Does Pinyin Spelling Matter in Self-Teaching in Chinese as a Foreign Language?

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Abstract

To date, the utility of Pinyin in teaching and learning Chinese as a foreign language (CFL) is still under debate. This study sought to enhance the understanding of Pinyin's role in CFL self-teaching by investigating the association of Pinyin spelling with word meaning inference among non-alphabetic L1 CFL learners. Fifty-four Japanese-speaking university first-year CFL learners completed one test consisting of five paper-and-pencil tasks, including Pinyin spelling, phonetic radical knowledge, semantic radical knowledge, single-character word meaning inferencing, and contextualized multi-character word meaning inferencing. Correlation and regression analyses yielded three major findings: (1) Pinyin spelling was significantly related to single-character word meaning inferencing, over and above phonetic and semantic radical knowledge. (2) Semantic radical knowledge was directly related to contextualized multi-character word inferencing. (3) Pinyin spelling was indirectly related to contextualized multi-character word inferencing via single-character word meaning inferencing. The results suggested that Pinyin spelling does matter in CFL self-teaching, even for non-alphabetic CFL learners.

Keywords: Chinese, foreign language, Pinyin spelling, self-teaching, word meaning inferencing

1. Introduction

Self-teaching refers to the learning process of acquiring new words via reading. The self-teaching hypothesis (Share, 1995, 2008) has proposed that there are three mechanisms (i.e., phonological recoding, context, spelling) toward the orthographic and semantic learning of novel words. In the past two decades, emerging evidence in support of the self-teaching hypothesis has been generated from empirical studies with first-language (L1) children of alphabetic and nonalphabetic languages (for a review, see Espinas et al. 2022), and second-language (L2) learners of two alphabetic languages (e.g., L1 Spanish-L2 English, Li, Wang, and Espinas 2022; L1 Russian-L2 Hebrew, Schwartz et al. 2014). Nevertheless, there are three major gaps in the literature: (1) Among the three self-teaching mechanisms, phonological recoding and context have been more widely examined, and very few studies have investigated how spelling connects with novel word learning via reading. (2) Much less research has been carried out to validate the self-teaching hypothesis in L2 learners of nonalphabetic languages (e.g., morphosyllabic[1] Chinese). (3) The utility of Pinyin, an external phonological coding system of Mandarin Chinese (Li et al. 2018), has been under debate in existing literature of teaching and learning Chinese as a foreign language (CFL), especially for non-alphabetic L1 CFL learners (for a review, see Everson 2018). To date, it is still unclear as to whether Pinyin spelling can contribute to CFL self-teaching in non-alphabetic L1 learners; if yes, how Pinyin spelling interacts with other resources commonly examined in the literature (e.g., phonetic and radical knowledge) in predicting CFL self-teaching. To address these open questions, this exploratory study investigated whether Pinyin spelling matters in semantic-based self-teaching

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[1] Chinese is often cited as a "logographic" language in the literature. However, DeFrancis (1989) dismissed the term "logographic" as unsuitable for describing the Chinese orthography, instead defining it as "morphosyllabic". Gelb (1952) explained that a logographic language uses logograms as signs for the language's words (e.g., numerals, objects, and personal names). In comparison, in the morphosyllabic Chinese system, each character represents not only a syllable but also a certain aspect of the morpheme's meaning (DeFrancis 1989; as cited in Sproat and Gutkin 2021).

among novice-level non-alphabetic learners of Chinese as a foreign language (CFL). Specifically, it compared the relative roles of Pinyin spelling and knowledge of phonetic and semantic radicals in semantic-based self-teaching (measured by single-character and multi-character word meaning inferencing) with fifty-four Japanese-speaking university learners of first-year Chinese. Methodologically speaking, previous research has mainly focused on English alphabetic L1 CFL learners in the U.S. context. Much less attention has been paid to the CFL learners of non-alphabetic L1 backgrounds in the East Asian context. In this regard, the findings derived from research with Japanese CFL learners will fill an important gap in the literature. Pedagogically speaking, given that whether and how Pinyin should be introduced to novice-level CFL teaching and learning is still contentious in the field, findings of the research will not only help uncover the spelling mechanism of self-teaching in Chinese, but also provide important implications for how Pinyin can be utilized to promote novel word learning via reading in CFL instruction.

2. Literature Review
2.1 The Self-teaching Hypothesis Applied to Chinese

To reiterate, three mechanisms, namely, phonological recoding, context and spelling, have been proposed by the self-teaching hypothesis toward successful orthographic and semantic learning of novel words via reading (Share 1995, 2008), among which phonological recoding has been mostly widely examined in L1 and L2 learners of alphabetic languages (e.g., English). For example, phonological recoding has often been operationalized as decoding (reading aloud written words) in previous studies that examined the connection between L1 and L2 English children's decoding accuracy of novel written words and their successful learning of the orthographic forms of the target novel words embedded in story text readings (e.g., Cunningham 2006; Wang et al. 2011; Li et al. 2022). Regarding phonological recoding and self-teaching in Chinese, Share (1995) proposed two possible pathways: one via phonetic radicals, the other via the use

of Pinyin (as cited in Y. Li et al. 2020).

The Chinese writing system is morphosyllabic, with the basic grapheme unit (i.e., a character) mapped onto a morpheme at the syllable level. There are two phonological coding systems for written (Mandarin) Chinese, including phonetic radicals as the internal phonological aid, and Pinyin as the external phonological coding system[2] (Li et al. 2018). Pinyin has been used to annotate Chinese characters for the first two primary school years in mainland China and in textbooks designed for novice-level CFL learners overseas. Approximately 80 to 90% of modern Chinese characters are semantic-phonetic compound characters, with a semantic radical cuing a character's semantic category and a phonetic radical, often an independent character with its own meaning and tonal syllable, cuing a character's sound (Taylor and Taylor 2014). For instance, in the compound character 清 ([qīng], clear), the semantic radical 氵 is positioned on the left, meaning "water" in English, and the phonetic radical on the right 青 is pronounced as [qīng] when it is used as an independent character (meaning "green") (as cited in Shu et al. 2003). While grapheme-phoneme correspondence is lacking in character-based written Chinese, Pinyin[3] (literally translated as "spell the sound") utilizes an alphabet coding system that translates Chinese characters using both Roman alphabet letters and lexical tone transcriptions, and represents single phonemes in spoken Chinese (e.g., the syllable [qīng] can be divided into onset [q], rime [ing], and tone marker [-]). Notably, existing evidence seems to suggest that L1 Chinese readers can benefit from both phonetic radical cues and the use of Pinyin in novel word learning, whereas L2 Chinese readers benefit more from the use of Pinyin (e.g., Zhang et al. 2020).

In Zhang et al.'s (2020) research, 48 L1 Chinese second graders in Beijing, China and 19 American university CFL learners studied the same 15 pairs between spoken monosyllabic labels and pictures accompanied either by no

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[2] Li et al. (2018) mentioned both Zhuyin (mainly used in Taiwan) and Pinyin as the external phonological system. This study focused on Pinyin, the system used in mainland China and Singapore and widely adopted by teachers of Chinese as a foreign language overseas.

