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Foreign Language Development in ADHD-Diagnosed and Non-Diagnosed Children: an Experimental Research

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ABSTRACT

Objective: Attention Deficit Hyperactivity Disorder (ADHD) is one of the most prevalent behavioural disorders among children in which L1 impairments are often displayed. There is a conventional assumption that ADHD-diagnosed children experience difficulties in L2 development as well. The present research aimed at investigating possible L2-related behaviours of ADHD-diagnosed children.

Methods: To track L2 profiles among ADHD children, this mixed methods study examined L2 learning performance of ADHD-diagnosed children in terms of English phonological, lexical, and syntactic development compared with typically developing children. To this end, 10 ADHD-diagnosed and 10 typically-developing children were recruited from a public primary school located in Kerman, Iran, during the 2022-2023 academic year. The participants were then assigned to two experimental groups receiving English instructions with the same instructor.

Results: The quantitative results showed that ADHD-diagnosed learners underperformed the typically-developing learners in all phonological, morphological, and syntactic production and recognition tests. However, the only significant difference was in the phonological recognition test ($p = 0.04$). Also, the qualitative results demonstrated that both groups were almost equally engaged in classroom interactions.

Conclusion: The findings highlighted the importance of speech processing and sustained attention in lexical and syntactic learning ability among ADHD students. The implications of the study for L2 instructors were discussed.

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Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a prevalent behavioural and developmental disorder among children characterized by developmentally inappropriate levels of hyperactivity, impulsivity, and inattention (Bitsko et al., 2024). As the name suggests, inattention and hyperactivity are the two major ADHD symptoms, which are considered the key indicators used in diagnosing children with this disorder (American Psychiatric Association, 2013). Given the relevance and importance of attention in every type of learning process, scholars have attempted to investigate possible learning difficulties among ADHD-affected children. They reported that between 25 and 50% of ADHD-affected children have a comorbid learning disorder in different domains. For instance, it has been reported that 18% to 45% of the ADHD-affected chilren have shown reading disabilities (Holopainen et al., 2019), 9% to 63% have displayed writing difficulties (Molitor et al., 2016), and 11% to 30% have demonstrated math-related deficits (Holopainen et al., 2019).

Additionaly, several studies have identified the potential association between ADHD symptoms and language impairments. The reported language impairments include oral and communicative difficulties (Tetnowski, 2004), pragmatic language deficits (Bishop & Baird, 2001; Bruce et al., 2006; Im-Bolter & Cohen, 2007), delayed development of speech perception (Angelidou & Argyriadis, 2023), and difficulty in reformulating or recalling complex sentences (Kim & Kaiser, 2000). Problems in functional areas like speech sequencing, turn-taking, topic maintenance, and thematic coherence are other language-related deficiencies reported among ADHD-diagnosed children (e.g., El Sady et al., 2013). As such, scholars traced some possible reasons of language impairments such as working memory deficiency (Thapar et al., 2013). Also, some other researchers have claimed that speech reception and production are other underlying factors making the process of language learning rather challenging for these children (Turketi, 2010).

Considering the fact that success of language learning and use highly relies on continuous engagement and speech processing, learning the second language poses an additional burden for ADHD-diagnosed children. Moreover, it has been reported that difficulties faced when speaking, listening, reading, and writing can negatively influence ADHD-diagnosed childrens' L2 learning behaviour as well (Nijakowska, 2010; Spear-Swerling & Owen-Brucker 2006). Although the existing research has focused on possible learning difficulties experienced by ADHD-diagnosed children in different domains, to the authors' knowledge, no empirical study has investigated their second language (L2) learning skills. Thus, the present study was set up to explore ADHD-diagnosed learners' L2 phonological, lexical, and syntactic learning skills as well as interactional behaviours.

Backgrounds and Objectives

Over the past few years, both L1 and L2 educators have contemplated the potential correlations between L1 and L2 proficiency and explored the link between learners' proficiency in their L1 and their ability to acquire L2 skills. Cummins (1979), in his linguistic interdependence hypothesis, admitted that language and literacy skills transfer to another language and proposed two hypotheses namely the threshold hypothesis and the interdependence hypothesis. Whereas the former states that if a learner's L1 competence is high, his/her L2 competence will also be high, and low L1 literacy skills predict limited L2 proficiency, the latter contends that language skills transfer from L1 to L2 when there is sufficient exposure to the L2 and high motivation to learn the L2 (Cummins, 1984).

