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Reading Comprehension Component Skills of Chinese-Speaking ESL and EFL Learners

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Abstract

This research compared the contributions of lexical inferencing, decoding, and listening comprehension to reading comprehension in Chinese-speaking learners of English as a second language (ESL) enrolled in university bridging programs in the U.S. and Chinese-speaking university learners of English as a foreign language (EFL) in mainland China. The findings suggested that the contributions of these three reading component skills differed in ESL and EFL contexts: In the ESL context, both second language (L2) lexical inferencing and L2 decoding were significant predictors of L2 reading comprehension, but L2 listening comprehension did not correlate with L2 reading comprehension. In the EFL context, L2 lexical inferencing was the only significant predictor of L2 reading comprehension. Thus, it appears that the Simple View Reading (decoding + listening comprehension = reading comprehension) is not applicable to Chinese-speaking adult learners of L2 English because learners in both ESL and EFL contexts rely on word-level reading subskills.

Keywords: Simple View of Reading, Chinese, English, writing system, context

The Simple View of Reading (SVR) holds that reading comprehension is a product of decoding and language comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990). The SVR is important for understanding how readers learn to understand texts and is highly influential in reading research and practices (Castles et al., 2018). However, three major gaps remain regarding the validity of the SVR in predicting second language (L2) reading development: (1) While the SVR is supported by substantial empirical evidence stemming from monolingual and bilingual child reading research across diverse languages and writing systems (see a meta-analysis by Melby- Lervåg & Lervåg, 2014), much less attention has been paid to the applicability of the SVR in adult L2 learners who have well-developed first language (L1) reading skills when they begin learning to read in an L2. To date, it is still unclear whether the SVR is a valid account of *adult* L2 reading development. (2) Recent L2 reading research has suggested that lexical inferencing (the ability to infer unknown word meanings during reading) contributes to reading comprehension beyond decoding and language comprehension (e.g., Li, 2012), and lexical inferencing (a meaning-related word-level subskill) is closely connected with real word decoding (a sound-related word-related subskill) (e.g., Hamada & Koda, 2010); yet, lexical inferencing has not been examined as a critical component skill in previous L2 research

aimed at validating the SVR. To improve current understanding of adult L2 reading acquisition, there is a need to test whether the SVR can be expanded by including additional component skills such as lexical inferencing. (3) In addition, Anglocentric trend prevails in previous research. The majority of previous L2 reading studies have focused on two alphabetic languages. Thus, studies need to investigate whether the SVR still holds for L2 reading development involving two different writing systems (e.g., morphosyllabic Chinese and alphabetic English) (e.g., Li, 2012; Uchikoshi, 2013), and whether the various components skills contribute equally to reading comprehension across different educational contexts (e.g., English as a second language (ESL) versus English as a foreign language (EFL), cf., Erbeli & Joshi, 2020).

To fill the gaps mentioned above, this research compared the relative contributions of lexical inferencing, word decoding, and listening comprehension to L2 English reading comprehension with L1 Chinese adult learners via two studies in two different contexts: Study One was conducted with L1 Chinese ESL students enrolled in university bridging programs in the U.S., an under examined population in the literature (cf. Schmidtke & Moro, 2021). Study Two was conducted with Chinese university EFL students in mainland China. The findings of this study will expand our knowledge of the validity of the SVR in adult L2 reading and provide implications for reading instruction that takes linguistic (i.e., L1-L2 writing system distance) and contextual (i.e., ESL vs. EFL) factors into consideration.

"L2" reading is treated as an umbrella term henceforth, referring to reading acquisition in an additional language other than a learner's L1 or mother tongue or dominant language. Throughout the manuscript, "L1" and "L2" respectively indicate the sequence of language learning. ESL and EFL contexts are categorized after Bae and Joshi (2018), "English is a dominant language of communication and instruction for ESL learners, while it is their [L1] for EFL learners. Second, ESL learners use English as their institutional and social language, whereas EFL learners use their L1" (p. 1823).

Literature Review

Examining the Simple View of Reading (SVR) in adult second language readers

Recent years have witnessed an increasing interest in examining the SVR in L2 reading (vis-à-vis L1 reading). For instance, Melby-Lervåg and Lervåg (2014) reported a meta-analysis of 82 studies comparing reading comprehension and its underlying components (language comprehension and decoding) in L1 and L2 learners with a mean age below 18 years old. The meta-analytic results suggested that, compared to L1 learners, L2 learners displayed a medium-sized deficit in reading comprehension ($d = –0.62$) and a large deficit in language comprehension ($d = –1.12$), but only a small difference in decoding (pooled effect size $d = –0.12$). They also identified significant moderators at the learner (e.g., socioeconomic status), task (e.g., reading comprehension task reliability), and contextual levels (e.g., L2 learners had better word decoding skills than L1 learners in Canada, yet poorer word decoding skills than L1 learners in the U.S.). While Melby-Lervåg and Lervåg's meta-analysis provides insights about the applicability of the SVR to child L2 reading and potential moderators to be considered in future research, the results

based on children who are developing biliteracy in both L1 and L2 might not be generalizable to adolescent and adult learners who have stronger L1 reading skills when learning to read in an L2.