[3] A more detailed explanation of the Pinyin coding system can be found in Lü (2017) and Xiao et al. (2020). Due to space limit, it is not elaborated in this study.

orthography, by Pinyin, or regular characters (composed of regular phonetic radicals and transparent semantic radicals) in a repeated measures design. The participants were asked to recall by pronouncing the newly learned monosyllabic words based on pictures. The results suggested two different learning patterns between L1 and L2 learners: (1) L1 Chinese children's learning was facilitated by both Pinyin and regular character conditions, not by no orthography condition. (2) American university CFL learners' learning was facilitated by the Pinyin condition only. It should be noted that Zhang et al. (2020) did not examine the respective functions of semantic and phonetic radicals in new word learning. More recently, Y. Li et al. (2020) conducted a study of L1 Chinese-speaking second graders self-teaching pseudowords after reading story texts in Chinese, and they found that phonetic radicals and semantic radicals play different roles—regular phonetic radicals facilitate phonology-orthography association (measured by character writing, orthographic choice, and naming tasks), whereas transparent semantic radicals support semantic-orthography mapping (measured by a semantic production task).

Another mechanism of self-teaching is the use of context. According to Share (1995,2008), contextual information plays a secondary role in self-teaching in L1 children of alphabetic languages for it only compensates for partial phonological recoding of irregularly spelled words, yet makes no difference for the learning of regularly-spelled words (e.g., Cunningham 2006; Wang et al. 2011). As to the role of context in self-teaching in L2 Chinese novel word learning, there has also been emerging evidence in the literature (e.g., Ke and Koda 2017; Xu and Zhang 2022). Ke and Koda (2017) observed that, with only three years of CFL learning, American university learners of advanced Chinese were able to successfully guess unknown multi-character word meanings presented in context (i.e., phrases or short sentences). Most recently, Xu and Zhang (2022) compared second-year American university intermediate L2 Chinese learners' word meaning guessing performances in two tasks, one with context, another without context. Think-aloud protocols were analyzed, whose results suggested that the word retention rate was higher for the context-based task than the no-context task. As to the use of context, unknown word meanings be derived through both semantic

and syntactic constraints embedded in context. Interestingly, even when target words were presented without context, participants sometimes created a sentence to evaluate their guesses.

Lastly, spelling as a self-teaching mechanism has gained increasing attention in existing literature. It has been postulated that spelling may be superior to phonological recoding and the use of context in self-teaching (Share 2008). The logic is that the process of spelling requires the learner to attend to print-to-sound relationships in a comprehensive manner when learning new words. Also, spelling is more demanding than phonological recoding or using context alone, since spelling involves the integration of multiple sources of information from several modalities, including visual-perceptual, motor-kinesthetic and linguistic information (for a review, see Shahar-Yames and Share 2008), thus may lead to higher "lexical quality[4]" (Perfetti and Hart 2002; Perfetti and Stafura 2014). There may be doubt, however, about how spelling facilitates learning Chinese, which is discussed below.

2.2 The Role of Pinyin Spelling in Learning Chinese

This section reviews three lines of research in relation to the connection between Pinyin spelling and self-teaching in Chinese. First, it briefly explains the debate over the impacts of using Pinyin on CFL teaching and learning. Second, it reviews exiting literature that provides rationales for the facilitative versus interfering effects of Pinyin spelling on character-based literacy acquisition. Finally, it evaluates a third line of research that either compared the contributions of Pinyin spelling relative to other knowledge resources (e.g., phonetic radicals, semantic radicals, and context) in Chinese novel word learning or investigated how Pinyin spelling interact with different knowledge sources in Chinese self-teaching.

To reiterate, whether and how Pinyin can be used to foster CFL literacy development has been contentious (Everson 2018). CFL educators who are native

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[4] The Lexical Quality Hypothesis posits that lexical knowledge is comprised of up to three overlapping representations: phonological, orthographic, and semantic (Perfetti and Hart 2002).

Chinese speakers in mainland China tend to claim that the use of Pinyin could result in CFL learners' overdependence on Pinyin as a character pronunciation aid device and produces an attitude among CFL learners that hinders their foundational learning of Chinese characters and character learning in the long run (e.g., Ding 2010). In contrast, in North America, there seems to be a favorable trend toward Pinyin as a bridge to Chinese literacy development in CFL learners of an alphabetic language background, with the support of empirical evidence (e.g., Packard 1990; Ye 2013; Lü 2017). In a study by Lü (2017), she provided empirical support for the positive impact of learning Pinyin in younger Chinese learners. She tracked the roles of Pinyin spelling in Chinese-English biliteracy learning among a group of 37 second-grade learners in a Chinese immersion program for one academic year and observed that Pinyin facilitates subsequent Chinese word reading at no cost to young learners' English literacy learning. The majority of the 37 learners were non-Mandarin speakers (namely their parents do not speak Mandarin at home), and all the children spoke English as their stronger language. Lü concluded that young immersion Chinese program learners can not only utilize Pinyin to develop character-based literacy, but also differentiate Chinese Pinyin from English script. This finding was consistent with the review conducted by Zhou and McBride (2023). They posited that, for native Chinese-speaking children, "not only does pinyin learning not interfere with the acquisition of [L2 English learning,] but it may actually have a positive effect on phonological awareness skills" (p.3). For instance, Cheung et al. (2001) compared phonological awareness skills between Cantonese speaking children in Guangzhou and Hong Kong, and identified an advantage possibly resulting from pinyin training in the Guangzhou children on English onset, rime, and coda analyses compared with their Hong Kong counterparts.

Countering to Lü (2017)'s argument for the facilitative role of Pinyin in Chinese-English biliteracy development, other researchers have identified interfering effects of Pinyin for CFL learning (e.g., Hayes-Harb and Cheng 2016; Hao and Yang 2021;). For instance, Hao and Yang (2021) compared the effect of Pinyin and Chinese characters on English speakers' Mandarin word learning.

They found that for advanced learners, the Character group was more accurate than the Pinyin group in a post-learning meaning–auditory stimulus matching task while the opposite tendency was observed with naïve learners. Hao and Yang posited that novel graphemes (i.e., characters) facilitate L1 English advanced-level Chinese learners' tonal encoding more than familiar graphemes (i.e., Pinyin). In other words, despite the familiarity of Pinyin graphemes to L1 English speakers, the need to suppress native language grapheme-phoneme correspondences in favor of new ones can lead to less target-like knowledge of newly learned words' forms (cf. Hayes-Harb and Cheng 2016).

