Atouf, N.,& Harrizi, M. (2022). The effects of an on-line reading intervention on the development of English decoding skills among Moroccan adult struggling readers, *The international journal of applied language studies and culture (IJALSC), 5*(2), https://doi.org/10.34301/alsc.v5i2.36

THE EFFECTS OF AN ON-LINE READING INTERVENTION ON THE DEVELOPMENT OF ENGLISH DECODING SKILLS AMONG MOROCCAN ADULT STRUGGLING READERS

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Abstract. The present study examines the role of an intensive phonics-based online reading program in developing decoding skills among a group of low-intermediate adult learners. All the participants taking part in this experiment are defined as low-level, or struggling, readers. A lexical-decision task is administered to a total of twenty-four students divided into two main groups: treatment and control groups. The administration of the computer-based test is twofold and is done over two main phases: pre- and post-intervention. The online reading intervention, which is tailored to cover English orthographic knowledge and sound processing of high and low frequency words, is exclusively designed for the experimental group for four weeks. The intervention group demonstrates a significant improvement in spelling skills, reading speed and phoneme awareness. The results, on the one hand, suggest the importance of L2 print exposure which fosters phonological processing skills. On the other hand, the findings show that word identification processes operate at a pre-lexical access stage and are rudimentary to recognize and activate a lexical item.

Keywords: *Decoding, Intervention program, orthographic knowledge, phonological processing, word identification.*

Introduction

With the shift to online instruction during the looming widespread of Covid-19, there has been a growing need to find optimal ways to cope with reading difficulties, especially among EFL adult population. In most EFL traditional classes, teachers often tend to check the reading development of their students throughout the use of certain comprehension strategies (making inferences, text completion, argumentations, to name but a few). The focus on readers' background knowledge is remarkably followed by an inability to process written code by means of basic decoding skills. Failure to decode the phonemes and their corresponding graphemes results in comprehension deficiency (Holmes, 2009; Jiang, 2018). To address this issue, reading intervention programs are useful tools to help below-average readers, even at an advanced age, improve their literacy skills. In light of the increasing number of online classes, under the current circumstances, devising specialized online interventions may very well be a prominently efficient alternative to in-person instruction and progress monitoring.

Readding Models

Reading is defined as a complex cognitive skill which entails an intricate interplay between adequate lower- and higher-level processes (Nassaji,2014; Grabe,2012; Martin,2017). Reading fluency is inextricably interrelated with the readers' ability to convert printed (or orthographic) information into phonological constituents which in turn predict comprehension (Liu, 2010; Holmes, 2009; Helland et al., 2011; Fatemi, Vahedi, & Sayyedrezaie, 2014; Suraprajit, 2019; Zhang et al., 2021). Higher-level processes, also known as text-level skills, includes reading comprehension strategies and subskills such as making predictions, skimming, and activating background knowledge, etc. (Jiang, 2017; Yamashita, 2013).

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The bottom-up approach looks at reading as rigorously consisting of phases starting from early analysis of graphic symbols and their phonemic counterparts (Nassaji, 2014; Liu, 2010; Holmes, 2009). Orthographic knowledge, a subcomponent of lower-level abilities, involves assigning each grapheme a corresponding sound, identifying phonemic units, combining the sound segments to form words and phrases, and eventually activating the semantic representations of the text in a sequential fashion (Nassaji, 2003; Yamashita, 2013). While the bottom-up model pays little attention to comprehension processes, it accentuates the major role of decoding skills that function by virtue of graphophonic word-level parameters, namely orthographic and phonological processing. The last two terms, basically making up the bulk of the ongoing research paper, are underlined in detail here.

Contrary to visual word-recognition conceptual framework, the psycholinguistic reading model puts much emphasis on the contributions of higher-level processes. Reading, from a top-down standpoint, is conceptualized as a guessing game where readers employ a number of inferential strategies, critical thinking skills, jigsaw reading techniques in order to extract meaning from the text (Nassaji, 2014; Liu, 2010; Holmes, 2009). In this vein, the significance of word analysis is systematically downgraded. Individual differences in reading ability are measured by higher-level sources. In other words, print processing is highly contingent upon semantic as well as syntactic cues rather than automatic word decoding, reflected in the letter-to-sound correspondences assumption (Nassaji & Geva 1999; Colteheart et al., 1979).