Emerging research in adolescent and adult L2 reading has examined how word decoding (WD) and listening comprehension (LC) jointly contribute to L2 reading comprehension (RC) (i.e., in an additive WD+LC=RC, multiplicate WD x LC=RC, or combined model WD+LC+WD x LC=RC) (e.g., Erbeli & Joshi, 2020; Ghaedsharafi & Yamini, 2011; Kang, 2020). For example, Erbeli and Joshi (2020) found that in L1 Slovenian seventh graders, the additive model fit well in predicting their EFL reading comprehension (measured by expository and narrative text reading from the Qualitative Reading Inventory, Leslie & Caldwell, 2010), and that word decoding was a stronger predictor than listening comprehension. Erbeli and Joshi (2020) also noted that these participants possessed A1 level (i.e., beginner level) English proficiency in accordance with the Common European Framework of Languages (Council of Europe, 2020). Kang's (2020) research was conducted with EFL learners of similar age (seventh and eighth graders) in a local public middle school in Seoul, Korea. These students had been learning English since third grade. The tests of word decoding, listening comprehension, and reading comprehension were all adopted from the subtests of standardized tests (i.e., the Reading Fluency subtest of the Woodcock Johnson Diagnostic Reading Battery by Woodcock et al., 2004; the Listening Comprehension subtest of WLPB-R by Woodcock, 1991, and the Passage Comprehension subtest of the Woodcock Reading Mastery Test-Revised by Woodcock, 1998). In this research, Kang (2020) only identified listening comprehension as a significant predictor of English reading comprehension in L1 Korean EFL learners.

While standardized reading comprehension tasks were used by Erbeli and Joshi (2020) and Kang (2020), Ghaedsharafi and Yamini (2011) measured EFL reading comprehension with a researcher-designed cloze test in a group of L1 Persian female adolescent and adult EFL learners between 15 and 25 years old. The participants had received about 192 hours of English instruction at a language institute in Shiraz, Iran. The results suggested that a combined model (i.e., WD+LC+WD x LC=RC) more accurately described the interrelationship among word decoding, listening comprehension, and reading comprehension; and there was a significant interactive effect between word decoding and listening comprehension in predicting EFL reading comprehension in this L1 Persian learner group.

Various conclusions about the interrelationships between word decoding and listening comprehension in predicting EFL reading comprehension have been made in the studies reviewed above. Moreover, the findings are less clear-cut in the case of L2 English learners of a typologically different L1 writing system (e.g., Chinese) in different educational contexts.

L2 English reading development in the ESL vis-à-vis EFL context: The case of Chinese-speaking learners of English

Research about reading development in L1 Chinese learners of L2 English is of both theoretical and practical significance. Theoretically speaking, empirical findings in this area can contribute to the understanding of long-lasting L1 impacts on L2 reading. The Chinese orthography (i.e., morphosyllabic, with a character mapped on a morpheme at the syllable level) and the English orthography (i.e., alphabetic) are typologically distinct. Previous research has indicated that L1

Chinese learners adopt different processing strategies than L1 alphabet learners when reading L2 English at the word- or text-levels (e.g., Hamada & Koda, 2010; Jiang, 2016). Practically speaking, even after about ten years of formal EFL education from grade three to high school[1], there are significant individual differences in terms of English reading competency in L1 Chinese learners of English at home and abroad. These differences affect their academic advancement when English is the medium of academic communication (e.g., Trenkic & Warmington, 2019). L1 Chinese students account for a large portion of English learners globally: There are approximately 390 million native speakers of Chinese studying English as a foreign language in mainland China according to Wei and Su (2012), and 662,100 Chinese students studying abroad in 2018 (mostly in English-speaking countries) (Textor, 2020). To date, there is a dearth of empirical or classroom intervention research exploring whether L1 Chinese learners approach L2 English reading differently in ESL and EFL contexts. Previous studies have focused on one specific context only (e.g., ESL context in Jiang, 2016; Uchikoshi, 2013; EFL context in Haynes, 1989; Haynes and Carr, 1990; Xue, 2021).

In the ESL context, Jiang (2016) compared the relationship between oral reading fluency (words read accurately per minute) and reading comprehension (measured by the TOEFL reading section) in four groups of adult L2 English learners who were enrolled in undergraduate or graduate programs in the U.S. (L1 Arabic, Chinese, Japanese, and Spanish). She observed that an L1 effect, that is, word reading accuracy or efficiency, was a significant predictor of reading comprehension in L1 Arabic and Spanish learners, but not in L1 Chinese and Japanese learners. Jiang, however, did not measure English listening comprehension. As a comparison, in a study of L1 Chinese ESL second graders in the U.S., Uchikoshi (2013) did identify a significant effect of word decoding (measured by real and nonsense word reading accuracy) on reading comprehension (measured by the reading comprehension subtest of the WLPB) but no significant effect of listening comprehension (a cloze-type assessment that asked children to listen to passages and produce oral responses to unfinished sentences). Uchikoshi speculated that there were two possible reasons for the lack of correlation between listening comprehension and reading comprehension: One is that the linkage between oral language and reading weakens when the differences between oral language (L1 Chinese at home) and written language (L2 English as the societal language) increase; the other is that children in her study still needed to develop their English decoding skills before an effect of listening comprehension on reading comprehension surfaces.