Still, other researchers are not concerned about whether Pinyin should be taught or used in CFL instruction, but for whom and how Pinyin should be presented with characters (e.g., Chung 2002; Zhang et al. 2019). Zhang et al. (2019) compared Pinyin versus no Pinyin conditions in assessing CFL vocabulary between heritage and non-heritage learners, and found that heritage learners outperformed the non-heritage learners in Pinyin condition, and there was no significant difference under the no pinyin condition. It seems that heritage learners, who possess a larger amount of oral Chinese vocabulary than non-heritage learners, can better utilize Pinyin in vocabulary assessment. Chung (2002) argued that for English-speaking CFL non-heritage learners, characters, Pinyin and English translation should not be presented simultaneously to avoid cognitive overload due to the presentation of multiple information sources. Rather, characters should be presented first, followed by a short delay in presenting Pinyin and English translation prompts.

Perhaps the most outstanding question is: what are the underlying mechanisms that support the use of Romanized Pinyin script for character-based literacy development in Chinese? Four major rationales have been proposed in the field (see also Lin et al. 2010; Xiao et al. 2020): first, the facilitative role of Pinyin in CFL acquisition is consistent with the universal phonological principle of reading (Perfetti and Tan 1998; Perfetti 2003), according to which, there is phonological activation in recognizing printed words across all writing systems, including morphosyllabic Chinese. Second, when there is irregularity in orthography-phonology convergence based on phonetic radical cues, Pinyin helps

to bridge the gap between phonology and orthography in Chinese reliably and directly. Notably, the percentage of regular, semiregular, and irregular characters[5] in primary school textbooks used in mainland China are, on average, 43%, 30%, and 12%, respectively (Shu et al. 2003). Third, phonology is thought to facilitate the integration of segmental information for text-meaning construction in working memory (Hamada and Koda 2010); and Pinyin facilitates learners' pronunciation and recognition of new characters, without external assistance, through sublexical phonology, such as onset awareness, syllable awareness, and tone awareness. Some researchers have considered the measure of Pinyin spelling as an index of Chinese phonological awareness, an important predictor of early Chinese literacy acquisition (e.g., Lin et al. 2010; Zhang and Roberts 2021). Finally, there are also other practical reasons to use Pinyin. As pointed out by Xiao et al. (2020), Pinyin enables learners to (1) smoothly acquire the Chinese phonological system (e.g., using Pinyin typewriting as a convenient communicative script), avoiding the difficulties in writing Chinese characters, and (2) learn to speak Chinese and to gain a sense of achievement in communication earlier. Most recently, in a study by Li et al. (2022), they found that Pinyin training with American university novice-level learners of Chinese led to significant retention of novel word phonological judgment, tone identification, and comprehension (measured by word picture mapping).

2.3 Another Piece of the Puzzle: The Interaction between Pinyin Spelling and Other Learner Resources

To date, there is little research examining whether Pinyin spelling interacts with other self-teaching mechanisms in Chinese word learning (e.g., phonetic radical as a phonological recoding tool, as well as the use of word-internal cues like semantic radicals and word-external contextual cues like surrounding

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[5] As mentioned earlier, the phonetic radical 青 ([qīng], green) serves as a regular phonetic radical in the compound character 清 ([qīng], clear), given that they have the same pronunciation. But 青 ([qīng], green) acts as a semiregular phonetic radical in the character 精 (([jīng], perfect) since they have different onsets in spite of the same rime and tone, and an irregular phonetic radical in the character 倩 ([qiàn], pretty) since they have different rimes and tones.

characters). A pertinent study is Li et al.'s (2018) study that compared the impacts of Zhuyin and phonetic radicals, and they found that phonetic radical knowledge, rather than Zhuyin knowledge, played a significant role. Another relevant study is Zhang et al.'s (2020) research reviewed earlier, who found that American university CFL learners acquired new oral Chinese vocabulary via Pinyin condition only, and failed under regular character condition that presented phonetically regular and semantically transparent characters. It is possible that for CFL learners of an alphabetic language background, they benefit more from the spelling of Pinyin, a Romanized script, than from recognizing phonetic radicals or semantic radicals to infer new word sounds or meanings. For example, Lin and Collins (2012) compared L1 Japanese and L1 English learners' sensitivity to phonetic radical regularity and semantic radical transparency in character learning, and found that both L1 groups could use the sublexical features of the characters when reading, L1 Japanese learners made greater use of phonetic and semantic radical knowledge perhaps due to their prior kanji reading experience.

As to how Pinyin spelling may interact with contextual information in Chinese self-teaching, this question has been only investigated in Chinese-speaking children (e.g., Shu and Liu 1994; as cited in Lü 2017). For instance, Shu and Liu (1994) examined whether Pinyin annotation assisted sentence reading comprehension among children in grades one and two with low-, mid-, and high-literacy skills, and found that children with higher literacy skills were more readily to make use of Pinyin when the contextual clues were strong. The facilitation of context in CFL novel word meaning learning, however, seems to depend on learners' L2 proficiency level, as argued by Chen (2018). He examined word meaning inferencing ability with two groups of first-year CFL adult learners studying abroad in China (i.e. more skilled versus less skilled). And he found that intraword awareness (e.g., recognizing a character corresponds to a morpheme) predicted both contextualized and decontextualized word meaning inferencing in more skilled learners; but for less skilled learners, intraword awareness correlated with decontextualized word meaning inferencing only.

2.4 Summary

Viewed collectively, it is generally agreed in the literature that self-teaching (i.e., learning novel words via reading) occurred at the beginning stage of learning to read in both L1 and L2 learners (Share 2008; Li et al. 2022). While the relationship between spelling and self-teaching has been examined in alphabetic languages as the target L1 or L2, there has been little research validating the utility of spelling in self-teaching with CFL learners who learn to read in a non-alphabetic L2 (i.e., morphosyllabic Chinese). According to the review above, the impacts of Pinyin spelling on CFL acquisition has been under debate, subject to the influence of learners' prior language and literacy knowledge, instructional settings and research methodological design. Theoretically speaking, how Pinyin spelling interacts with other self-teaching tools (e.g., the use of phonological and semantic radical cues) is still unclear. Methodologically speaking, it is important to attend to learner- and task-level factors. At the learner level, existing debate on the utility of pinyin for novice-level CFL teaching and learning has mainly centered on alphabetic L1 learner in North America; yet, it is unclear whether Pinyin spelling matters for nonalphabetic L1 learners' CFL self-teaching in East Asia. For example, CFL beginners of L1 Japanese, a syllabary language, tend to rely on their prior Kanji knowledge for CFL character reading (Lin and Collins 2012) and text comprehension (Ke and Chan 2017) since written Japanese involves a combination of three different types of scripts: Hiragana, Katakana, as well as Kanji derived from Chinese characters.

Notably, different research paradigms have been used to examine self-teaching (i.e., novel word learning via reading) in Chinese. For instance, the two respective studies by Ke and Koda (2017) and Chen (2018) used a componential skill research paradigm (see M. Li et al. 2020) by examining how different subskills interact and predict novel word meaning guessing with or without context, while the majority of prior investigations of self-teaching that used a learning-via-text paradigm with (quasi-) experimental design (e.g., Li et al. 2022; Xu and Zhang 2022).