Finally, and prior to highlighting research studies that track down the stages of L2 word reading, we find it incumbent upon us to acknowledge that both views interact to improve comprehension (Holmes, 2009). The interactive model brings both lower-and higher-level components together in the attempt to reach the goal of reading-comprehension (Nassaji, 2014; Perfetti, 2007; Brenznitz, 2006). In what follows, the discussion is solely confined to research body casting the light on the relationship between lower-level processes and L2 reading.

Lower-level Processes in L2 Reading

Even though L2 readers may not have adequate vocabulary and grammar rules, adept manipulation of linguistic units facilitates the reading process (Mulder et al., 2021). Efficient L2 reading is undoubtedly the outcome of readers' ability to distinguish sounds and graphic segments, use spelling rules correctly, and recognize morphemes and syllables in words. These lower-level processes, already experienced by learners while striving to read in L1, may equally account for the development of L2 literacy practices later. Since the process of learning to read is pretty much the same in all languages, L2 readers tap into their knowledge of L1 reading abilities to decipher and comprehend written code (Nassaji 2011, 2014). The focus here, nonetheless, is far from merely drawing cross-linguistic comparisons, but the interest of the current study rather inheres in the multiple contributions of word analysis skills in L2 reading.

To begin with, let us provide a cogently terse description of the two central elements embedded within lower-level processes, videlicet, orthographic, and phonological processing. Orthographic processing is the capacity to observe how letters are joined together to form words. Simply put, orthographic processing occurs when readers visually recognize letters as unified symbols (Fender, 2003, 2008; Nassaji, 2014). Research shows that L2 reading fluency is grossly ascribed to the appropriate use of conventional spelling regularities (Abu Rabia, 2014; Houlis et al,.2019). That is, Skilled reading is endowed with quick and accurate print processing when retrieval of visual orthographic information is triggered by efficient mastery of rule-governed spelling forms (Fender, 2003).

Like orthographic processing, readers rely on phonological information, the pronunciation form of consonants and vowels alike, to process graphemes particularly while reading in an alphabetic script (Van Orden & Cloos, 2008; Martin, 2017). As a matter of fact, phonological processing skills impose theoretical and methodological issues because they are inevitably intertwined within the scheme of orthography. Evidence coming from a proliferative body of research in the literature, however, indicates the independent nature of sound decoding from that of spelling skills in L2 reading (Burt, 2006). The ability to sound out the minimal linguistic units is believed to be critical for the development of normal reading (Goswami, 2000; Hulme et al.,2005). In this line of research, phonological processing is viewed as comprising three integral cognitive abilities: phonological awareness (identifying and manipulating speech sound), phonological decoding (phonologically realizing print information), and phonological recoding

(retrieving meaning from the mental lexicon based on phonological units).

Many L2 reading research studies build upon findings that reveal strong relationships between lower-level processes and enhanced reading. The Phonological awareness (PA) skill, for instance, is found to be a predictor of word recognition among L2 readers (Chiappe et al., 2002; Lesaux & Siegel 2003; Netten, Droop & Verhoeven, 2011; Russak & Saiegh-Haddad 2011). Further, in an innovative study on the impact of L2 reading intervention on L1 literacy skills, Abu Rabia reported positive correlations between PA and reading ability (Abu Rabia & Shakkour, 2014). Fender (2003), in his comparative study on the performance of Arabic and Japanese subjects over a lexical decision task, concluded that Arabic learners excessively resorted to phonology to decode English words due to L1 alphabetic mapping principle. Because Arabic is featured by a shallow orthography, i.e., letters and sounds are highly consistent, Arab participants failed to successfully read English words. Fender's study implied that L2 word recognition sprang from accurate phonological decoding and that disparities attested at the level of script could be handled by extensive exposure of L2 print.