In the EFL context, Haynes and Carr (1990) examined the interrelationships among lower-level orthographic processing, higher-level listening comprehension, and passage reading comprehension with a series of researcher-designed tasks in a group of Taiwanese college students who were highly skilled in EFL. In this study, Haynes and Carr identified a significant correlation between listening comprehension and reading comprehension. More recently, Xue (2021) tracked the development of English reading subskills in college students majoring in English in mainland China. The participants had learned English in school for about eight years before they went to college. According to pre- and post-test results, subskills related to word decoding, such as phonological awareness and morphological awareness, were significant predictors of English reading comprehension (measured by Gates Macginitie Reading Comprehension) in the pre-test; yet, after nine months, higher level language comprehension such as listening comprehension at the sentence level played a more important role in predicting

reading comprehension. Xue posited that the relationship between word decoding and language comprehension in adult L2 reading development is dynamic, and that, once word decoding skills are automated, adult L2 learners reply more on higher level language comprehension in reading comprehension. It can be inferred that the participants' English proficiency in Haynes and Carr's (1990) and Xue's (2021) studies might be higher than those in Jiang (2016) and Uchikoshi (2013); therefore, higher-level listening comprehension was found to play a more important role in reading comprehension in highly proficient L2 English learners. However, different reading comprehension tasks were used, and no firm conclusions can be drawn.

Lexical inferencing as another critical reading comprehension component skill

Lexical inferencing is often defined as "making informed guesses as to the meaning of a word, in light of all available linguistic cues in combination with the learner's general knowledge of the world, her awareness of context and her relevant linguistic knowledge" (Haastrup, 1991, p. 40). Lexical inferencing is sometimes also referred to as "word meaning inferencing" or "guessing from context" in the literature. In a series of studies of lexical inferencing and reading comprehension in L1 English readers by Cain and colleagues (e.g., Cain et al., 2004; Cain & Oakhill, 1999; Daugaard et al., 2017), lexical inferencing has been treated as a construct distinct from language comprehension (measured by vocabulary knowledge) and been found to mediate the relationship between language comprehension and reading comprehension. Zhang and Koda (2012) examined the mechanism through which lexical inferencing contributes to L2 English reading comprehension in L1 Chinese university EFL students in mainland China. They found that lexical inferencing was a significant predictor of reading comprehension and also a mediator of the contributions of morphological awareness and vocabulary knowledge to reading comprehension. Notably, they measured both vocabulary size and depth and still identified significant and unique contributions from lexical inferencing to reading comprehension. With regard to the relative contributions of lexical inferencing, word decoding, and listening comprehension, no comprehensive research has been carried out in adult L2 readers to the best of the author's knowledge. Thus, the following includes a review of pertinent studies that compared the relative contributions of the three component skills in L1 Chinese child learners of English (e.g., Li, 2012; Li et al., 2021), and the relative contributions between lexical meaning access[2] and word decoding in non-alphabetic L1 Japanese adult EFL learners (i.e., Yamashita, 2013).

Li's (2012) study might be among the first to validate the SVR in L1 Chinese learners of L2 English. She recruited a special student cohort, that is, eighth grade English immersion students in mainland China. Unlike traditional approaches to teaching English as a subject in public schools in mainland China, English-immersion programs involve the use of English to teach non-language subjects. Li (2012) administered a series of tests in English (including word decoding, listening comprehension, morphological awareness, vocabulary knowledge, inference and strategy, and reading comprehension). The inference and strategy task measured (a) lexical inferencing as well as coherence and elaborative inferences, (b) conjunction use, and (c) comprehension monitoring. Li found that the SVR model did not adequately predict Chinese English-immersion students' English reading comprehension. Inferencing skills and vocabulary were significant predictors of English reading comprehension, whereas word decoding and listening comprehension were not. More recently, Li et al. (2021) adopted a similar design, yet examined a different population (i.e., L1 Chinese ESL students in grades four to six in Canada).

They identified three groups of comprehenders (poor, average, and good) and observed that poor comprehenders lagged behind in listening comprehension when compared to average and good comprehenders, and poor and average comprehenders' performance in inference and strategy was not as strong as that of good comprehenders. In other words, L1 Chinese ESL learners who were poor English comprehenders were weak in both listening comprehension and inferencing.

The two studies reviewed above did not identify any significant effects of word decoding on reading comprehension beyond listening comprehension or lexical inferencing in non-alphabetic L1 Chinese learners of L2 English. According to a review of L2 reading research by Yamashita (2013), when both L1 and L2 are alphabetic languages, word-level reading skills are associated with both reading comprehension and reading rate; in contrast, when the L1 is a non-alphabetic language, word-level reading skills is only related with reading rate, not reading comprehension. Yamashita also conducted an empirical study in Japanese EFL university students who studied English for six to seven years through formal education in Japan. This study measured word decoding, lexical meaning access, general English ability (with a cloze test), and text reading comprehension in English. The results suggested that lexical meaning access was a significant predictor of both reading comprehension and reading rate after the effect of general English ability was controlled, and that decoding was a predictor of reading rate only.

