second-largest improvement, and vocabulary instruction alone producing the smallest, though still substantial, change.

Table 3

MANCOVA and Follow-Up ANCOVA Results for Posttest Reading Components After Controlling for Pretest Scores

Outcome	Adjusted posttest mean: Vocabulary learning	Adjusted posttest mean: Text-reader	Adjusted posttest mean: Combined method	F(2, 25)	p	Partial η^2
Word-reading accuracy	16.48	17.21	19.11	12.84	< .001	.507
Nonword decoding	12.48	13.42	15.20	16.31	< .001	.566
Reading fluency	18.08	20.03	22.49	21.76	< .001	.635
Reading comprehension	17.68	18.13	19.39	7.62	.003	.379

The multivariate analysis demonstrated that intervention condition had a statistically significant overall effect on the combined set of reading outcomes after adjustment for their corresponding baseline scores, Wilks' $\Lambda = .214$, $F(8, 44) = 6.77$, $p < .001$, partial $\eta^2 = .552$. This result indicated that the pattern of post-intervention performance across word-reading accuracy, nonword decoding, reading fluency, and reading comprehension differed significantly among the three instructional conditions. Follow-up univariate analyses, presented in Table 3, demonstrated significant intervention effects for all four reading components. For word-reading accuracy, the group effect was statistically significant, $F(2, 25) = 12.84$, $p < .001$, partial $\eta^2 = .507$. The adjusted mean was highest for the combined-method group (19.11), followed by the text-reader group (17.21) and vocabulary-learning group (16.48). Bonferroni comparisons indicated that the combined method was significantly superior to vocabulary learning ($p < .001$) and the text-reader intervention ($p = .014$), whereas the difference between vocabulary learning and the text-reader program was smaller and did not reach the same magnitude. For nonword decoding, a significant group effect was also identified, $F(2, 25) = 16.31$, $p < .001$, partial $\eta^2 = .566$. The combined group achieved an adjusted mean of 15.20, compared with 13.42 for the text-reader group and 12.48 for the vocabulary-learning group. Pairwise comparisons showed that the combined intervention significantly outperformed both single-method interventions, while the text-reader program was also more effective than vocabulary learning for decoding unfamiliar letter strings. The strongest group effect among the individual reading components was observed for reading fluency, $F(2, 25) = 21.76$, $p < .001$, partial $\eta^2 = .635$. Adjusted posttest means were 18.08 for vocabulary learning, 20.03 for the text-reader program, and 22.49 for the combined method. Pairwise comparisons indicated statistically significant differences between all three groups, with the combined method producing the strongest fluency improvement, followed by the text-reader intervention. Reading comprehension also differed significantly across groups, $F(2, 25) = 7.62$, $p = .003$, partial $\eta^2 = .379$. Although

E-ISSN: 3041-8828

the magnitude of this effect was smaller than that observed for fluency and decoding, the combined-method group still obtained the highest adjusted comprehension score (19.39), followed by the text-reader group (18.13) and vocabulary-learning group (17.68). Pairwise analysis indicated a significant difference between the combined intervention and vocabulary-learning condition, whereas the differences involving the text-reader group were comparatively smaller. Taken together, the multivariate and univariate findings demonstrated that integrating explicit vocabulary instruction with synchronized text-reader practice generated the broadest and strongest improvements across the constituent dimensions of reading performance.