Word Recognition and Spelling

Word recognition skills are linked to reading proficiency and refer to the rapid identification of individual words (Han, 2015; Martin, 2017; Jiang, 2018). Both L1 and L2 reading research contend that word recognition is the process of identifying familiar letter clusters as whole units (Torgeson, Wagner & Rashotte, 1999; Jiang, 2018). Two mechanisms, which revolve around solid orthographic skills, are utilized to identify words: word sub-forms (derivational as well as inflectional morphemes) and sight words (letter combinations recognized with relative ease and automaticity). Meanwhile, reading low-frequency and unfamiliar words presupposes matching letters to their analogous sounds (Zeigler & Goswami, 2005). It stands to reasons that graphophonic processes are crucial to word recognition, which is argued to be a precursor of reading fluency and comprehension (Abu Rabia & Danon, 2012; Nassaji & Geva, 1999; Jiang, 2018).

Analogous to word recognition, spelling involves lower word-level processes (Jiang, 2018). To attain a high level of spelling skills, readers are required to manipulate and play with different linguistic units namely complex morphological forms as well as phonemes accordingly (Ehri, 2000). The Lexical Quality Hypothesis (Perfetti & Hart, 2001) defines three constituents of words (orthographic, phonological, and semantic components). According to the Lexical Quality Hypothesis, word recognition is enhanced once readers establish the connection between spelling representations and their relevant phonological and semantic properties (Perfetti & Hart, 2001; Martin,2017 Jiang, 2018). Learning how words are spelt is, therefore, conducive to exemplary word identification (Berninger et al., 2002; Burt & Tate, 2002; Caravoles, Hulme, & Snowling, 2001; Perfetti & Hart, 2001; Martinez et al., 2021).

Lexical access seems to operate at a phonological level when the orthography entails a direct relationship between letters and their phonemic counterparts (Abu Rabia & Shakkour, 2014; Koda & Reddy, 2008). Lexical access underpinned by phonology fails when words are characterized by irregular spelling patterns. In such case, recognition is largely based on interventions, word-frequency, and word length (Nassaji, 2014). For instance, studies examining the impact of instruction on decoding and spelling indicate positive improvements in overall phonemic awareness skills, decoding, word fluency and comprehension (Weiser & Mathes, 2011; Helland, Heimann, &Tjus, 2011). Differentiated instruction may very well boost readers' awareness of lower-level literacy skills (Jiang, 2018).

It is within the precepts of the research body underlined in the above section that the present paper is located. In this study, we seek to investigate the occurrence of possible correlations between developed lower-level processes and word recognition in English as a result of an online phonic program. Much attention is paid to the contribution of fostered orthographic and phonological processing abilities to accurate and rapid decoding of words. Less attention is paid to the role of word recognition skills in comprehension for two reasons. First, comprehension starts from a bottom-up layer that stresses the role of graphophonic skills in the process of learning to read. Second, this research paper is part of a longitudinal study that digs into the influence of L2 print exposure and practice on developing the major components of reading including comprehension.

Materials and Method

The research population includes a sample of (60% female and 40% male) twenty-four Moroccan EFL students split into two major groups: control and experimental groups. All the participants come from a middle socio-economic level. They are adult learners operating within A2 CEFR level (equivalent to pre-intermediate level) at the American Language Center El Jadida, Morocco. The selection process was based on the students' performance scores in different reading tasks as well as their English level which is reckoned to be below average. All the participants are ipso facto defined by their teacher, also the experimenter, as struggling readers.

Procedure

A lexical decision task was administered to each individual participant in a quiet room and in-person (Appendix 1). The administration took place in a rotated order and lasted for two sessions spread over two days. One computer was used given the small-size sample. Before starting the test, the experimenter provided verbal and printed instructions in Arabic to ensure understanding. The lexical decision was controlled by the DMDX program software (Froster & Froster, 2003), in which lexical items were displayed on the computer screen.