In regards to the validation of the SVR in L2 reading, there is much less attention to adult L2 readers than to child bilingual readers. Unlike child bilingual learners who are learning to read in two languages simultaneously, adult L2 learners usually have well-developed L1 reading skills but insufficient L2 language comprehension in L2 reading (Koda, 2005). Notably, previous studies of non-alphabetic L1 Chinese learners of L2 English seemed to suggest that the SVR varied in the conclusions about the relative contributions of word decoding and listening comprehension to reading comprehension in L2 English reading. Some found that word decoding was a significant predictor of reading comprehension whereas listening comprehension is not (e.g., Uchikoshi, 2013); some found that listening comprehension differentiates poor comprehenders from average and good comprehenders (e.g., Haynes & Carr, 1990; Li et al., 2021) and word decoding was not a significant predictor of reading comprehension (e.g., Yamashita, 2013); still others suggest that the relative contributions of word decoding and listening comprehension to L2 reading comprehension change as learners' L2 proficiency increases, and that inferencing skills (including lexical inferencing) also contribute to reading comprehension beyond word decoding or language comprehension (e.g., Li, 2012; Xue, 2021; Zhang & Koda, 2012). To reiterate, there is a need for a comprehensive investigation of the interrelationships among lexical inferencing, word decoding, listening comprehension, and reading comprehension as well as linguistic (i.e., L1-L2 writing system distance) and contextual effects (i.e., ESL vs. EFL) in adult L2 readers.

The Present Study

The objectives of this study were to examine whether the SVR is valid in adult L2 reading for two distinct writing systems (i.e., L1 morphosyllabic Chinese and L2 morphophonemic English) and to explore whether the relative contributions of component skills (i.e., lexical inferencing, word decoding, and listening comprehension) to reading comprehension are subject to the

influence of educational contexts (i.e., ESL versus EFL). This study was guided by two research questions:

1. How do L2 lexical inferencing, L2 word decoding, and L2 listening comprehension contribute to L2 reading comprehension in L1 Chinese ESL learners in the U.S.?
2. How do L2 lexical inferencing, L2 word decoding, and L2 listening comprehension contribute to L2 reading comprehension in L1 Chinese EFL learners in China?

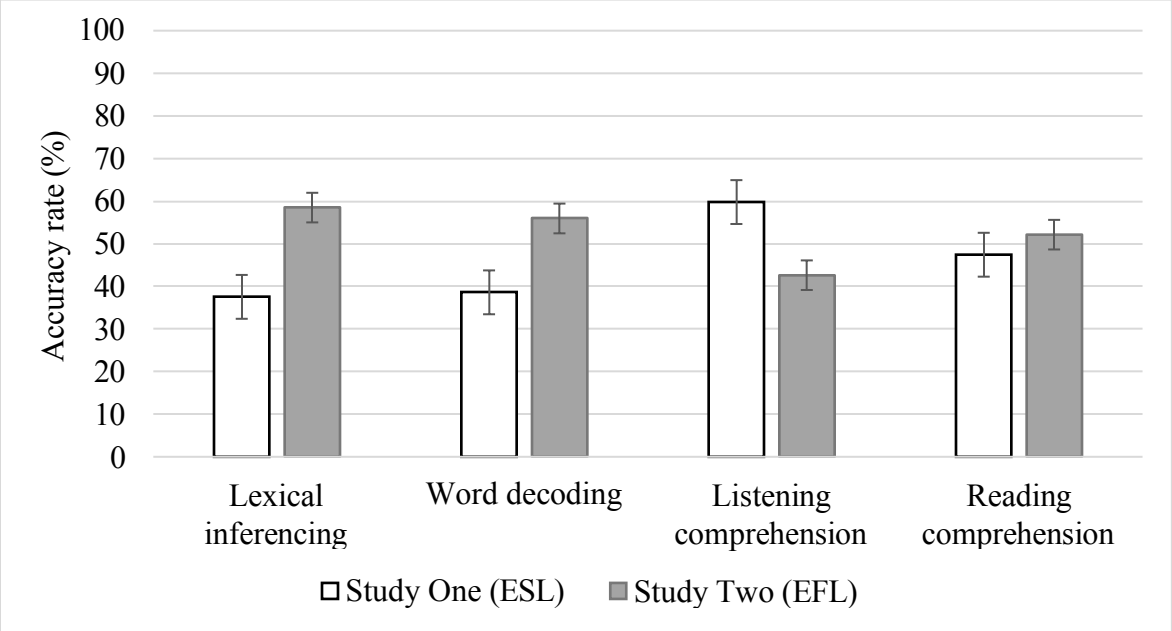
Method

General design

To answer these research questions, two studies were conducted between Fall 2019 and Summer 2020. The following information includes the description of participants and educational contexts and instruments, as well as data collection and analytical procedures for Study One (ESL context) and Study Two (EFL context) respectively. The L1 Chinese participants in Study One (N=25) and Study Two (N=40) both attended primary, middle, and high schools learning EFL in mainland China, yet they received different English language education in higher education settings (i.e., ESL versus EFL). None of the EFL learners had studied abroad for an extended period (i.e., more than three months) in an English-speaking region. The quantities of oral and print exposure in each language were not equivalent between the two groups: dominant L2 input for the ESL group; dominant L1 input for the EFL group (see also Bae & Joshi, 2018). The participants in the two studies were similar in age (M = 20.80 years old, SD = 1.23 in Study One; M = 19.92 years old, SD = 1.25 in Study Two). The respective female:male ratios of Study One and Study Two were 1.50:1 and 1.85:1. A comparison of their performance via MANOVA with the four L2 English outcomes (i.e., lexical inferencing, word decoding, listening comprehension, and reading comprehension) as the dependent variables and educational context (ESL vs. EFL) as the independent variable indicated that educational context had a significant effect on the two learner groups' L2 English performance ($F_{4, 60}$=25.90, p < .001), and that separate univariate ANOVAs on the four outcome variables revealed a non-significant difference in reading comprehension ($F_{1, 63}$=1.26, p = .267), yet significant differences in lexical inferencing ($F_{1, 63}$=15.13, p < .001), word decoding ($F_{1, 63}$=19.50, p < .001), and listening comprehension ($F_{1, 63}$=34.74, p < .001). Figure 1 indicates that the ESL learners were stronger in listening comprehension, yet weaker in lexical inferencing and word decoding than the EFL learners. The detailed descriptive statistics for each study are presented below.