The pattern of findings was therefore consistent across descriptive and inferential analyses. All three instructional approaches were associated with improvements in children's reading skills, indicating that structured remedial instruction was beneficial for children aged 9–11 years with reading disorders. However, the magnitude of improvement varied according to instructional method. Vocabulary instruction alone was effective primarily in strengthening word recognition and comprehension through increased lexical familiarity and semantic knowledge. The text-reader program produced larger improvements, particularly in decoding and reading fluency, suggesting that repeated synchronized exposure to written and auditory forms facilitated more efficient orthographic–phonological processing and more fluent oral reading. The combined intervention consistently produced the highest posttest scores and the largest adjusted effects across all assessed outcomes. This pattern indicated that the simultaneous strengthening of lexical-semantic knowledge and repeated visual–auditory reading practice produced an additive or complementary instructional advantage. The especially large effects observed for reading fluency and nonword decoding suggest that the combined method was particularly effective in improving the automaticity and phonological decoding processes that are commonly impaired in children with reading disorders. At the same time, the significant improvement in reading comprehension indicated that the benefits of the combined intervention were not restricted to mechanical reading performance but extended to higher-level understanding of written material. Overall, the findings supported the conclusion that while vocabulary learning and text-reader-assisted training were independently effective, combining the two instructional approaches yielded the most substantial improvement in reading performance among the participating children.

4. Discussion and Conclusion

The present study investigated and compared the effectiveness of three instructional approaches—vocabulary learning, a text-reader program, and a combined vocabulary learning–text-reader method—in improving reading performance among Iranian children aged 9–11 years with reading disorders. The findings showed that all three interventions were associated with improvement in overall reading performance from pretest to posttest; however, the magnitude of improvement differed significantly across the intervention conditions. The combined-method group achieved the greatest gains in overall reading performance and consistently obtained the highest adjusted posttest scores across word-reading accuracy, nonword decoding, reading fluency, and reading comprehension. The text-reader group produced the second-largest gains, particularly in fluency and decoding, whereas the vocabulary-learning group demonstrated meaningful but comparatively smaller improvements. These findings suggest that although both explicit lexical instruction and technology-assisted reading practice can contribute to reading remediation, integrating the two approaches may produce a broader and more powerful effect by simultaneously targeting lexical-semantic, orthographic, phonological, and fluency-related components of reading.

The significant improvement observed in the vocabulary-learning group is consistent with the substantial body of evidence demonstrating that vocabulary knowledge is closely linked to reading performance. Vocabulary provides readers with direct access to the meanings of written words and reduces the cognitive burden associated with interpreting unfamiliar lexical items. Previous research has shown that both vocabulary breadth and vocabulary depth contribute to reading comprehension, indicating that successful reading depends not only on the number of words known but also on the richness and accessibility of lexical representations (Dagnaw, 2023). Similar findings have been reported in studies demonstrating significant associations between vocabulary knowledge and reading comprehension across different learner populations (Al-Khasawneh, 2019; Al Qunayeer, 2021; Rahmasari et al., 2023). In the present study, direct attention to pronunciation, orthographic form, meaning, semantic relationships, and contextual use likely strengthened lexical representations and facilitated more efficient recognition of familiar written words. This may explain the improvement observed in word-reading accuracy and comprehension following the vocabulary intervention.

E-ISSN: 3041-8828

The present findings also correspond with research suggesting that vocabulary is multidimensional and that different components of lexical knowledge make distinct contributions to reading. Röthlisberger and colleagues emphasized the importance of vocabulary components in early reading comprehension, showing that lexical knowledge supports readers in constructing meaning from text (Röthlisberger et al., 2023). Tong et al. further demonstrated that vocabulary fluency can moderate the association between vocabulary knowledge and reading proficiency, suggesting that knowing a word is not sufficient unless that knowledge can be accessed efficiently during reading (Tong et al., 2023). The vocabulary-learning intervention used in the present study incorporated repeated exposure, oral production, contextualized usage, and review across sessions. These features may have increased both the stability and accessibility of lexical representations. Consequently, children may have required less effort to recognize taught words during connected-text reading, freeing cognitive resources for comprehension and integration of ideas.

The improvement associated with vocabulary instruction is also consistent with intervention research emphasizing explicit and systematic teaching. Explicit vocabulary instruction has been shown to facilitate lexical development more effectively than relying exclusively on incidental exposure in contexts where learners have limited lexical knowledge (Khamesipour, 2015). Reviews of vocabulary instruction similarly indicate that repeated, meaningful, and contextually embedded encounters with target words can positively influence text comprehension (Wright & Cervetti, 2017). The instructional logic underlying the present vocabulary protocol was consistent with these principles, as children were not simply asked to memorize isolated definitions; instead, they encountered words repeatedly, practiced their pronunciation, identified meanings and semantic relations, and used them in sentences and short passages. This structured approach may have been particularly beneficial for children with reading disorders, who are less likely than proficient readers to acquire new vocabulary incidentally through independent reading because the act of decoding itself is more effortful.