There was a total of 60 words divided into two main categories: (1) English real words (words that follow correct consistent and inconsistent spelling patterns such as MEAT/heat and DONE/bone) (2) English non-words, pseudo-words, (words that do not exist but follow a consistent and inconsistent spelling pattern, e.g., PHINT/hint; *ZOW/kow). The participants were guided to make a response using the computer keyboard. For real words, the subjects' correct answers were determined by a swift pressing of the right shift key (yes-answers). For non-words, correct responses were made by pressing the left shift key (no-answers).

The subjects had 2s or less to make their decisions before the next stimulus appeared on the screen. Time out responses, literally making no decision, occurred when the 2s elapsed. By and large, the task took three to five minutes in case technical issues were brought up. Upon completion of the test, DMDX asked the cohorts to save the data. The results of the lexical decision task in this phase were especially important in establishing a baseline for comparison with the participants' scores obtained at the end of the intervention program, which was exclusively designed for the intervention group.

A virtual platform with appropriate features was chosen to hold the online classes. The materials such as the supporting cards and the worksheets were thus distributed in soft copies via e-mails before the commencement of the intervention. The phonics program consisted of four tiers: 1. consonants; 2. Long/short vowels; 3. spelling rules; 4. sight words (Appendix 2). The program was roughly an expansion of Knight's "Inspire a life of reading" and "Teaching English Spelling" by Ruth Shemesh and Sheila Waller (Knight, 2005; Shemesh & Waller,2011). As to the time framework, the intensive online intervention lasted for a month with classes of 90 minutes taking place three times a week. By the end of the scheduled lessons, both control and intervention groups took the same lexical decision test.

Results

To test the validity of the ongoing research paper's hypotheses (i.e., extensive exposure and practice of lower-level processes through delivering a phonic-based intervention in English would bring about an improvement in word decoding skills) a descriptive analysis was conducted to verify data and the general performance of both groups on the lexical decision task before and after the intervention program. Time out responses were excluded from the analysis. Table 1 and 2 show the frequency of responses made regarding correct and incorrect trials before and after the end of the intervention program accordingly:

Table 1: Cor & Inc Responses_Before Intervention

Groups		*Frequency*	*Percentage*
Control Group	Incorrect Answers	524	74%
	Correct Answers	184	26%
	Total	708	100%
Intervention Group	Incorrect Answers	446	63%
	Correct Answers	262	37%
	Total	708	100%

Table 2: Cor &_Inc Responses_After Intervention

Groups		*Frequency*	*Percentage*
Control Group	Incorrect Answers	437	62%
	Correct Answers	271	38%
	Total	708	100%
Intervention Group	Incorrect Answers	208	29%
	Correct Answers	500	71%
	Total	708	100%

To check for any statistically significant difference in the test performance of both groups, Response Times were compared by means of a paired-samples t-test. For the record, in psycholinguistic experiments, response times are interchangeably known as reaction times (RTs). The values presented in table 3 show the means and standard deviations of the response times before and after the intervention:

Table 3: means and standard deviations of RTs before and after intr.

Groups	*Response Times*	*N*	*Means*	*SD*
Control Group	RTs_bef	707	547,5036	9,34527
	RTs_aft	708	548,7224	6,1075
Intervention Group	RTs_bef	708	599,3478	7,0255
	RTs_aft	708	617,1046	5,30191

Findings

Both groups did not do well on the judgement task before the intervention. Only 26% of correct answers were recorded for the control group, while 37% of correct trials described the overall achievement of the intervention group (see Table1). However, the post-intervention test results demonstrate a significant improvement in the lexical decision for the intervention group -- 70% of valid correct trials (see table 2). In table 4, the data presented point to the correct and incorrect responses of both non-words and existing English words. As shown, the experimental group outperformed its counterpart as the post-intervention test results indicate an outstanding development in orthographic and spelling knowledge skills (64% of correct decisions over non-English words and 76% of correct trials on real words). The percentage scores imply that the intervention program targeting basic English spelling conventions of consistent and inconsistent words had a positive effect on the performance of the intervention group on the word recognition task compared to the control group's results which remained stagnant (error rate of incorrect trials over non-words was 65%. An error rate of 57% was also recorded about incorrect answers upon judging real English words):