Figure 1

ESL and EFL learners' Performance in L2 English Tasks



Study One

Participants and ESL context

Between Fall 2019 and Spring 2020, 25 L1 Chinese learners were recruited from the intensive English bridging programs at two universities in the Midwest of the United States. They completed their high school education in mainland China and attended the bridging programs so as to continue undergraduate study (on the condition that they received at least a 71 out of 120 on the TOEFL iBT test). The participants received approximately 20 hours of instruction per week in grammar, reading, and writing, as well as listening and speaking.

Instruments

Lexical inferencing. The participants were asked to read an expository passage about healthy living that contained 271 words (Flesch Kincaid Reading Ease index and grade level were 74.1 and 6, respectively) and guess the meanings of nine real words underlined in the passage, and then write down the word meaning in English. Each answer with both the correct meaning and correct part-of-speech was awarded two points; if the meaning was correct but part-of-speech was wrong, one point was awarded. The maximum score possible was 18 points.

Word decoding. This task was adopted from Form A of the Test of Word Reading Efficiency–Second Edition (TOWRE–2) (Torgesen et al., 1999). Participants were asked to read aloud a list of English pseudowords as fast and accurately as possible within 45 seconds. The maximum score possible was 66 points.

Listening comprehension. This test was adopted from a retired TOEFL test that included three listening segments (two dialogues and one lecture) and required participants to answer multiple-choice questions. The maximum score possible was 19 points.

Reading comprehension. This skill was measured using a retired TOEFL test that asked participants to read a passage about 19th century politics in the U.S. and answer multiple-choice questions that addressed L2 learners' gist comprehension, local information searching, co-referencing, and text-based inferencing skills (after Jiang, 2016). The maximum score possible was 14 points.

Data collection and analytical procedures

A paper-and-pencil test battery consisting of the four instruments described above was administered to participants in a quiet classroom by the author or four undergraduate and graduate researchers trained in data collection. Listening comprehension, reading comprehension, and lexical inferencing were first tested in small groups. Afterward, individual participants completed word decoding tests with a member of the research team. The tests took approximately 60 minutes to complete. Regarding the power analysis for regression analysis with three predictors (power = .80, p =.05, R^2= 0.35 within the medium range), it was estimated that a minimum of 25 participants are needed. The sample size of Study One met this requirement.

Study Two

Participants and EFL context

Forty participants were recruited from three major universities in Guangdong, China. Similar to the participants in Study One, the participants in Study Two began to learn English as a subject in primary grade three; by the time of data collection, they had about 10 years of formal English learning experience. They attended English courses during their freshman or sophomore years to fulfill the foreign language requirement (meaning none of them majored or minored in English). Each week they had about 4.5 class hours to develop their reading and writing as well as oral communication skills.

Instruments, data collection and analytical procedures

The same battery of tasks was used in Study Two conducted between June and July 2020. Reliability for each task is reported in Table 1 in the Results section. Due to Covid-19 pandemic restrictions, the test was delivered via an online testing platform names "eztest[3]" (易考 in Chinese), and the participants completed the test on their personal computers individually. This platform was chosen because it can monitor the test delivery process in real time, which is advantageous for this researcher to administer receptive and productive oral tasks including listening comprehension and word decoding. It should be noted that the test delivery format (computer-based) of Study Two was different from that of Study One (i.e., paper-based). According to reports by Kirsch et al. (1998) as well as Taylor et al. (1998), test taker performance is compatible between computer-based and paper-based TOEFL tests regardless of test takers' prior computer familiarity experience (as cited in Choi et al., 2003). Yao (2020) cautioned that lower proficiency L2 English test-takers' performance can appear poorer on computer-based tests, whereas higher proficiency L2 English test-teackers' performance will not be influenced by test delivery format. The compatibility between the two test delivery formats is revisited in the Discussion section.

Similar to Study One, correlational analysis was conducted first to explore the interrelationships among the four L2 English variables, followed by multiple regression analyses with L2 English reading comprehension as the criterion variable and L2 listening comprehension, L2 word decoding, and L2 lexical inferencing as the predictors. As mentioned in Study One, to reach a power level of 0.8 with three predictors in regression analysis (p =.05, R^2= 0.35), a minimum of 25 participants are needed. Therefore, the sample size of Study Two was appropriate.