The present findings regarding the text-reader program are likewise theoretically and empirically plausible. Children in this group demonstrated larger gains than those receiving vocabulary instruction alone, particularly in nonword decoding and reading fluency. The text-reader intervention provided synchronized visual and auditory exposure, allowing children to see written words while simultaneously hearing an accurate spoken model. This repeated mapping between orthographic and phonological representations may have strengthened decoding efficiency and reduced uncertainty in word pronunciation. Although much of the technology-supported reading literature has been conducted in language-learning contexts, previous research suggests that digital and computer-assisted instruction can facilitate both vocabulary development and reading comprehension when auditory, visual, and interactive features are incorporated into a structured instructional design (Abdolmaleki & Saeedi, 2024). The improvement observed in the present text-reader group therefore supports the broader proposition that technology is most effective when it is used to strengthen specific underlying processes rather than functioning merely as an alternative medium for displaying text.

The particularly strong effect of the text-reader intervention on reading fluency can be explained through repeated reading and modeling mechanisms. Children with reading disorders often devote considerable attentional resources to decoding individual words, resulting in slow, fragmented, and hesitant oral reading. The opportunity to hear correct pronunciation, follow text visually, repeat passages, and gradually reduce assistance may promote automaticity by allowing repeated practice with accurate linguistic input. Input enhancement has previously been associated with improved reading fluency, suggesting that drawing attention to important linguistic forms within reading material can facilitate more efficient processing (Fatahzadeh et al., 2022). In addition, research on supported vocabulary learning from reading indicates that supplementary information attached to unfamiliar lexical items can facilitate learning when it reduces processing difficulty and focuses attention on the relationship between form and meaning (Yanagisawa et al., 2020). Although the present text-reader program was not identical to glossing or input enhancement interventions, the underlying principle of reducing processing demands while strengthening form-to-sound mapping is comparable.

The most important finding of the study was the superior performance of the combined-method group. Children who received integrated vocabulary instruction and text-reader practice demonstrated the greatest overall improvement and the highest posttest scores across all four specific reading domains. This result suggests that the two approaches may operate through complementary rather than redundant mechanisms. Vocabulary instruction strengthens lexical-

E-ISSN: 3041-8828

semantic knowledge, whereas the text-reader program supports phonological decoding, pronunciation, orthographic familiarity, repeated reading, and fluency. When these two components are combined, children are given the opportunity to learn the meaning and structure of target words explicitly and then encounter those same words repeatedly in connected text accompanied by accurate auditory modeling. Such an instructional sequence may reinforce multiple representations of the same lexical items and improve both accuracy and speed of access.

This interpretation is compatible with evidence emphasizing the reciprocal relationship between vocabulary and reading comprehension. Wang and Zhang reported reciprocal associations among vocabulary breadth, vocabulary depth, and reading comprehension, indicating that growth in lexical knowledge can support comprehension while successful reading experiences can further strengthen vocabulary (Wang & Zhang, 2025). The combined intervention in the present study may have capitalized on this reciprocal relationship by first strengthening vocabulary and then providing repeated opportunities to encounter and process that vocabulary during supported reading. Rather than treating lexical learning and reading fluency as independent instructional goals, the combined method integrated them within a single learning sequence. This may explain why it produced stronger effects than either isolated intervention.