Numerous studies supported Commins' (1984) interdependence hypothesis; in that L1 skills transfer to L2 learning, and learners with a high degree of L1 competence exhibit stronger L2 proficiency and achievement. Empirical research for this hypothesis reported that non-word decoding skills in English played a strong predictive role in L2 grammar, vocabulary, decoding, and reading comprehension among U.S. college students (Meschyan & Hernandez, 2002). In a longitudinal study done by İlerten (2021), the researcher examined the role of linguistic variables in the development of word reading and reading comprehension in 138 Turkish-Arabic bilingual children with the age range of 7-8. The researcher concluded that morphosyntactic awareness, L1 morphological and phonological awareness were the strongest predictors of the participants' word reading skill while vocabulary knowledge and phonological memory were the most powerful indicators of reading comprehension.

Further empirical evidence comes from Sparks and Ganschow's (1991) linguistic coding differences hypothesis, asserting that L2 skills are built on L1 skills. That is, any language-related problems with one skill (e.g., phonological processing) carry a negative impact on other (say second or third) language systems. In a recent study done by Van Koert et al. (2023), the researchers examined whether the differences in Dutch vocabulary and grammar skills predict differences in English grammatical proficiency in 9-year-old Dutch children in primary school. The results demonstrated that there was a strong positive correlation between word and grammar knowledge in L1 and English grammatical proficiency.

Additionally, Sparks et al. (2003) found that students with learning difficulties (hereafter LD) and ADHD show significantly lower achievement and L1 literacy skills and hypothesized that their L1 problems may affect L2 learning as well. In so doing, they compared two groups of students' performance classified as both LD/ADHD and LD only in L1 and L2 achievement. The results demonstrated that the LD/ADHD participants (i.e., participants who had passed L2 courses) scored significantly higher than the LD counterparts (i.e., participants with more L2 requirements) on reading, college entrance, and IQ measures. In another research, Sparks et al. (2005) compared a group of ADHD students who had fulfilled L2 requirements with LD and LD/ADHD students on academic achievement and L1 cognitive measures. The findings revealed slight between-group differences in L1 skills and yielded that all the groups' scores on the cognitive and achievement measures were above average range. To gain more insight, Sparks et al. (2008) compared varied cases including high-achieving, low-achieving, LD, and ADHD-affected students. The

results demonstrated that ADHD-affected learners who had average or better L1 skills showed stronger L2 phonological processing skills than LD learners, and did not differ from high-achieving learners on the L2 achievement tests (L2 word decoding and spelling measures).

While these studies may provide a sobering reaffirmation of the L1-L2 relationships, the authors believed that a closer examination of the role of cognitive and behavioural factors in L2 learning may be warranted. At the core of ADHD cognitive problems in L1 is phonological short-term memory capacity, which plays a crucial role in decoding sequences of sounds and associating them with words and their meanings (Kohonen, 1995; Service, 1992). Research findings have demonstrated that ADHD-affected children have a smaller short-term memory span for processing verbal and visuo-spatial information (Rapport et al., 2008), which may in turn influence the L2 learning process. Also, Thapar et al. (2013) suggested that ADHD students' poor language abilities are primary influenced by their working memory deficiency. Hence, impairment in individual learners' selective attention can intervene in the L2 learning process (Willcutt et al., 2005).

Although the existing research has been conducted on L2 performance of ADHD students, they left some important questions unanswered. First, the primary purpose of the previous research was to examine the correlation between L1 literary skills and L2 achievement. Second, the participants in these studies were not homogenous (e.g., LD and ADHD learners), which may not provide an in-depth analysis of ADHD students' L2 achievement and skills. Third, they mainly focused on the learning outcomes of ADHD children and overlooked their classroom interactions and behaviours during the learning process.

Inspired by the linguistic coding differences hypothesis and the existing cognitive and behavioural impairments among ADHD children, the present experimental research addressed their L2-related profiles, with a particular focus on phonological, lexical, and grammatical developments. The students' L2 learning performances and behaviours during L2 instruction were also observed and recorded. Therefore, the aim of this study was to address the following questions:

1. Is there any significant difference in L2 phonological, lexical, and syntactic skills of ADHD and non-diagnosed groups?