Results

The relative contributions of L2 lexical inferencing, L2 word decoding, and L2 listening comprehension to L2 reading comprehension in L1 Chinese ESL learners

To answer Research Question 1 *(How do L2 lexical inferencing, L2 word decoding, and L2 listening comprehension contribute to L2 reading comprehension in L1 Chinese ESL learners in the U.S.?*), subsequent analyses aimed to examine whether L2 word-level skills contributed to L2 reading comprehension over and above L2 listening comprehension, and if so, whether L2 lexical inferencing and L2 word decoding were both significant predictors of L2 reading comprehension in L1 Chinese ESL learners. Descriptive statistics are reported in Table 1, followed by correlation and multiple regression analysis results in Tables 2 and 3 respectively.

Table 1

Descriptive Statistics of Lexical Inferencing, Word Decoding, Listening Comprehension, and Reading Comprehension in L1 Chinese ESL Learners (N = 25)

Variable (accuracy rate in %)	Reliability (Cronbach's alpha)	Mean	SD	95% CI
Lexical inferencing	.60	37.56	19.20	29.63, 45.48
Word decoding	.94	38.61	14.18	32.75, 44.46
Listening comprehension	.55	59.79	11.66	54.98, 64.60
Reading comprehension	.55	47.43	14.71	41.36, 53.50

As shown in Table 2, L2 reading comprehension correlated significantly with both lexical inferencing (r = .49, p = .013) and word decoding (r =.52, p = .008) for L1 Chinese ESL learners. There was no significant correlation between L2 listening comprehension and L2 reading comprehension (r = .31, p = .128). And there was also a significant correlation between lexical inferencing and word decoding (r = .45, p = .023). To test whether there was any interactional effect between lexical inferencing and word decoding on reading comprehension, a regression model was run via PROCESS, an add-on program in SPSS (Hayes, 2018), with L2 reading comprehension as the criterion variable, listening comprehension as the covariate, lexical inferencing as the predictor, and word decoding as the moderator. The results suggested that there was no significant interactional effect ($F_{1,20}$ = .25, p = .623). Therefore, two

hierarchical regression analyses were conducted, with L2 reading comprehension as the criterion variable, listening comprehension as the covariate, and L2 lexical inferencing and L2 word decoding as the predictors. The entering order of L2 lexical inferencing and L2 word decoding were switched in the two respective regression models (see Table 3).

Table 2

Correlations of Lexical Inferencing, Word Decoding, Listening Comprehension, and Reading Comprehension in L1 Chinese ESL Learners (N = 25)

	Lexical inferencing	Word decoding	Listening comprehension	Reading comprehension
Lexical inferencing	--			
Word decoding	.45*	--		
Listening comprehension	.28	.37	--	
Reading comprehension	.49*	.52**	0.31	--

Note. **, $p < .01$; *, $p < .05$.

Table 3

Regression Models with ESL Reading Comprehension (RC) as the Criterion Variable, Listening Comprehension (LC) as the Covariate, and L2 Lexical Inferencing (LI) and L2 Word Decoding (WD) as the Predictors (N = 25)

	R	R^2	ΔR^2	*B*	*SE*	*β*	*t*	*Sig.*
Model 1								
Step 1	.31	.10	.10					
LC				.31	.20	.31	1.58	.128
Step 2	.52	.27	.17*					
LC				.19	.19	.19	1.00	.313
LI				.44	.19	.44	2.31	.031
Step 3	.60	.36	.09					
LC				.10	.19	.10	.53	.603
LI				.31	.20	.31	1.55	.135
WD				.34	.20	.34	1.69	.105
Model 2								
Step 1	.31	.10	.10					
LC				.31	.20	.31	1.58	.128
Step 2	.54	.29	.19*					

LC				.14	.19	.14	.73	.470
WD				.47	.19	.49	2.42	.024
Step 3	.60	.36	.07					
LC				.10	.19	.10	.53	.603
WD				.34	.20	.34	1.69	.105
LI				.31	.20	.31	1.55	.135

Note. *, $p < .05$.

As indicated by the regression analysis results in Table 3, when L2 lexical inferencing was entered after L2 listening comprehension in Model 1, it made a significant and additional contribution to L2 reading comprehension ($\Delta R^2 = .17$, $p = .031$). L2 word decoding did not have any significant effect when L2 listening comprehension and L2 lexical inferencing were controlled for ($p = .105$). In Model 2, L2 word decoding was entered after L2 listening comprehension and was found to make a significant and additional contribution to L2 reading comprehension (ΔR^2=.19, $p = .024$). L2 lexical inferencing did not make any significant contribution beyond L2 listening comprehension and L2 word decoding ($p = .135$). The results indicated that L2 lexical inferencing and L2 word decoding were significant and independent predictors of L2 reading comprehension in L1 Chinese ESL learners, jointly explaining about 26% of the variance in ESL reading comprehension.

The relative contributions of L2 lexical inferencing, L2 word decoding, and L2 listening comprehension to L2 reading comprehension in L1 Chinese EFL learners

In response to Research Question 2 (*How do L2 lexical inferencing, L2 word decoding, and L2 listening comprehension contribute to L2 reading comprehension in L1 Chinese EFL learners in China?*), descriptive statistics are reported in Table 4 below. In addition, correlational analysis results are presented in Table 5.