The superior effects of the combined method on nonword decoding are also noteworthy. Nonword reading requires children to apply phonological decoding rules without relying on previously stored lexical representations. Because the combined intervention included repeated visual–auditory mapping and explicit attention to word structure, children may have developed more efficient strategies for analyzing unfamiliar written forms. Although vocabulary instruction primarily focuses on known words and their meanings, repeated attention to pronunciation, syllabic structure, and orthographic patterns may still contribute indirectly to decoding. The addition of computerized auditory modeling likely strengthened this effect. The stronger performance of the combined group may therefore reflect transfer from practiced orthographic–phonological correspondences to unfamiliar items.

The especially large group difference in reading fluency further supports the complementary-mechanisms explanation. Reading fluency depends on accurate and increasingly automatic word recognition, efficient phonological processing, and sufficient lexical familiarity to minimize hesitation. The combined method addressed all three components simultaneously. Vocabulary instruction reduced uncertainty regarding the identity and meaning of words, while text-reader practice offered repeated opportunities to hear and reproduce accurate oral reading. The integration of these processes may have accelerated the transition from effortful decoding to more automatic recognition. This interpretation is broadly consistent with research showing that vocabulary knowledge and fluency are interconnected and that efficient lexical access can strengthen the relationship between vocabulary and overall reading proficiency (Tong et al., 2023). It is also compatible with evidence that lexical coverage influences how effectively a reader can process connected text (Laufer, 2016). When more words in a passage are familiar and accessible, fewer cognitive resources are consumed by local word-level processing, allowing reading to become smoother and more continuous.

The improvement in reading comprehension across all three groups provides further evidence that interventions targeting lower-level reading processes can produce benefits at higher levels of textual understanding. Comprehension depends on more than decoding accuracy; however, inadequate lexical knowledge and slow word recognition can impose substantial constraints on meaning construction. The lexical-threshold perspective suggests that comprehension becomes more efficient once a sufficient proportion of the words in a text are recognized and understood (Laufer, 2016). Differences in vocabulary size may therefore create substantial inequalities in comprehension performance, especially among struggling readers (Duff & Brydon, 2020). The present findings are consistent with this framework. The vocabulary group improved comprehension through enhanced lexical knowledge, while the text-reader group likely benefited from reduced decoding demands. The combined group achieved the largest comprehension gain because both sources of difficulty were addressed simultaneously.

The findings are also consistent with research emphasizing the importance of instructional scaffolding. Hasani et al. showed that scaffolded differentiation can enhance receptive vocabulary and inferential reading comprehension (Hasani et al., 2024). In the present study, all interventions incorporated graduated support, repeated practice, and immediate correction, while the combined method offered the broadest form of scaffolding by supporting both lexical understanding and oral decoding. Similarly, multiple-intelligence approaches to vocabulary

E-ISSN: 3041-8828

learning have demonstrated that varied modes of engagement can facilitate vocabulary acquisition during reading instruction (Miolo et al., 2023). The success of the combined method may therefore be partly attributable to its multimodal nature. Children were required to listen, visually track, pronounce, interpret, and apply written words, thereby engaging several channels of processing rather than relying on a single instructional route.

The present findings also align with studies highlighting the importance of contextually meaningful vocabulary learning. Harji and Balakrishnan emphasized that vocabulary instruction should extend beyond isolated word learning and support broader reading development (Harji & Balakrishnan, 2019). Lenhart et al. similarly showed that enriched and engaging language presentation can improve word learning and comprehension in children (Lenhart et al., 2020). In the present combined intervention, target words were not practiced only as discrete units but were embedded in sentences and passages that were then read with digital support. This may have strengthened retention by linking lexical meaning with actual textual use. Such contextualization can be especially valuable for children with reading disorders, whose lexical representations may be less stable or less efficiently accessed during reading.

The findings also have relevance to Iranian educational settings. Previous Iranian research has demonstrated that vocabulary plays a significant role in reading comprehension and interacts with other language components such as syntax (Shirazizadeh, 2020). The present study extends this line of evidence by focusing specifically on children with reading disorders and by comparing three different remediation strategies. Although many previous studies have examined typically developing learners or second-language populations, the pattern observed here suggests that principles derived from vocabulary and reading research may also be applicable to remedial literacy instruction in Persian-speaking children. This is important because children with reading disorders may require more explicit, repeated, and multimodal instruction than typically developing readers.