At the task level, previous studies have mainly assessed the learning

outcomes of single-character words presented in decontextualized manner, in spite that the majority of modern Chinese words (i.e., 94%) are consisted of two or more characters (Lexicon of Common Words in Contemporary Chinese Research Team 2008, as cited in Li et al. 2014). An exception might be Lü's (2017) study, which examined the correlations among Pinyin spelling and decontextualized two-character word reading, and sentence reading comprehension with second-grade Chinese immersion learners. Lü identified a significant correlation between Pinyin spelling and decontextualized two-character word reading only. Both single-character reading and multi-character word reading are involved in Chinese text comprehension, but they may entail different cognitive processes (Li and McBride-Chang 2014; Wang and McBride 2016). Taken together, there is a need for more systematic investigation to unveil the connection between Pinyin spelling and CFL self-teaching.

3. The Present Study

This study aimed to explore the spelling mechanism in Chinese self-teaching with university novice-level CFL learners whose L1 is non-alphabetic (i.e., Japanese). Specifically, spelling was measured with Pinyin spelling (after Lin et al. 2010; Lü 2017), and self-teaching was operationalized as word meaning inferencing (see also Liu 2013; Chen 2018; Ke and Koda 2017, 2019). It was guided by two research questions (RQs):

RQ1: Are Pinyin spelling, phonetic radical knowledge, and semantic radical knowledge jointly related to single-character word meaning inferencing?

RQ2: Are Pinyin spelling, phonetic radical knowledge, and semantic radical knowledge jointly related to contextualized multi-character word meaning inferencing?

4. Method
4.1 Research Paradigm

As mentioned earlier, two major research paradigms have been adopted in previous studies investigating self-teaching (i.e., novel word learning via reading)

in Chinese in the literature: one is the learning-via-text paradigm which requires participants to read texts embedded with target novel words and complete tests of their orthographic or semantic learning of the target words post-reading (e.g., Y. Li et al. 2020; Xu and Zhang 2022). In this line of research, the participants often have learned Chinese for two years and above. The other is a componential skill research paradigm (e.g., Liu 2013; Chen 2018; Ke and Koda 2017, 2019) that administers a task battery with participants and subsequently examine the relationship between literacy skill sets and participants' performance in a word meaning inferencing task. The latter often includes single- or multi-character words and presents target words with or without contextual cues (i.e., with target words presented in isolation or embedded in short sentences). Given that the participants of the present study were novice-level learners who were enrolled in a first- year Chinese program in Japan by the time of data collection, they might not be ready to read story texts yet. Therefore, the componential skill research paradigm was used for the research described below.

4.2 Participants

Initially, 67 students from a first-year novice-level Chinese course were recruited from a Japanese university. Their mean age was 20.30 years old (SD = 1.05). Female: male ratio was 1:1.58. They had learned English as a foreign language for an average of 5.07 years (SD = 2.72) by the time of data collection. None of the students reported any study-abroad experience in Chinese-speaking countries. They received explicit instructions of the Pinyin system in the first week of study and encountered Pinyin annotations of new vocabulary in their textbook. Only 54 participants completed all five tasks; thus, their data were included in subsequent analyses.

To control for any potential confounding effect from the participants' English proficiency, an English vocabulary size test, adopted from Matsuo (2017), was used as a background check task. In this task, participants were given a target vocabulary word within a sentence and asked to select the most appropriate English meaning or synonym from four options. For instance, for the target word "time," participants were presented with the sentence "Time: They have a lot of

time." and asked to choose the meaning from "A. money, B. food, C. hours, and D. friends." The correct answer is "C. hours." The task consisted of 40 items, with a maximum possible score of 40. Cronbach's alpha was .87. The average accuracy rate among participants was only 51.63% (SD=19.40%). Correlational analyses revealed no significant correlations between English vocabulary knowledge and Pinyin knowledge (r=.14, p=.147), or decontextualized single-character meaning inferencing (r=−.02, p=.453), or contextualized multi-character word meaning inferencing (r=.08, p=.282).

4.3 Instruments

4.3.1. Pinyin Spelling

This task was adopted from Lin et al. (2010) and administered in a dictation manner. The course instructor read aloud five one-syllable Chinese words (蝦 [xiā], 字[zì], 龍[lóng], 車[chē], and 豆[dòu]) to the participants, who were asked to write down the Pinyin on paper. The complete rating rubric can be found in Lin et al. (2010) and Lü (2017). Maximum score possible was 60, and Cronbach's alpha was .83. Coding was based on the composite scores of onset, rime, onset-rime order, and tone accuracy. Two coders, including the author and a trained research assistant, coded seven participants' responses (about 13% of the data). The inter-coder agreement rate was 94.17%. After disagreement was resolved, the author coded the rest of the data.

4.3.2 Phonetic Radical Knowledge

A phonetic radical knowledge task was adapted from Liu (2018), which asked the participants to self-report if they know the pronunciation of 48 phonetic radicals and indicated YES or NO in Japanese. Each correct answer was awarded with one point. Cronbach's alpha was .92.

4.3.3 Semantic radical knowledge

This task was also adapted from Liu (2018). It required the participants to self-report if they know the meanings of 30 semantic radicals and indicated YES or NO in Japanese. The maximum score possible was 30. Cronbach's alpha was .90. There may be doubt about the self-reporting format for the phonetical

radical knowledge and semantic radical knowledge tasks. It should be noted that a similar YES/NO checklist, with sufficient reliability, has been adopted by Ke and Koda (2021) and Qi et al. (2022).

4.3.4 Single-character Word Meaning Inferencing

After Shu and Anderson (1997), the participants' single-character word meaning inferencing ability was measured by a multiple-choice task. The participants were presented with an unknown character (e.g., 叮) and three meanings in Japanese (English translations are: "nail", "bite", and "stare") and asked to select the correct meaning (The correct answer is "bite"). There were 12 items in this task, with a maximum score possible of 12. Cronbach's alpha was .55.

4.3.5 Contextualized Multi-character Word Meaning Inferencing

This multiple-choice task was adapted from Ke and Koda (2017). The participants were asked to guess the meaning of an unfamiliar Chinese multi-character word underlined in a short sentence. To control for the potential confounding effect of L1 Japanese learners' knowledge of Kanji, the unfamiliar words included 16 cognate words and 16 noncognate words based on the similarities or differences between Chinese characters and Japanese kanji (e.g., 多民族 was a cognate word item because it is written in the same form in Chinese characters and Japanese Kanji, both meaning "multi-ethnic"; 覆蓋面 was a noncognate word item because it means "coverage" in Chinese, but the equivalent word in Japanese was written in Katakana カバレッジ). Cronbach's alpha was .55.

4.3.6 Data Collection and Analysis Procedures

Data were collected in Week Five of participants' first-year Chinese course. The five paper-and-pencil tasks were distributed to the participants in class, with instruction provided by the course instructor. It took about 35 minutes to complete all the tasks.

Preliminary statistical analyses included descriptive statistics and correlational analysis to explore the interrelationships among variables of interest.