Table 4

Descriptive Statistics of Lexical Inferencing, Word Decoding, Listening Comprehension, and Reading Comprehension in L1 Chinese EFL Learners (N = 40)

Variable (accuracy rate in %)	Reliability (Cronbach's alpha)	Mean	SD	95% CI
Lexical inferencing	.64	58.50	21.58	50.92, 64.08
Word decoding	.90	55.95	16.19	50.77, 61.13
Listening comprehension	.41	42.63	11.17	39.06, 46.20
Reading comprehension	.65	52.14	17.44	46.57, 57.72

Table 5

Correlations of Lexical Inferencing, Word Decoding, Listening Comprehension, and Reading Comprehension in L1 Chinese EFL Learners (N = 40)

	Lexical inferencing	Word decoding	Listening comprehension	Reading comprehension
Lexical inferencing	--			
Word decoding	.001	--		
Listening comprehension	.02	.44**	--	
Reading comprehension	.35*	.25	.05	--

Note. *, $p < .05$.

As shown in Table 5 above, L2 reading comprehension in L1 Chinese EFL learners correlated significantly with L2 lexical inferencing only ($r = .35$, $p = .026$); it did not correlate significantly with L2 word decoding ($r = .25$, $p = .127$) or L2 listening comprehension ($r = .05$, $p = .766$). Subsequently, in the hierarchical regression model (see Table 6 below), L2 reading comprehension was analyzed as the criterion variable, L2 listening comprehension and L2 word decoding as covariates, and L2 lexical inferencing as the predictor.

Table 6

The Regression Model with EFL Reading Comprehension (RC) as the Criterion Variable, L2 Listening Comprehension (LC) as the Covariate, and L2 Lexical Inferencing (LI) and L2 Word Decoding (WD) as the Predictors (N = 40)

	R	R^2	ΔR^2	*B*	*SE*	*β*	*t*	*Sig.*
Step 1	.05	.002	.002					
LC				.05	.16	.05	.30	.766
Step 2	.25	.07	.07					
LC				−.07	.18	−.07	.157	.125
WD				.28	.18	.28	.000	1.000
Step 3	.44	.19	.12*					
LC				−.08	.17	−.08	−.49	.62
WD				.28	.17	.28	1.68	.10
LI				.35	.15	.35	2.35	.025

Note. *, $p < .05$.

As indicated by the regression analysis results above, L2 lexical inferencing made a significant contribution to L2 reading comprehension over and above L2 listening comprehension and L2

word decoding ($\Delta R^2 = .12$, $p = .025$). To sum up, out of the three component skills (i.e., L2 lexical inferencing, L2 word decoding, and L2 listening comprehension), L2 lexical inferencing was the sole significant predictor of L2 reading comprehension in L1 Chinese EFL learners and explained about 12% of the variance in EFL reading comprehension.

Discussion

To recapitulate, this exploratory research aimed to validate the SVR in L1 Chinese adult learners of L2 English in ESL versus EFL context by examining the relative contributions of lexical inferencing, word decoding, and listening comprehension to reading comprehension. There were three major findings: First, in the ESL context, both lexical inferencing and word decoding were significant predictors of reading comprehension, and had *additive* effects which explained about 26% of the variance in reading comprehension. Second, in the EFL context, lexical inferencing was the only significant predictor of reading comprehension, and explained about 12% of its variance. Lastly, listening comprehension did not have any significant effect on ESL or EFL reading comprehension. Taken together, the SVR (i.e., word decoding and listening comprehension jointly predicts reading comprehension) is not applicable to the two L1 Chinese university learner groups examined in this research. L1 Chinese adult learners in both ESL and EFL contexts relied on word-level skills instead of listening comprehension for reading comprehension; yet, learners in the ESL context seem to rely on both meaning- and sound-related word-level skills (i.e., via both lexical inferencing and word decoding) whereas EFL learners seemed to be biased toward meaning-related processes (i.e., via lexical inferencing).

The findings of this research in L1 Chinese learners of L2 English differed from those previous studies of L2 English adolescent and adult learners of L1s typologically closer to English (e.g., Erbeli & Joshi, 2020; Ghaedsharafi & Yamini, 2011; Kang, 2020), according to which listening comprehension was consistently a significant predictor of L2 English reading comprehension. It is possible that L1 Chinese learners, regardless of their English educational context, tend to rely on word-level processing in L2 English reading comprehension. Another possibility is that the participants in this research have not yet automatized word-level processing in L2 English reading; thus, they cannot utilize higher level language comprehension skills such as listening comprehension. A similar position can be found in prior research of L1 Chinese child learners[4] (e.g., Uchikoshi, 2013) and adult learners (e.g., Xue, 2021).

The unique contribution of this research is that it identified the different roles of lexical inferencing and word decoding in predicting L2 English reading comprehension in ESL and EFL contexts. To reiterate, both lexical inferencing and word decoding were significant predictors for L1 Chinese ESL learners, whereas lexical inferencing was the only significant predictor for EFL learners. These findings are consistent with previous EFL reading studies in non-alphabetic L1 adult learners in the EFL context, that is, meaning-related word-level skills (e.g., lexical inferencing or lexical meaning access) had significant influence on reading comprehension (e.g., L1 Japanese in Yamashita, 2013 and L1 Chinese in Zhang & Koda, 2012).