2. Does the ADHD group display similar classroom behaviours and interactional patterns to the normal group?

Materials and Methods

Design of the Study

This study employed a mixed methods quasi-experimental design (Creswell & Plano Clark 2007), which intended to explore possible L2 skills among ADHD-affected children. The authors first planned and implemented a quantitative design whereby the two experimental groups received L2 instructions. To have a true understanding of the learning process and provide additional information not provided by the quantitative data, the instructor (the second author) observed the participants' classroom activities and recorded learning behaviours using fieldnotes.

Participants and Instructional Context

Studies on learning disabilities (LD) and mental disorders often face challenges due to the restricted number of participants. This is because only a few institutions and clinical facilities are accessible or willing to collaborate in these research endeavours (Houghton et al., 2013; Lee et al., 2016). Furthermore, the frequent fluctuations in L1 characteristics within ADHD populations could be attributed to examining language deficiencies at different age ranges (Perani et al., 2003). To compensate for that, two age-matched groups of children at seven were selected: an ADHD group (10 males) and a non-ADHD (control) group (10 males). The two groups were beginners in English.

Both groups were recruited from a public primary school located in Kerman and spoke Persian as their L1. The experimental group consisted of 10 students diagnosed with ADHD according to Conner's (1999) criteria filled by their teachers. The non- ADHD participants were randomly selected from among the non-diagnosed population. The class met three times a week for 45 minutes per session (8 weeks, a total of 18 hours). Both groups received identical instructional treatments from the same instructor.

Instruments

Conners Rating Scale. Numerous experts have advocated utilizing behavioural observations and normative behavioural ratings for comprehensive evaluation of ADHD (e.g., Barkley, 1997; DuPaul & Stoner, 2003). In this respect, the Persian version of Conners' (1997) Rating Scales Revised–Short Form (Conners, 1997) was administered to the teachers after the participants met two criteria: (1) identifying ADHD diagnosis by a psychiatrist, and (2) displaying the pre-defined ADHD symptoms based on an interview with both parents and teachers. Twelve students who met the criteria were further rated by the short form of the teacher CTRS-R: S in which the 90th percentile cut-off scores were used to select the ADHD sample (Sullivan & Riccio, 2007). Ten ADHD students whose scores were above the 90th percentile cut-off scores were finally selected as the experimental group. The Persian version of the scale has been reported to have clinical validity with a high predictive value (0.85) to diagnose children with ADHD from children without ADHD (Alizadeh, 2005). CTRS-R: S has 28 items which require the instructor to rate the accuracy and severity of each item. It includes four scales: hyperactivity (i.e., impulsivity and restlessness), ADHD index (i.e., identifying children and adolescents at risk of ADHD diagnosis), cognitive problems/ inattention (i.e., difficulties related to inattention, disorganization, poor task completion, and academic struggles), and oppositional (i.e., having difficulty with authority, the tendency to break rules, and getting easily annoyed or angry). The respondents rate each item on a Likert scale of 0 (not true at all) to 3 (very much true). The reliability of the scale was acceptable following Cohen's criteria ($\alpha = .73$).

Intelligence. Although the established link between IQ and achievement seems an age-old debate, research findings suggest that psychometric intelligence predicts future achievement (see, Watkins et al., 2007). Hence, the groups were further assessed using Wechsler's (1991) Intelligence Scale for Children – (WISC-3, Third Revision). It is a 25-item scale with an acceptable reliability index in this study ($\alpha = .73$).

Observation and Field Notes. Group performances and behaviours, including questions answering, sharing opinions in class, trying out difficult (lexical) forms, participating in classroom activities, and doing in-class assignments were observed and recorded by the instructor in both classes. Then, the researchers studied the observed behaviours, elicited the patterns, and discussed the ambiguities until full consensus was achieved.

Ethical Consideration

Prior to the study, ethical approval for the experiment was obtained from the Ethics Review Committee on Human Research of the Ministry of Education (no. 1402/22). Moreover, the participants' parents gave their written consent after getting informed about the research.