Table 4: non-words incorrect trials Inc_NW; non-words correct trials C_NW; real words incorrect trials Inc_RW; real words correct trials C_RW

Groups (post-intervention results)		*Cor vs. Inc trials over non words and real words*	*Frequency*	*Percentage*
Control Group	English non-words	INC_NW	236	65,60%
		C_NW	124	34,40%
		Total	360	100%
	English real words	C_NW	1	0,30%
		INC_RW	200	57,50%
		C_RW	147	42,20%
		Total	348	100,00%
Intervention Group	English non-words	INC_NW	127	35,30%
		C_NW	233	64,7
		Total	360	100
	English real words	INC_RW	81	23,3
		C_RW	267	76,7
		Total	348	100

Similarly, statistical significance was attested at the level of boosted response times. There was no significance in the mean scores of the control group as far as reaction times were concerned (P<0,56 before intervention; p<0,65 after intervention). However, as we observe from table 5 below, the mean scores for the response time in the intervention group are relatively significant especially when reading real words (M=588 ms before intervention/ M=577 ms after intervention; p<0,3).

This means that reading speed positively changed as the subjects responded quickly and accurately to stimuli items. Another important element demonstrated by the intervention group post-test results is the mean score of recognizing non-words both before and after the program (M=610 ms bef./M=655 ms aft.; p<0,00). In lexical decision tasks, the NO Latencies mark the use of phonological processing to identify ill-spelt words that adhere to a certain orthographic rule (readable pseudo-words in this context). Therefore, the subjects, by taking more time to make a response to lexical items, phonologically realized the irregularity of the words presented:

Table 5: Mean scores, standard deviations, and P value of RTs before and after intervention

Groups			*Mean*	*Standard Dev.*	*p_value*
Control Group	English non-words	RTs_bef	555,4371	13,26077	0,569
		RTs_aft	563,9654	8,67607	
	English real words	RTs_bef	539,273	13,16832	0,657
		RTs_aft	532,7388	8,54537	
Intervention Group	English non-words	RTs_bef	610,187	10,3086	0,000
		RTs_aft	655,3926	7,30024	
	English real words	RTs_bef	588,1349	9,49479	0,308
		RTs_aft	577,4964	7,11287	

Discussions

The present study scrutinized the development of basic grapho-phonic skills because of an online reading intervention program. The findings, as delineated in the previous section, revealed that improved orthographic processing, spelling knowledge and phonological awareness are precursors of rapid and accurate word identification which was measured by the lexical decision task. This study also revealed a strong correlation between orthographic processing and automatic word recognition especially when reading consistent high-frequency words. Subsequently, reading speed increasingly improved as the participants read words with direct letter-sound correspondences (Fender, 2003; Jiang, 2018).

On the one hand, reading unfamiliar words excessively relied on phonological processing, more particularly with non-words that sounded like real words (i.e., words that are unreal but follow a certain English spelling pattern). On the other hand, the lexical decision task showcased that the reading speed was affected when the subjects correctly judged pseudo words. The more words were familiar and consistently spelt, the more participants used orthographic processing skills to decode words (Jiang, 2018). The more words were unfamiliar and quaint, the more participants used phonological processing skills and the more time they took before making correct decisions. Therefore, we can say that orthographic knowledge strongly correlated with reading fluency more than phonological processing.

Recommendations and Future Research

Word integration, which measures the ability to integrate read words into long structures, is an ideal follow-up to a word recognition task. Under a comprehensive reading model, future research may delve into the various relationships between decoding skills (orthographic, phonological, and semantic sources) and integrating words into sentential contexts. Moreover, and given the fact that reading skills can be transferrable across languages (Abu Rabia & Shakkour, 2014), especially languages with alphabetic scripts, researchers are invited to check whether improved reading abilities from one language to another transfer irrespective of the direction, i.e., from L1 to L2 or vice versa.