To better understand why word decoding is not a significant predictor of EFL reading comprehension and how this finding is comparable to previous evidence (e.g., Hamada & Koda, 2010; Yamashita, 2013), it is important to reflect upon the oral and reading English profiles of

the EFL learners in Study Two and the ESL learners in Study One. When compared with the EFL learners in Study Two, the ESL learners in Study One performed better in listening comprehension, yet poorer in both lexical inferencing and word decoding. The two learner groups were matched in L2 reading comprehension accuracy. It is thus unlikely that the EFL learners were weaker in word decoding than the ESL learners and could not use sound-related cues in reading comprehension. One determining factor might be the different types of input in the ESL and EFL contexts. The oral and print input are not only rich in the ESL context (see also Bae & Joshi, 2018; Erbeli & Joshi, 2020) but also multimodal. The ESL learners in the bridging programs in American universities were immersed in intensive integrated instruction in oral and written English; whereas EFL learners' experience is dominated primarily by their exposure to written English. Therefore, ESL learners might have a tendency to utilize letter-sound mapping (i.e., word decoding) in addition to lexical inferencing strategies. Another possible explanation is related to how word decoding and reading comprehension were operationalized in this research (measured as pseudoword naming and reading comprehension accuracy respectively). Yamashita (2013) did not find any significant contribution of word decoding to EFL reading comprehension in L1 Japanese learners, and she speculated that word decoding is more related to reading rate. Hamada and Koda (2010) found a higher correlation between real word decoding and reading comprehension than between pseudoword decoding and reading comprehension in L1 Chinese learners of L2 English. Yet, no measure of real word decoding was included in this research.

Lastly, the different test delivery formats in these two studies might raise questions (i.e., paper-based in Study One and computer/online-based in Study Two). Yao (2020) cautioned that lower proficiency level (i.e., CEFR A2 level) L2 English test takers' performance might be better on the paper-based tests than computer-based tests, but concluded after a review of pertinent literature that performance is compatible for L2 English test takers at the higher proficiency levels (B1 and above). In the study, it is estimated that the participants' English proficiency levels ranged between CEFR B1 and B2 levels. Therefore, according to Yao (2020), the participants performance should not be influenced by the test delivery format.

Conclusions, Limitations, and Implications

This exploratory research set out to validate the SVR in L1 Chinese learners in ESL and EFL contexts. It is among the first to validate the SVR in L1 Chinese adult learners in two different educational contexts. It was found that the significant predictors of L2 English reading comprehension varied between the two contexts, that is, lexical inferencing and word decoding in the ESL context and lexical inferencing only in the EFL context. The finding did not seem to support the SVR, which views word decoding and listening comprehension as two critical predictors of reading comprehension. As pointed out by an anonymous reviewer, it is important to note that the SVR is not an explanatory theory to explain how language learners process reading. Yet, the SVR has been supported in both L1 and L2 reading research as a viable model to assess L2 reading skills and identify strong and weak L2 readers (Sparks, 2021), which pertains to the goal of this research (i.e., exploring the profiles of L1 Chinese ESL and EFL readers).

Given the small-scale study and relatively low L2 English proficiency of the participants in the present research, more replication studies need to be carried out in L1 Chinese learners of different L2 English proficiency levels in EFL and ESL contexts. It should be acknowledged that the confounding effect of testing delivery formats (i.e., paper-based in the ESL context and online/computer-based in the EFL context) cannot be completely ruled out in this research. Also, most of the tasks used in the research are standardized except the lexical inferencing task. Future research should consider comparing standardized versus researcher-designed task effects. Another limitation lies in the task reliability because reliability was lower than .70 for some of the tasks. This decreased reliability could be related with the learners' relatively low L2 English proficiency (Plonsky & Derrick, 2016). Also, as suggested by one of the anonymous reviewers, multiple reading passages should be incorporated in the reading comprehension task in future research. Still, important implications can be drawn for facilitating English reading development in L1 Chinese adults who are less skilled English learners. Researchers and instructors should not assume that learners of the same L1 writing system background (i.e., Chinese) might adopt similar strategies to approach reading comprehension. The types of English input and adoption of English as the medium of instruction can have a profound impact on how L1 Chinese learners comprehend English texts. To identify learners' strengths and weaknesses in reading comprehension, it is important to incorporate component skills such as lexical inferencing in addition to word decoding and listening comprehension in assessment and instruction.

Notes

[1]Since 2003, English has been a compulsory subject from Primary Three in China, and it is gradually being introduced even earlier into the curriculum in many schools (Qi, 2016).

[2]It should be acknowledged that lexical meaning access measured in Yamashita (2013)'s study is a different construct from lexical inferencing, but lexical meaning access and lexical inferencing both involve word-level meaning retrieval. Since no studies have directly compared the relative contributions between lexical inferencing and word decoding to adult L2 reading comprehension, Yamashita's study is considered to be relatively pertinent.

[3]An introduction to the "eztest" platform is available at: https://eztest.org/.

[4]In contrast, previous empirical research has shown that the SVR is supported in native readers of Chinese (i.e., Chinese reading comprehension= word decoding + listening comprehension) (e.g., Ho et al., 2012; Joshi et al., 2012).

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Ethical Statement

This research adhered to the human subject review standards established by the University of Kentucky (IRB#:47251).

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