In response to RQ1 and RQ2, single-character word meaning inferencing and contextualized multi-character word meaning inferencing were treated as the respective dependent variables in regression modeling, with Pinyin spelling, phonetic radical knowledge, and semantic radical knowledge as the independent variables. Data analyses were processed by Microsoft Excel, SPSS Version 28.0, and PROCESS 4.0 version, a macro add-on used in SPSS (Hayes, 2018; see a similar approached by Ke and Koda, 2019; Yuan et al., 2020). All research materials, data, and analysis code are available at: https://osf.io/2haxv/?view_only=09202d4e46e74ef2affe3dba2129bf1d

5. Results
5.1 Preliminary Analyses

Descriptive statistics and correlational analysis results are presented in Table 1 and Table 2 respectively. As shown in Table 2, single-character word meaning inferencing was significantly correlated with Pinyin spelling ($r=.32$, $p=.009$), yet was not significantly correlated with phonetic radical knowledge ($r=.06$, $p=.340$) or semantic radical knowledge ($r=.09$, $p=.266$); contextualized multi-character word meaning inferencing was significantly correlated with Pinyin spelling ($r=.33$, $p=.007$), phonetic radical knowledge ($r=.24$, $p=.039$), semantic radical knowledge ($r=.42$, $p<.001$), and single-character word meaning inferencing ($r=.35$, $p=.005$).

Table 1: Descriptive Statistics for Pinyin Spelling, Phonetic Radical Knowledge, Semantic Radical Knowledge, Single-character Word Meaning Inferencing, and Contextualized Multi-character Word Meaning Inferencing ($N = 54$)

Task	k	MSP	Cronbach's alpha	Mean	95% CI	SD
Pinyin Spelling	5	60	.83	37.56	35.46, 39.65	7.67
Phonetic radical knowledge	48	48	.92	10.41	8.70, 12.12	6.27
Semantic radical knowledge	30	30	.90	9.33	7.63, 11.04	6.26
Single-character word meaning inferencing	12	12	.55	9.50	8.91, 10.09	2.15
Contextualized multi-character word meaning inferencing	32	32	.55	15.17	14.32, 16.01	3.09

Note. MSP, maximum score possible.

Table 2: Bivariate Correlations among Pinyin Spelling, Phonetic Radical Knowledge, Semantic Radical Knowledge, Single-character Word Meaning Inferencing, and Contextualized Multi-character Word Meaning Inferencing ($N = 54$)

	PS	PRK	SRK	SCWMI	CMCWMI
PS	--				
PRK	0.38**	--			
SRK	0.13	0.22	--		
SCWMI	0.32**	0.06	0.09	--	
CMCWMI	0.33**	0.24	0.42***	0.35**	--

Note. PS, Pinyin spelling; PRK, phonetic radical knowledge; SRK, semantic radical knowledge; SCWMI, single-character word meaning inferencing; CMCWMI, contextualized multi-character word meaning inferencing.

5.2 Findings in Response to *RQ1*

Given that, among the three predictors (i.e., Pinyin spelling, phonetic radical knowledge, and semantic radical knowledge) of single-character word meaning inferencing, only Pinyin spelling correlated significantly with single-character word meaning inferencing, phonetic radical knowledge and semantic radical knowledge were entered first in the regression model, followed by Pinyin spelling. The results are shown in Table 3. It was found that Pinyin spelling alone predicted about 10% of the variance of single-character word meaning inferencing, when the effects of phonetic radical knowledge and semantic radical knowledge were controlled.

Table 3: Regression Analysis with Single-character Word Meaning Inferencing as the Dependent Variable as well as Phonetic Radical Knowledge, Semantic Radical Knowledge and Pinyin Spelling as the Predictors ($N = 54$)

Model 1	R	R^2	ΔR^2	B	SE	β	t	$Sig.$
Step 1	.06	.003	.003					
PRK				.02	.05	.06	.41	.680
Step 2	.10	.01	.01					
PRK				.01	.05	.04	.28	.780
SRK				.03	.05	.08	.55	.588
Step 3	.33	.11	.10*					
PRK				−.03	.05	−.09	−.60	.552
SRK				.02	.05	.06	.45	.657
PS				.10	.04	.35	2.39	.021

Note. PS, Pinyin spelling; PRK, phonetic radical knowledge; SRK, semantic radical knowledge.

To answer RQ1, Pinyin spelling, phonetic radical knowledge, and semantic radical knowledge were not jointly related to single-character word meaning inferencing; Pinyin spelling was the only significant predictor of single-character word meaning inferencing.

5.3 Findings in Response to *RQ2*

To recapitulate, based on the correlational analysis results, Pinyin spelling, phonetic radical knowledge, and semantic radical knowledge were all

significantly correlated with contextualized multi-character word meaning inferencing. In addition, single-character word meaning inferencing was found to be correlated with contextualized multi-character word meaning inferencing. Therefore, single-character word meaning inferencing was also entered in the regression model (as shown in Table 4). The entry order of the four predictors followed the logic below: (1) phonetic radical knowledge and semantic radical knowledge were entered first because they both measured sublexical and subsyllabic knowledge. Notably, when phonetic radical knowledge was entered as the first predictor, no significant effect on contextualized multi-character word meaning inferencing was found ($F_{1, 52}$=3.24, p=.078). Phonetic radical knowledge was thus threated as a covariate in subsequent analyses and entered before semantic radical knowledge. (2) Pinyin spelling, which was based on the composite scores of five monosyllabic words, was entered after semantic radical knowledge. (3) Single-character word meaning inferencing was entered last because the regression analysis above (see Table 3 above) indicated that Pinyin spelling was significantly related to single-character word meaning inferencing.

As indicated in Table 4, semantic radical knowledge was significantly related to contextualized multi-character word meaning inferencing ($F_{1, 51}$=8.87, p=.004), predicting about 14.0% of the variance; Pinyin spelling only had a marginal effect on contextualized multi-character word meaning inferencing ($F_{1, 50}$=3.83, p=.056); and single-character word meaning inferencing was significantly related to contextualized multi-character word meaning inferencing ($F_{1, 49}$=4.11, p=.048), predicting about 6% of the variance, beyond phonetic radical knowledge, semantic radical knowledge and Pinyin spelling.

Table 4: Regression Analysis with Contextualized Multi-character Word Meaning Inferencing as the Dependent Variable as well as Phonetic Radical Knowledge, Semantic Radical Knowledge and Pinyin Spelling and Single-character Word Meaning Inferencing as the Predictors ($N = 54$)

Model 2	R	R^2	ΔR^2	B	SE	β	t	$Sig.$
Step 1	.24	.06	.06					
PRK				.12	.07	.24	1.80	.078
Step 2	.45	.20	.14**					
PRK				.08	.06	.16	1.22	.226
SRK				.19	.06	.38	2.98	.004
Step 3	.51	.26	.06					
PRK				.06	.07	.06	.46	.649
SRK				.37	.06	.37	2.96	.005
PS				.26	.05	.26	1.96	.056
Step 4	.56	.31	.06*					
PRK				.04	.07	.08	.64	.524
SRK				.18	.06	.36	2.91	.005
PS				.07	.06	.17	1.26	.214
SCWMI				.37	.18	.26	2.23	.048

Note. PS, Pinyin spelling; PRK, phonetic radical knowledge; SRK, semantic radical knowledge; SCWMI, single-character word meaning inferencing.