Research Limitations

This experimental study has some limitations. First, the hypotheses were tested

over a small-size research sample. A large population sample would have yielded more representative findings. Second, the number of stimuli presented in the lexical decision task was not sufficient; it should be extended taking into consideration such variables as low-frequency and vocabulary size. Additionally, there was no guarantee that the acquired skills would be maintained in the long run. This study did not provide tools to monitor progress and retention after taking the reinforced reading lessons. Finally, and in order to scrutinize the role of phonology in word identification, researchers usually devise homophonic and non-homophonic pairs to detect phonological processing skills in silent reading. However, in this experiment, only single words were presented one by one.

Conclusion

The present study explores the contribution of an online intervention program in developing decoding skills among learners with reading difficulties. The administration of the phonics intervention brought about a remarkable development of decoding skills as well as reading speed. Lower-level processes, namely orthographic processing and phonological processing, are important in the access and retrieval of lexical items, thus facilitating word recognition.

Acknowledgments

We would like to wholeheartedly thank Mr. Robert Barns, the former Director of the American Language Center El Jadida, for putting the testing room at the disposal of the experimenters. The help he provided to urge students to be committed throughout the online reading intervention was so significant in the completion of this study. Our thanks are also extended to Professor Ayoub Lotfi for taking the time to proofread and give annotated constructive feedback.

References

Abu-Rabia, S. & Bluestein-Danon, D. (2012). A Study into the Results of an Intervention Program of Linguistic Skills in English (L2) and Its Effect on Hebrew (L1) among Poor Readers: An Examination of the Cognitive-Retroactive Transfer (CRT) Hypothesis. Open Journal of Modern Linguistics, 2, 131-139. doi: 10.4236/ojml.2012.24017.

Abu-Rabia S. & Shakkour W. (2014). Cognitive retroactive transfer (crt) of language skills among trilingual arabic-hebrew and english learners. Open Journal of Modern Linguistics 1–20. https://doi.org/10.4236/ojml.2014.41001

Breznitz Z. (2013). Fluency in reading : synchronization of processes. Routledge.

Berninger V. W. Abbott R. D. Abbott S. P. Graham S. & Richards T. (n.d.). Writing and reading: connections between language by hand and language by eye. Journal of Learning Disabilities 39–56. https://doi.org/10.1177/0022219402035001O4.

Burt J. S. & Tate H. (2002). Does a reading lexicon provide orthographic representations for spelling? Journal of Memory and Language 20020401.

Burt J. S. (2006). What is orthographic processing skill and how does it relate to word identification in reading? Journal of Research in Reading 400–417.

Caravolas Markéta Hulme C. & Snowling M. J. (n.d.). The foundations of spelling ability: evidence from a 3-year longitudinal study. Journal of Memory and Language 751–774. https://doi.org/10.1006/jmla.2000.2785

Chiappe P. Siegel L. S. & Wade-Woolley L. (2002). Linguistic diversity and the development of reading skills: a longitudinal study. Scientific Studies of Reading 369–400.

Coltheart M. Besner D. Jonasson J. T. & Davelaar E. (1979). Phonological encoding in the lexical decision task. Quarterly Journal of Experimental Psychology 489–507. https://doi.org/10.1080/14640747908400741.

Ehri L. C. (2000). Learning to read and learning to spell: two sides of a coin. Topics in Language Disorders 19–36.

Fatemi A. H. Vahedi V. S. & Seyyedrezaie Z. S. (n.d.). The effects of top-down/bottom-up processing and field-dependent/field-independent cognitive style on iranian efl learners' reading comprehension. Theory and Practice in Language Studies 686–693. https://doi.org/10.4304/tpls.4.4.686-693.

Fender M. (n.d.). English word recognition and word integration skills of native arabic- and japanese-speaking learners of english as a second language. Applied Psycholinguistics 289–315. https://doi.org/10.1017/S014271640300016X.

Fender M. (n.d.). Spelling knowledge and reading development: insights from arab esl learners. Reading in a Foreign Language 19–42.

Forster K. I. & Forster J. C. (2003). Dmdx: a windows display program with millisecond accuracy. Behavior Research Methods Instruments & Computers 116–124. https://doi.org/10.3758/BF03195503.