Procedure

Choice of Target Items

Fourteen nouns, three adjectives, and nine verbs were chosen as the target items (TIs) from Let's Go II (Nakata et al., 2008). Five criteria guided the selection of the TIs: (1) The groups would know their L1 equivalents; (2) They were not present in the list of English loan words (to avoid the possibility of inferring the meaning); (3) The target nouns were concrete; (4) The adjectives were common descriptors of the target nouns; and (5) The grammatical rules were selected from the most frequent errors of Iranian L2 learners, which included word order (WO), subject-verb agreement (SVA), and number agreement (NA) (Nezami & Najafi, 2012).

Instructional Interventions

Although researchers have advocated for and against both component and whole-language approaches, there is no agreement on the best instructional approach. Because phonological, morphological, and syntactic deficits are mostly reported among ADHD-affected children, the instructional approaches targeted the underlying deficits associated with learning difficulties. Hence, two letters were taught per session by drawing the learners' attention to the relationship between the letters and sounds. To allow the students more exposure to the target sounds and letters, the activities contained combining the target sounds with flashcards and identifying the target letters in the learnt words.

Lexical instructional treatments were then offered through extensive exposure to the target words and sounds, where two words were taught explicitly per session. The assignments included distinguishing the learnt letters within each vocabulary for sound recall and roleplaying for the concrete verbs (e.g., run, laugh, sing, and jump).

Finally, the target structures were taught every three sessions through explicit rule explanation (e.g., add /s/ or /es/ to make a plural form) and iterated and practiced in other sessions. The assignments required the

students to make sentences for the individual pictures displayed on the slides. Target syntactic structures included word order, subject-verb agreement, and number agreement.

Testing Materials

To reduce test bias, both production and recognition tests were designed. All testing was completed in a quiet, familiar environment within the participants' school. The students took the tests one-on-one with the instructor.

Discrete-Item Production Test. The test involved naming individual target items on each slide. Four slides representing the words with initial red letters were used for the phonological production test, in which the participants had to produce red-coloured sounds. In the lexical production test, two-word sets consisting of four target words (both in L1 and L2) were chosen. The participants had to supply L2 equivalents for the first set and L1 equivalents for the second. Finally, in the syntactic production test, the participants made sentences for individual pictures presented on the slides. If a learner did not understand the question, the researcher switched to L1 and asked for the translation of the sentence.

Recognition Test. In the phonological recognition subtest, four slides with different sounds were shown and the individual participants were asked to identify the target sound. To assess the lexical recognition, four slides with three pictures were shown, where the researcher read out the target word and the participants chose the corresponding picture in the slides. Finally, two slides were used for the grammatical recognition test, in which the participants had to identify the pictures for plural and singular forms.

One point was awarded for each phonological, lexical, and syntactic item produced correctly. Moreover, half a point was awarded for lexical production answers that were too close to the correct answer (i.e. acceptable word method). The total possible score was 4 points for phonological production, 4 for phonological recognition, 8 for lexical production, 4 for lexical recognition, 6 for syntactic production, and 2 points for syntactic recognition.

Quantitative Results

Normality Test

To determine whether the sample data were from a normally distributed population, two tests of normality, namely the Kolmogorov-Smirnov Test and the Shapiro-Wilk test were utilised. As can be seen in Table 1, the data are normally distributed. In other words, the probabilities are greater than 0.05 (Rezaeyan et al., 2018).

Table 1. Multivariate normality test results

	Variables	Group	CR of Skewness	prob	CR of Kurtosis	prob
Production	Phonology	Normal	.224	.168	.911	.287
		ADHD	.241	.103	.855	.067
	Morphology	Normal	.142	.200	.966	.849
		ADHD	.124	.200	.966	.852
	Syntax	Normal	.158	.200	.942	.578

	Variables	Group	CR of Skewness	prob	CR of Kurtosis	prob
		ADHD	.073	.200	.995	1.000
Recognition	Phonology	Normal	.202	.200	.878	.124
		ADHD	.245	.090	.892	.177
	Morphology	Normal	.181	.200	.895	.191
		ADHD	.224	.168	.911	.287
	Syntax	Normal	.240	.107	.886	.152
		ADHD	.195	.200	.878	.124
	Intelligence	Normal	.229	.147	.919	.352
		ADHD	.150	.200	.940	.549
		Normal	.136	.200	.931	.455
		ADHD	.189	.200	.923	.385

Independent Samples T-test

An independent samples t-test was conducted to explore the mean differences between the two groups. Table 2 summarizes the mean percentages of the groups. As the table suggests, the non-diagnosed children outperformed the ADHD group on phonological production (M=2.70, SD=.94), lexical production (M=5.40, SD=1.59), syntactic production (M=4.50, SD=1.22), phonological recognition (M=2.70, SD=1.16), lexical recognition (M=2.80, SD=1.03), and syntactic recognition (M=1.90, SD=.99) measures.