It should be noted that there was no significant correlation between semantic radical knowledge and Pinyin spelling, yet a significant correlation between Pinyin spelling and single-character word meaning inferencing. The observation that Pinyin spelling only had a marginal effect on contextualized multi-character word meaning inferencing could be due to the interaction between Pinyin spelling and single-character word meaning inferencing. Subsequently, a regression path model based on a bootstrapping method (samples =5000) was run with PROCESS 4.0 version. Contextualized multi-character word meaning inferencing was treated as the criterion model; Pinyin spelling and single-character word meaning inferencing were entered as the independent variable and mediator respectively; and phonetic radical knowledge and semantic radical knowledge were entered as

covariates. The mediation effect was significant (without zero falling between 95% CI): effect =. 04, SE =.02, BootLLCI= .0001, BootULCI=.0833. Their interrelationships and relevant coefficients are illustrated in Figure 1. Details of bootstrap results for regression model parameters are available in Appendix A.
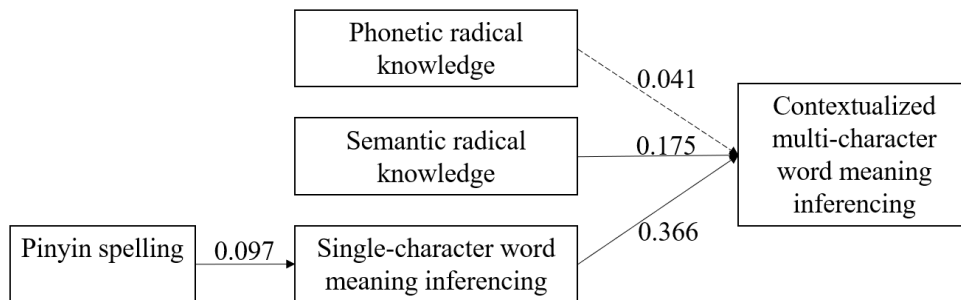

Figure 1: Interrelationships among Pinyin Spelling, Phonetic Radical Knowledge, Semantic Radical Knowledge, Single-character Word Meaning Inferencing and Contextualized Multi-character Word Meaning Inferencing based on Bootstrap Regression Path Analysis Results

To answer RQ2, there was no significant correlation between phonetic radical knowledge and contextualized multi-character word meaning inferencing; semantic radical knowledge was significantly and directly related to contextualized multi-character word meaning inferencing; in addition, Pinyin spelling was indirectly related to contextualized multi-character word meaning inferencing via the mediation of single-character word meaning inferencing.

6. Discussion

The results of the study indicated that Pinyin spelling was indeed significant in CFL self-teaching, even for non-alphabetic first language (L1) learners such as Japanese speakers. Specifically, this research examined the interrelationships among Pinyin spelling, phonetic radical knowledge, semantic radical knowledge, single-character word meaning inferencing, and contextualized multi-character word meaning inferencing with nonalphabetic L1 Japanese-speaking university novice-level CFL learners. There were two major findings: (1) for single-character word meaning inferencing measured in a decontextualized

manner, Pinyin spelling was the only significant predictor, and there was no significant effect of phonetic radical knowledge or semantic radical knowledge. (2) For contextualized multi-character word meaning inferencing, there were two paths to successful word meaning inferencing: one is the semantic path since semantic radical knowledge had a significant association with contextualized multi-character word meaning inferencing; the other is the spelling path because Pinyin spelling was indirectly related to contextualized multi-character word meaning inferencing via the mediation of single-character word meaning inferencing. To the best of the author's knowledge, this study was among the first to provide evidence supporting the connection between Pinyin spelling and contextualized multi-character word meaning inferencing in Chinese since previous studies have predominantly focused on single-character novel word learning.

The evidence above lends support to the facilitative role of Pinyin spelling in CFL self-teaching. It confirms that spelling, as one of the three self-teaching mechanism proposed by Share (1995, 2008), is also applicable to the learning of a non-alphabetic L2 (Chinese) by L1 non-alphabetic (Japanese) learners. Notably, the facilitative role of Pinyin spelling was observed in a meaning inferencing task that does not involve overt phonological manipulation. According to Hamada and Koda (2010), phonology is thought to facilitate the integration of segmental information for text-meaning construction by mitigating working memory load. It is also possible that, since spelling involves the integration of multiple sources of information from several modalities, it may lead to higher "lexical quality" word representation (Perfetti and Hart 2002; Perfetti and Stafura 2014).

There were three possible explanations for the findings of this study in comparison to those of previous research. First, there might be doubt about the lack of significant correlation between phonetic radical knowledge and novel word meaning inferencing. For instance, Li et al. (2018) found phonetic radical knowledge, rather than Zhuyin knowledge, contributed significantly to second grade Taiwanese children's orthographic learning via self-teaching in Chinese (measured by orthographic choice and spelling tasks). This study, however, observed the opposite, Pinyin spelling, rather than phonetic radical knowledge,

contributed significantly to semantic learning measured by novel word meaning inferencing in adult novice-level CFL learners. Given that the learning outcome of this research is semantic-based instead of orthographic-based, phonetic radical knowledge might not be sufficient. For another, Pinyin provides a direct letter-phoneme mapping, whereas phonetic radicals do not always provide reliable phonological information (Shu et al. 2003).

Second, it is noteworthy that semantic radical knowledge seemed to play different roles in single-character word meaning inferencing versus contextualized multi-character word meaning inferencing. It is likely that contextualized multi-character word learning inferencing demands higher level of semantic knowledge, therefore, a significant effect of semantic radical knowledge was observed. For example, Li et al. (2019) tracked native Chinese speakers' eye movement during orthographic learning and written cloze tests, and concluded that semantic radical knowledge does not affect the reading of novel compound characters in natural texts or orthographic learning, but that it does seem to assist in learning semantics measured by written cloze tests.

Last, a novel finding of the present study was the indirect effect of Pinyin spelling on contextualized multi-character word meaning inferencing mediated by single-character word meaning inferencing, which was different from previous evidence gathered from learners of Chinese as an additional language (e.g., Lü, 2017). Lü (2017) only identified significant influence of Pinyin knowledge on word-level reading but not on sentence-level reading. But she did not test whether word-level reading had any mediation effect on the relationship between Pinyin knowledge and sentence-level reading. According to previous research of Chinese-speaking children, Pinyin knowledge explains variance in both single-character and multi-character word reading, and children perform better in recognizing the same characters within the context of a word than in isolation (Li et al. 2017; Wang and McBride 2016). This might help explain why there was an indirect link between Pinyin spelling and multi-character word meaning inferencing, mediated by single-character word meaning inferencing.