The results should also be interpreted within a broader developmental framework. Reading disorders are heterogeneous, and children with learning disabilities may differ substantially in cognitive, attentional, linguistic, and executive profiles (Stewart et al., 2025). Developmental cognitive neuroscience has similarly emphasized the interaction between executive functioning and learning disabilities, including reading difficulties (Horowitz-Kraus et al., 2026). The success of the combined intervention may therefore reflect not only direct improvements in lexical and decoding skills but also a reduction in cognitive load during reading. By providing explicit lexical preparation and external auditory support, the intervention may have reduced the working-memory and attentional demands associated with independent reading. This could have allowed children to allocate more cognitive resources to fluent processing and comprehension.

The present study is also compatible with findings showing that nontraditional interventions can influence reading outcomes in children with learning difficulties. Xu reported improvement in reading performance among children with learning disabilities following an intervention that addressed the broader learning context rather than reading mechanics alone (Xu, 2025). Although the intervention differed substantially from the instructional methods examined here, the study reinforces the broader principle that reading performance is responsive to structured intervention during late primary-school years. The current findings add to this evidence by showing that targeted educational methods can produce measurable improvements in several dimensions of reading among children aged 9–11 years.

Several limitations should be considered when interpreting the findings. First, the study included only 30 participants, with 10 children in each intervention condition. Although significant and relatively large effects were observed, the small sample limits the precision and generalizability of the estimates. Second, participants were recruited from Tehran, and educational resources, socioeconomic conditions, school practices, and access to technology may differ across other regions of Iran. Third, the study used a quasi-experimental design and did not include a no-treatment or wait-list control group, meaning that the degree to which improvement exceeded natural maturation or ordinary school instruction cannot be established with complete certainty. Fourth, the posttest was conducted immediately after completion of the intervention, and no long-term follow-up assessment was included. It is therefore unclear whether the observed gains were maintained over several months. Fifth, although the intervention groups received equal treatment duration, individual variation in motivation, home reading practice, parental support, and prior exposure to digital educational tools may have influenced responsiveness to treatment.

Future research should replicate the study using larger and more diverse samples drawn from multiple Iranian cities

E-ISSN: 3041-8828

and educational settings. Randomized controlled trials would provide stronger causal evidence and should ideally include an untreated or usual-instruction comparison group. Follow-up assessments conducted three, six, or twelve months after intervention would help determine whether improvements in fluency, decoding, vocabulary, and comprehension are maintained over time. Future studies should also examine whether treatment effects vary according to baseline reading severity, age, sex, grade level, executive functioning, phonological awareness, working memory, or initial vocabulary level. It would additionally be valuable to compare different intensities and durations of the combined method and to determine which components contribute most strongly to improvement. Studies using process measures, such as reading speed, eye movements, error patterns, or digital usage logs, could further clarify the mechanisms through which technology-assisted reading affects performance.

In practice, the findings suggest that remedial reading programs for children aged 9–11 years should avoid relying exclusively on isolated vocabulary exercises or unsupported repeated reading. A more comprehensive approach that combines explicit vocabulary instruction with guided text reading, auditory modeling, repeated practice, and gradual withdrawal of assistance may be more effective. Schools and learning-disability centers could incorporate text-reader software into structured literacy sessions rather than using it only as an accessibility tool. Teachers should preteach important vocabulary, reinforce pronunciation and meaning, and then embed the same words in connected texts that children can read with synchronized auditory support. Intervention sessions should progress from supported to increasingly independent reading, with immediate feedback and repeated exposure to difficult words. Such programs may be especially useful for children who continue to struggle with both decoding and comprehension despite regular classroom instruction.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all individuals for participating and cooperating us in this study.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

References

Abdolmaleki, N., & Saeedi, Z. (2024). Brain-Based CALL in Flipped Higher Education GE Courses Held Through LMS: Boosting Vocabulary Learning and Reading Comprehension. *International Journal of Educational Technology in Higher Education*, *21*(1). https://doi.org/10.1186/s41239-024-00442-9