Table 2. Group Statistics

	Variables	Group	N	Mean	Std. Deviation	Std. Error Mean
Production	Phonology	Normal	10	2.70	.94	.30
		ADHD	10	2.10	1.10	.34
	Morphology	Normal	10	5.40	1.59	.50
		ADHD	10	4.60	1.66	.52
	Syntax	Normal	10	4.50	1.22	.38
		ADHD	10	3.20	1.78	.56
Recognition	Phonology	Normal	10	2.70	1.16	.36
		ADHD	10	1.60	1.07	.34
	Morphology	Normal	10	2.80	1.03	.33
		ADHD	10	2.70	.94	.36
	Syntax	Normal	10	1.90	.99	.31
		ADHD	10	1.60	1.17	. .37

As Table 3 suggests, the ADHD (M = 113.29) and normal (M = 111.80) groups were not significantly different in learning motivation (t = .29, p =.774). Similarly, it was indicated that the ADHD (M =92.00) and normal (M = 95.70) groups were homogeneous in terms of intelligence (t = .80, p =.433).

Table 3.Independent samples T-test

Parameters	F	t	p-value
Intelligence	.58	.80	.433
Motivation	.1.38	.29	.774

Table 4 determines whether there is statistical evidence to support the observed differences between the two participating groups. As illustrated, the groups comparisons yielded a significant difference in phonological recognition domain (t= 2.20, p < .05). It implies that the instruction has been equally effective for both groups' phonological production (t= 1.30, p > .05), lexical production (t= 1.09, p > .05), syntactic production (t= 1.90, p > .05), lexical recognition (t= .22, p > .05), and syntactic recognition (t= .61, p > .05).

Table 4. Independent samples T-test

	Parameters	F	t	p-value
Production	Phonology	.484	1.30	.208
	Morphology	.003	1.09	.287
	Syntax	1.15	1.90	.073
Recognition	Phonology	.104	2.20	.041
	Morphology	.118	.22	.824
	Syntax	1.45	.61	.545

Qualitative Results

Some behavioural patterns were detected which were unique to the ADHD group. When new words were introduced by the instructor, they became actively engaged in finding assimilated words in their L1. For instance, when the word */knife/* was introduced, one of the students used the assimilated word */naf/* (pronounced as */næf/*) from his L1. Another example is their use of the Persian word */lamp/* (pronounced as */læmp/*) for the word */jump/*. This technique enabled ADHD group to become more engaged in answering questions. These patterns confirm that peer tutoring is an effective academic treatment for ADHD students in school settings (Raggi & Chronis, 2006).

Further analyses also indicated that whenever the instructor introduced the target words in L1, they tried out some different L2 forms. Below is an example of providing different forms after introducing the word *yellow*:

Student 1: *What is zard (pronounced as /Zærd/) in English?*
Student 2: *Pero…pero… I know its pre…pra… prar.*
Student 1: *What we call it? It is ogh… ool.*
Student 2: *Ogh.*
Instructor: *Yellow.*
Student 1: *Yellow.*
Student 2: *Yellow… Ye…le…o.*
Student 1: *Ye…le…o.*

There is also an instance in which ADHD students provided attuned assistance to each other to co-construct knowledge. Such an assistant can be inferred from the following excerpt in which the instructor is introducing a new word:

Instructor: *Look… it starts with /L/.*
Student 1: *Le… lebi… lebi… what is it?*
Instructor: *Leg.*
Student 2: *Le… ab… ab.*
Student 3: *Why leg?*
Student 2: *Del? Lig?*
Student 1: *Leg… leg… like lagan (pronounced as /lægæn/).*
Student 2: *Like lajan (pronounced as /lædʒæn/)… like lajankhar (pronounced as /lædʒænzar/.*

In sum, the analysis of ADHD-affected learners' behaviours in peer interaction activities accurately reflected how much they were willing to be more active and cooperative. Therefore, irrespective of their learning and attention deficits, the observation revealed that the collaborative tendency of the ADHD children was higher than that in the normal group.