Goswami U. (2000). Phonological representations reading development and dyslexia: towards a cross-linguistic theoretical framework. Dyslexia 133–151.

Grabe W. (2009). Reading in a second language : moving from theory to practice. Cambridge University Press.

Han F. (2015). Word recognition research in foreign language reading : a systematic review. University of Sydney Papers in Tesol 57–91.

Hale J. B. Fuchs D. Helland T. Tjus T. Hovden M. Ofte S. & Heimann M. (2011). Effects of bottom-up and top-down intervention principles in emergent literacy in children at risk of developmental dyslexia: a longitudinal study. Journal

of Learning Disabilities 105–122. https://doi.org/10.1177/0022219410391188.

Holmes V. M. (2009). Bottom-up processing and reading comprehension in experienced adult readers. Journal of Research in Reading 309–326.

Houlis K. Hogben J. H. Visser T. Ohan J. L. Anderson M. & Heath S. M. (2019). "zooming in" on orthographic knowledge to clarify the relationship between rapid automatised naming (ran) and word reading. Learning and Individual Differences. https://doi.org/10.1016/j.lindif.2019.101756.

Hulme C. Snowling M. Caravolas M. & Carroll J. (2005). Phonological skills are (probably) one cause of success in learning to read: a comment on castles and coltheart. Scientific Studies of Reading 351–365.

Jiang X. (2017). Lower-level processing skills in english-as-a-second-language reading comprehension: possible influence of first language orthography. Studies in English Language Teaching 448–448. https://doi.org/10.22158/selt.v5n3p448.

Jiang X. (2018). English spelling knowledge and word reading skills of arabic and japanese esl learners. Studies in English Language Teaching 186–186.

Knight C. S. Adult basic skills professional development project Appalachian State University & North Carolina Community College System. (2004). Inspire a life of reading : lesson plans to engage adult beginning readers. Appalachian State University ; North Carolina Community College System.

Koda K. & Reddy P. (n.d.). Cross-linguistic transfer in second language reading. Language Teaching 497–508. https://doi.org/10.1017/S0261444808005211.

Lesaux N. K. & Siegel L. S. (2003). The development of reading in children who speak english as a second language. Developmental Psychology 1005–1019.

Liu F. (2010). Reading abilities and strategies: a short introduction. International Education Studies 153–157.

Martin K. I. (2017). The impact of l1 writing system on esl knowledge of vowel and consonant spellings. Reading and Writing : An Interdisciplinary Journal 279–298.

Martinez D. Georgiou G. K. Inoue T. Falcón A. & Parrila R. (2021). How does rapid automatized naming influence orthographic knowledge? Journal of Experimental Child Psychology. https://doi.org/10.1016/j.jecp.2020.105064.

Mulder E. van de Ven M. Segers E. Krepel A. de Bree E. H. van der Maas H. de Jong P. F. Verhoeven L. Engelse taalkunde & Leerstoel L. (n.d.). Serious game-based word-to-text integration intervention effects in english as a second language. Contemporary Educational Psychology.

Nassaji H. (2003). Higher-level and lower-level text processing skills in advanced esl reading comprehension. The Modern Language Journal 261–276.

Nassaji H. & GEVA E. (n.d.). The contribution of phonological and orthographic processing skills to adult eslreading: evidence from native speakers of farsi. Applied Psycholinguistics 241–267. https://doi.org/10.1017/S0142716499002040.

Nassaji H. (2011). Issues in second-language reading: implications for acquisition and instruction. Reading Research Quarterly 173–184.

Nassaji H. (n.d.). The role and importance of lower-level processes in second language reading. Language Teaching 1–37. https://doi.org/10.1017/S0261444813000396.

Netten A. Droop M. & Verhoeven L. (2011). Predictors of reading literacy for first and second language learners. Reading and Writing: An Interdisciplinary Journal 413–425.