Al-Khasawneh, F. M. S. (2019). The impact of vocabulary knowledge on the reading comprehension of Saudi EFL learners. *Journal of Language and Education*, *5*(3), 24-34. https://doi.org/10.17323/jle.2019.8822

Al Qunayeer, H. S. (2021). An investigation of the relationship between reading comprehension, vocabulary knowledge, and English language proficiency level of Saudi EFL learners. *Advances in Language and Literary Studies*, *12*(2), 59-69. https://doi.org/10.7575/aiac.alls.v.12n.2.p.59

Blachowicz, C. (2008). Vocabulary: Questions from the classroom. *Reading Research Quarterly*, *41*(4), 524-539. https://ila.onlinelibrary.wiley.com/doi/abs/10.1598/RRQ.41.4.5

ÇİFtcİ, H., & Kömür, Ş. (2023). "Short-Circuit" L1 Use in Pre-Reading Activities and Its Effects on L2 Reading Comprehension and Focus-on-Vocabulary Learning. *International Journal of Social Sciences and Education Research*, *9*(3), 222-233. https://doi.org/10.24289/ijsser.1279975

Dagnaw, A. T. (2023). Revisiting the Role of Breadth and Depth of Vocabulary Knowledge in Reading Comprehension. *Cogent Education*, *10*(1), 2217345. https://doi.org/10.1080/2331186X.2023.2217345

Duff, D., & Brydon, M. M. (2020). Estimates of Individual Differences in Vocabulary Size in English: How Many Words Are Needed to 'Close the Vocabulary Gap'? *Journal of Research in Reading*, *43*(4), 454-481. https://doi.org/10.1111/1467-9817.12322

E-ISSN: 3041-8828

Fatahzadeh, S. S., Shafiee, S., & Rahimi Esfahani, F. (2022). Impact of Consciousness-Raising via Input Flooding vs. Vocabulary Input Enhancement on EFL Learners' Reading Fluency. *Language and Translation*, *12*(4), 119-130. https://journals.iau.ir/article_696827.html?lang=en

Harji, M. B., & Balakrishnan, K. (2019). Spire project: Beyond the reading vocabulary. *Jurnal Komunikasi: Malaysian Journal of Communication*, *35*(2), 465-484. https://doi.org/10.12691/education-12-9-1

Hasani, M., Mohseni, A., & Molaie, B. (2024). Effect of scaffolded differentiation strategies on inferential reading comprehension and receptive vocabulary improvement of intermediate students. *Journal of Language and Translation*, *14*(1), 191-211. https://oiccpress.com/ttlt/article/view/15533

Horowitz-Kraus, T., Cirino, P. T., Cutting, L. E., Hughes-Berheim, S. S., Wilkey, E. D., Barnes, M. A., Rosch, K. S., & Church, J. A. (2026). The Interplay Between Executive Function and Learning Disabilities: Developmental Cognitive Neuroscience Perspectives on Reading, Math, and ADHD. *Developmental Cognitive Neuroscience*, *79*, 101722. https://doi.org/10.1016/j.dcn.2026.101722

Khamesipour, M. (2015). The Effects of Explicit and Implicit Instruction of Vocabulary through Reading on EFL Learners' Vocabulary Development. *Theory and Practice in Language Studies*, *5*(8), 1620-1627. https://doi.org/10.17507/tpls.0508.11

Laufer, B. (2016). Lexical Threshold Revisited: Lexical Text Coverage, Learners' Vocabulary Size and Reading Comprehension. *Reading in a Foreign Language*, *22*(1), 15-30.