7. Conclusions, Pedagogical Implications, Limitations and Future Research Directions

This study aimed to uncover the spelling mechanism of self-teaching in Chinese. It is among the first to observe that Pinyin spelling facilitates CFL self-teaching, even for CFL learners of non-alphabetic L1 (i.e., Japanese). The findings have revealed the way in which Pinyin spelling facilitates decontextualized single-character word meaning inferencing vs. contextualized multi-character word meaning inferencing, and how Pinyin spelling interact with other self-teaching tools. Specifically, Pinyin spelling facilitates decontextualized single-character word meaning inferencing directly and contextualized multi-character word meaning inferencing indirectly. When novel-level CFL learners try to guess the meanings of novel multi-character words presented in sentences, both semantic radical knowledge and Pinyin spelling are significant predictors of successful word meaning inferencing, which indicates that there are two paths toward CFL self-teaching via reading: semantic-based and spelling-based. Two major implications can be drawn from these findings: (1) promoting refined Pinyin knowledge at the beginning of CFL programs can benefit character learning, which subsequently contributes to students' self-learning during text reading without external resources. (2) Pinyin training should be combined with other cues such as semantic radicals when learners transition from character-based reading to sentence-based reading.

Four limitations of the study should be acknowledged. First, the participants' first language background was nonalphabetic (i.e., Japanese). Future research may include and compare CFL learners of alphabetic and nonalphabetic language backgrounds. Second, The YES/NO checklists used for the phonetic and semantic knowledge tasks might tap into CFL learners' perception only. Recent research has shown that a receptive vocabulary size test can be quick and reliable for assessing Chinese learning (e.g., LexCH, Qi et al. 2022). Researchers may consider measuring productive knowledge in the future. Third, two different word meaning inferencing tasks were administered (i.e., decontextualized single-character words vs. contextualized multi-character words). Research in the future may expand the task by including four conditions (i.e., decontextualized

single-character words, contextualized single-character words, decontextualized multi-character words, and contextualized multi-character words) to tease apart the effects of context vs. word length (i.e., the number of characters within each word). Lastly, given that the participants were first-year CFL learners, the component skill research paradigm instead of the learning-via-text paradigm was adopted in this research. A range of instruments were adapted or adopted from previous research to measure component subskills for reliability considerations. And the analyses were based on correlation and regression modeling. For causal effect inference, researchers should consider conducting longitudinal or interventional (quasi-)experimental studies based on a different research paradigm with participants of various CFL proficiency levels in the future. For example, within-subject design can be applied by explicitly including identical (sub)lexical items across five tasks. Pertinent findings may shed light on whether the facilitation of Pinyin spelling in CFL teaching can go beyond the learning-to-read stage.

References

Chen, Tianxu. 2018. The contribution of morphological awareness to lexical inferencing in L2 Chinese: Comparing more-skilled and less-skilled learners. *Foreign Language Annals* 51.4: 816–830.

Cheung, Him, Hsuan-Chih Chen, Chun Yip Lai, On Chi Wong, and Melanie Hills. 2001. The development of phonological awareness: Effects of spoken language experience and orthography. *Cognition* 81: 227–241.

Chung, Kien Hoa Kevin. 2002. Effective use of Hanyu Pinyin and English translations as extra stimulus prompts on learning of Chinese characters. *Educational Psychology* 22.2: 149–164.

Cunningham, Anne E. (2006). Account for children's orthographic learning while reading text: Do children self-teach? *Journal of Experimental Child Psychology* 95.1: 56–77.

DeFrancis, John. 1989. *Visible Speech: The Diverse Oneness of Writing Systems*. Honolulu: University of Hawaii Press.

Ding, Yongshou. 2010. *A Complete Guide to Teaching Chinese as a Second Language.* Beijing: Beijing Language and Culture University.

Espinas, Daniel R., Wang, Min, and Li, Yixun. 2022. Orthographic learning: A multilingual perspective. *Research Anthology on Bilingual and Multilingual Education,* ed. by In Information Resources Management Association, 136–160. Hershey: IGI Global.

Everson, Michael. E. 2018. Confronting literacy in Chinese as a foreign language. *Issues in Language Program Direction: The Interconnected Language Curriculum: Critical Transitions and Interfaces in Articulated K-16 Contexts,* ed. by Per Urlaub, and Johanna Watzinger-Tharp, 159–173. Cengage Learning.

Gelb, Ignace J. 1952. *A Study of Writing*. Chicago: University of Chicago Press.

Hamada, Hamada, and Keiko Koda,. 2010. The role of phonological decoding in second language word-meaning inference. *Applied Linguistics* 31.4: 513–531.

Hao, Yen-Chen, and Chung-Lin Martin Yang. 2021. The effect of second-language orthographic input on the phonological encoding of Mandarin words. *Applied Psycholinguistics* 42.4: 887–906.

Hayes, Andrew F. 2018. Partial, conditional, and moderated moderated mediation: Quantification, inference, and interpretation. *Communication Monographs,* 1–37.

Hayes-Harb, Rachel, and Hui-Wen Cheng. 2016. The influence of the Pinyin and Zhuyin writing systems on the acquisition of Mandarin word forms by native English speakers. *Frontiers in Psychology* 7: 785.

Ke, Sihui, and Shui Duen Chan. 2017. Strategy use in L2 Chinese reading: The effect of L1 background and L2 proficiency. *System: An International Journal of Educational Technology and Applied Linguistics* 66: 27–38.

Ke, Sihui, and Keiko Koda. 2017. Contributions of morphological awareness to adult L2 Chinese word meaning inferencing. *The Modern Language Journal* 101.4: 742–755.

Ke, Sihui, and Keiko Koda. 2019. Is vocabulary knowledge sufficient for word meaning inference? An investigation of the role of morphological awareness in adult L2 learners of Chinese. *Applied Linguistics* 40.3: 456–477.

Ke, Sihui, and Keiko Koda. 2021. Transfer facilitation effects of morphological awareness on multicharacter word reading in Chinese as a second language. *Applied Psycholinguistics* 42.5: 1263–1286.

Lexicon of Common Words in Contemporary Chinese Research Team. 2008. *Lexicon of Common Words in Contemporary Chinese*. Beijing: The Commercial Press.

Li, Luan, Hua-Chen Wang, Anne Castles, Miao-Ling Hsieh, and Eva Marinus. 2018. Phonetic radicals, not phonological coding systems, support orthographic learning via self-teaching in Chinese. *Cognition* 176: 184–194.

Li, Luan, Eva Marinus, Anne Castles, Lili Yu, and Hua-Chen Wang. 2019. Eye-tracking the effect of semantic decoding on orthographic learning in Chinese. Accessed online, February 19, 2024. https://psyarxiv.com/ekxd6

Li, Miao, Poh Wee Koh, Esther Geva, R. Malatesha Joshi, and Xi Chen. 2020. The componential model of reading in bilingual learners. *Journal of Educational Psychology* 11.8:1532–1545.

Li, Tong, and Catherine McBride-Chang. 2014. How character reading can be different from word reading in Chinese and why it matters for Chinese reading development. *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, ed. by Xi Chen, Qiuying Wang, and Yang Cathy Luo, 49–65. New York: Springer.