Perfetti C. A. & Hart L. (2001). In The lexical basis of comprehension skill. essay Gorfein David S. https://doi.org/10.1037/10459-004

Perfetti C. (2007). Reading ability: lexical quality to comprehension. Scientific Studies of Reading 357–383.

Russak S. & Saiegh-haddad E. (n.d.). Phonological awareness in hebrew (l1) and english (l2) in normal and disabled readers. Reading and Writing 427–442.

Shemesh R. Waller S. & Ur P. (2011). Teaching english spelling : a practical guide (9th print). Cambridge University Press.

Suraprajit P. (n.d.). Bottom-up vs top-down model: the perception of reading strategies among thai university students. Journal of Language Teaching and Research 454–460. https://doi.org/10.17507/jltr.1003.07.

Torgesen J. K. Wagner R. K. & Rashotte C. A. (1999). Towre test of word reading efficiency : examiner's manual. PRO-ED.

Van Orden G. C. & Kloos H. (2008). The science of reading: a handbook. In The question of phonology and reading (pp. 61-Blackwell Publishing Ltd : Oxford UK). essay Snowling Margaret J. https://doi.org/10.1002/9780470757642.ch4.

Weiser B. & Mathes P. (2011). Using encoding instruction to improve the reading and spelling performances of elementary students at risk for literacy difficulties: a best-evidence synthesis. Review of Educational Research 170–200.

Yamashita J. (2013). Word recognition subcomponents and passage level reading in a foreign language. Reading in a Foreign Language 52–71.

Zhang L. Hong T. Li Y. Wang J. Zhang Y. & Shu H. (2021). Differences and similarities in the contributions of phonological awareness orthographic knowledge and semantic competence to reading fluency in chinese school-age children with and without hearing loss. Frontiers in Psychology 649375–649375.

Ziegler J. C. & Goswami U. (2005). Reading acquisition developmental dyslexia and skilled reading across languages: a psycholinguistic grain size theory. Psychological Bulletin 3–29.

APPENDIX A: LEXICAL DECISION TASK

Lexical Decison Test Stimuli			
Real Words		**Pseudo Words**	
Consistent Forms	**Inconsistent Forms**	**Consistent Forms**	**Inconsistent Forms**
heat meat beat	break great deaf	meaf reat lear	deak fleak
food shoot hoot	foot spook door	dase sabe	lare haid
slow low flow	plow mow bow	qow shmow clow	zow rmow kow
come done	gone bone	phint slint shrint	mivte clinte
fade plate	dais chain	bood boose lood	poot stook shkut
boat floor	board flood	shoth hoth	foth soth

APPENDIX B: READING INTERVENTION TIERS

Phonics Intevention Lessons			
Tiers	**Units**		
Consonants	Consonant Phonemes /b/ /d/ /f/ /g/ /h/ /j/ /k/ /l/ /m/ /n/ /p/ /r/ /S/ /t/ /v/ /w/ /y/ /Z/	Consonant Blends bl br cl dr fl fr gl pl pr sc sw sch sk sl sm sn spr str ld lf lk	Consonant Diagraphs /th/ /ng/ /sh/ / ch/ /zh/ /wh
Vowels	Long & Short Vowels /eɪ/ /i:/ /aɪ/ /ju:/ /u:/ /e/ /i/ /ɔ/ /æ/	Vowel Diphtongs /ow/ 'cow' /oy/ 'toy '	R-Controlled Vowels /a (r) / car /ei (r)/ hare / ɔ (r)/ door
Spelling Rules	**Sounds and Orthographic Forms "Vowel Diagraphs"**		
	The sound /k/ 'c'/ 'k'/ 'ic'/ 'qu'/ 'x'/ 'ck' The sound /əʊ/ 'o – e'/ '- ow' 'oa'	Single vowel followers '-ll'/ 'ss' '-dge'/ 'tch' The sound /aɪ/ 'I -e' '-igh'	The sound /eɪ/ '-ay' 'a – e' The sounds /ju:/ & /u:/ 'u -e'/ '-ue' '-ew'/'-oo'
Sight Words	bike does buy call come could	always around because been before best	Fast first fire forget gave go