Discussion

The purpose of the present comparative study was to explore possible L2-related behaviours of ADHD-affected children. The ADHD group demonstrated a different L2 developmental pattern from the normal group. The results are discussed concerning the L1 deficiencies and learning disabilities of ADHD individuals already documented in the literature.

Regarding L2 phonological development, the results demonstrated poor performance of the ADHD group in both phonological recognition and production tests and the only significant between-group difference was found in the phonological recognition domain. Whereas ADHD-affected children obtained lower scores than the control group in the phonological recognition test, their performance in phonological production was not significantly different. The results are congruent with the L2 studies which have found considerable difficulties in speech perception among language-impaired children (Vaughn et al., 2007). As highlighted by Vaughn et al. (2007), since high percentage of ADHD-affected children face speech processing difficulties, acquiring the second language poses an additional burden for these children. Therefore, one possible reason for the ADHD-affected participants' poor performance in phonological recognition test could be difficulties in speech processing due to dysfunction in their nervous system (Liontou, 2019).

Although there were no significant differences between the groups in terms of lexis and syntax, the ADHD group underperformed their normal peers in both lexical and syntactic tests. The existing phonological processing and lexical and syntactic differences among the groups can be interpreted in light of mapping theory. According to mapping theory lexical and syntactic developments heavily rely on phonological information being presented in an accurate way (Chiat,

2001). Hence, the findings confirm previous research findings which underscored the quality of phonological representation on other aspects of language (Chiat, 2001; Joanisse & Seidenberg, 1998). Nevertheless, the participants' struggle to segment the speech they heard and associate the meanings of the individual words underscores the importance of L2 phonological processing skills in enhancing lexical and syntactic skills.

Concerning the overall weak performance of the ADHD group, the results are consistent with the L1 findings reporting all types of language deficiencies. As mentioned before, ADHD-related symptoms might be responsible for both L1 and L2 deficits. In particular, research has recognized impulsivity and inattention as the major predictor of their L1 difficulties (e.g., Geurts & Embrechts, 2008). It is thus plausible to consider impulsivity as one reason for their L2 poor performance. ADHD-diagnosed children, according to Clauss-Ehlers (2010), may be extremely distractible, impulsive, and unable to remain concentrated for a long time on a specific task. Also, it is believed that not everything L2 learners are exposed to will be acquired, and that input alone is not a sufficient condition for L2 development. In other words, some degree of attention and noticing is required for successful L2 acquisition (Ellis, 2001; Rezaeyan & Gimeno Sanz, 2023; Smith, 1993). Therefore, ADHD-affected participants' poor performance can be attributed to impulsivity and their inability in sustained attention (Clauss-Ehlers, 2010; Zentall, 1993).

Respecting the in-class behaviours and interactional tendencies of the groups, a shared behaviour was identified: both groups were almost equally engaged in classroom interactions. That is, ADHD children showed an equal (or even more) tendency towards task completion as their non-diagnosed peers. Such a finding aligns with Junod et al. (2006)'s study which reported that ADHD children in Grades 1 up to 4 demonstrated the same tendency toward active task engagement as their normal peers.

Conclusion and Implications

Since the present study is a pioneering experiment on L2 profiles of ADHD children, one should be cautious in generalizing the findings. Perhaps the most intriguing finding is that there were no striking L2-related differences between ADHD students and the normal ones. L2 educators and disability service providers need to realize that ADHD students may do fairly well in L2 learning despite their oft-recorded learning disabilities. This indicates that L2 instructors should focus on effective tasks and strategies for teaching language skills to ADHD students and provide a safe and desirable environment in which they develop a positive attitude toward L2 learning.

The study has also documented the ADHD group's phonological recognition impairment, which needs to be considered in goal setting and intervention planning for these children. L2 instructors should employ diverse tasks and activities to facilitate their phonological awareness. Among them

are hybrid activities like oral narrative, storybook reading, and drill-based games which can be employed as remedial phonological enhancement techniques in L2 learning.

Author Contributions

Masoud Sharififar: Conceptualization, Methodology, Supervision, Software, Writing - Review & Editing. Mahshid Rezaeyan: Writing - Original Draft, Project administration, Investigation, Formal analysis.

Data Availability Statement

Not applicable.

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Ethical considerations

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Conflict of interest

The authors declare no conflicts of interest.

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