Lenhart, J., Lenhard, W., Vaahtoranta, E., & Suggate, S. (2020). More than words: Narrator engagement during storytelling increases children's word learning, story comprehension, and on-task behavior. *Early Childhood Research Quarterly*, *51*, 338-351. https://doi.org/10.1016/j.ecresq.2019.12.009

Miolo, S. T., Pilongo, J. H. D., Sambouw, E. L., & Luwiti, S. R. N. (2023). Enhancing English Vocabulary Acquisition in Reading Instruction Through Multiple Intelligences Approach. *Trans-Kata Journal of Language Literature Culture and Education*, *4*(1), 23-35. https://doi.org/10.54923/jllce.v4i1.67

Rahmasari, A. F. M., Baa, S., & Korompot, C. A. (2023). The Relationship between Vocabulary Knowledge and Reading Comprehension Ability of Junior High School Students. *Journal of Excellence in English Language Education*, *2*(1), 1-8. https://ojs.unm.ac.id/JoEELE/article/view/43576

Röthlisberger, M., Zangger, C., & Juska-Bacher, B. (2023). The Role of Vocabulary Components in Second Language Learners' Early Reading Comprehension. *Journal of Research in Reading*, *46*(1), 1-21. https://doi.org/10.1111/1467-9817.12411

Shirazizadeh, M. (2020). The role of vocabulary and syntax in EFL reading comprehension among Iranian graduate students: Evaluation of two causal models. *ZABANPAZHUHI (Journal of Language Research)*, *12*(36), 363-384. https://doi.org/10.22051/jlr.2020.25642.1689

Sidek, H. M., & Rahim, H. A. (2015). The role of vocabulary knowledge in reading comprehension: A cross-linguistic study. *Procedia-Social and Behavioral Sciences*, *197*, 50-56. https://doi.org/10.1016/j.sbspro.2015.07.046

Stewart, A. A., Scammacca, N., Lee, Y. R., & Cappelli, P. (2025). Exploring Differences Between Cognition, Reading, Math, and Attention Scores in Students With Disabilities: A Systematic Review. *Learning Disability Quarterly*, *49*(1), 39-53. https://doi.org/10.1177/07319487251318352

Tong, Y., Hasim, Z., & Abdul Halim, H. (2023). The Relationship Between L2 Vocabulary Knowledge and Reading Proficiency: The Moderating Effects of Vocabulary Fluency. *Humanities and Social Sciences Communications*, *10*(1), 1-14. https://doi.org/10.1057/s41599-023-02058-2

Verhoef, E., Shapland, C. Y., Fisher, S. E., Dale, P. S., & Pourcain, B. S. (2020). The Developmental Genetic Architecture of Vocabulary Skills During the First Three Years of Life: Capturing Emerging Associations With Later-Life Reading and Cognition. https://doi.org/10.1101/2020.10.05.325993

Wang, T., & Zhang, H. (2025). Reciprocal Effects of Vocabulary Breadth, Vocabulary Depth, and Reading Comprehension: A Cross-Lagged Panel Analysis in Chinese-Speaking EFL Learners. *Humanities and Social Sciences Communications*, *12*(1), 1-10. https://doi.org/10.1057/s41599-025-04694-2

Willingham, D., & Price, D. (2009). Theory to Practice: Vocabulary Instruction in Community College Developmental Education Reading Classes: What the Research Tells Us. *Journal of college reading and learning*, *40*(1). https://doi.org/10.1080/10790195.2009.10850325

Wright, T. S., & Cervetti, G. N. (2017). A Systematic Review of the Research on Vocabulary Instruction That Impacts Text Comprehension. *Reading Research Quarterly*, *52*, 203-226. https://doi.org/10.1002/rrq.163

Xu, T. (2025). Parent-Child Play Therapy Effect on 10 to 12-Year-Old Student' Reading Performance: A Case of Chinese Male Students With Learning Disabilities. *BMC psychology*, *13*(1). https://doi.org/10.1186/s40359-025-02436-2

Yanagisawa, A., Webb, S., & Uchihara, T. (2020). How do different forms of glossing contribute to L2 vocabulary learning from reading? A meta-regression analysis. *Studies in Second Language Acquisition*, *42*(2), 411-438. https://doi.org/10.1017/S0272263119000688

E-ISSN: 3041-8828