Li, Tong, Ying Wang, Xiuhong Tong, and Catherine McBride. 2017. A developmental study of Chinese children's word and character reading. *Journal of Psycholinguistic Research* 46.1: 141–155.

Li, Xing Shan, Klinton Bicknell, Ping Ping Liu, WeiWei, and Keith Rayner. 2014. Reading is fundamentally similar across disparate writing systems: A systematic characterization of how words and characters influence eye movements in Chinese reading. *Journal of Experimental Psychology: General* 143: 895–913.

Li, Yixun, Hong Li, and Min Wang. 2020. Orthographic learning via self-teaching in Chinese: The roles of phonological recoding, context, and phonetic and semantic radicals. *Journal of Experimental Child Psychology* 199: 104913.

Li, Yixun, Min Wang, and Daniel Espinas. 2022. Self-teaching new words among English language learners. *Reading and Writing* 35: 2389–2408.

Li, Yixun, Min Wang, Chuchu Li, and Man Li. 2022. Phonological training and word learning in a novel language. *Frontiers in Psychology* 7:629349.

Lin, Chin-Hsi, and Penelope Collins. 2012. The effects of L1 and orthographic regularity and consistency in naming Chinese characters. *Reading and Writing* 25.7: 1747–1767.

Lin, Da, Catherine McBride-Chang, Hua Shu, Yuping Zhang, Hong Li, Juan Zhang, Dorit Aram, and Iris Levin. 2010. Small wins big: Analytic Pinyin skills promote Chinese word reading. *Psychological Science* 21.8: 1117–1122.

Liu, Yan. 2013. *L1 Reading Ability, L2 Linguistic Knowledge, and L2 Semantic Gap Filling Ability* (Unpublished doctoral dissertation). Pittsburgh, PA: Carnegie Mellon University.

Liu, Yang. 2018. *Acquisition of Word Spelling and Meanings During Reading in Nonnative Chinese Speakers* (Unpublished doctoral dissertation). Bowling Green, KY: Western Kentucky University.

Lü, Chan. 2017. The roles of pinyin skill in English-Chinese biliteracy learning: Evidence from Chinese immersion learners. *Foreign Language Annals* 50.2: 306–322.

Matsuo, Tohru. 2017. *The Roles of Lexical Size, Depth, and Automaticity of Word Recognition on Reading Comprehension* (unpublished doctoral dissertation). Temple University, USA.

Packard, Jerome L. 1990. Effects of time lag in the introduction of characters into the Chinese language curriculum. *Modern Language Journal* 74: 167–175.

Perfetti, Charles A. 2003. The universal grammar of reading. *Scientific Studies of Reading* 7.1: 3–24.

Perfetti, Charles A., and Lesley Hart. 2002. The lexical quality hypothesis. *Precursors of Functional Literacy*, ed. by In Ludo Verhoeven, Carsten Elbro, and Pieter Reitsma, 189–214. Amsterdam/Philadelphia: John Benjamins.

Perfetti, Charles A., and Joseph Stafura. 2014. Word knowledge in a theory of reading comprehension. *Scientific Studies of Reading* 18.1:22–37.

Perfetti, Charles A., and Tan, Li Hai. 1998. The time course of graphic, phonological, and semantic activation in visual Chinese character identification. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 24:101–118.

Qi, Shiwen, Mark Feng Teng, and Ailan Fu. 2022. LexCH: a quick and reliable receptive vocabulary size test for Chinese learners. *Applied Linguistics Review*: aop.

Schwartz, Mila, Janina Kahn-Horwitz, and David L. Share. 2014. Orthographic learning and self-teaching in a bilingual and biliterate context. *Journal of Experimental Child Psychology* 117:45-58.

Shahar-Yames, Daphna, and David L. Share. 2008. Spelling as a self-teaching mechanism in orthographic learning. *Journal of Research in Reading* 31.1:22–39.

Share, David L. 1995. Phonological recoding and self-teaching: Sine qua non of reading acquisition. *Cognition* 55.2: 151–218.

Share, David L. 2008. Orthographic learning, phonological recoding, and self-teaching. *Advances in Child Development and Behavior* 36: 31–82.

Shu, Hua, and Richard C. Anderson. 1997. Role of radical awareness in the character and word acquisition of Chinese children. *Reading Research Quarterly* 32.1: 78–89.

Shu, Hua, Xi Chen, Richard C. Anderson, Ningning Wu, and Yue Xuan. 2003. Properties of school Chinese: Implications for learning to read. *Child Development* 74.1: 27–47.

Shu, Hua, and Baoxia Liu. 1994. The role of Pinyin on young primary school children's early reading. *Psychological Development and Education* 3: 11–15.

Sproat, Richard, and Alexander Gutkin. 2021. The taxonomy of writing systems: How to measure how logographic a system is. *Computational Linguistics*, 47.3: 477-528.

Taylor, Insup, and M. Martin Taylor. 2014. *Writing and Literacy in Chinese, Korean and Japanese: Revised Edition* (Vol. 14). Philadelphia: John Benjamins Publishing Company.

Wang, Hua-Chen, Anne Castles, Lyndsey Nickels, and Kate Nation. 2011. Context effects on orthographic learning of regular and irregular words. *Journal of Experimental Child Psychology* 109.1: 39–57.

Wang, Ying, and Catherine McBride. 2016. Character reading and word reading in Chinese: Unique correlates for Chinese kindergarteners. *Applied Psycholinguistics* 37.2:371–386.

Xiao, Hiumin, Caihua Xu, and Hetty Rusamy. 2020. Pinyin spelling promotes reading abilities of adolescents learning Chinese as a foreign language: evidence from mediation models. *Frontiers in Psychology* 11: 596680.

Xu, Yi, and Jie Zhang. 2022. Chinese compound word inference through context and word-internal cues. *Language Teaching Research* 26.3: 308–332.

Ye, Lijuan. 2013. Shall we delay teaching characters in teaching Chinese as a foreign language? *Foreign Language Annals* 46: 610–627.

Yuan, Han, Elaine Segers, and Ludo Verhoeven. 2020. Factors affecting L2 phonological awareness in Chinese-Dutch preschoolers. *Written, Language and Literacy* 23.1:109–128.

Zhang, Dongbo, Chin-His Lin, Yining Zhang, and Yunjeong Choi. 2019. Pinyin or no pinyin: does access to word pronunciation matter in the assessment of Chinese learners' vocabulary knowledge? *The Language Learning Journal* 47.3: 344–353.

Zhang, Haiwei, and Leah Roberts. 2021. A comparison of Pinyin invented spelling and oddity test in measuring phonological awareness in L2 learners of Chinese. *Journal of Psycholinguistic Research* 50.2: 375–396.

Zhang, Jie, Hong Li, Yang Liu, and Yu Chen. 2020. Orthographic facilitation in oral vocabulary learning: Effects of language backgrounds and orthographic type. *Reading and Writing* 33.1:187–206.

Zhou, Yanling, and Catherine McBride. 2023. Invented spelling in English and pinyin in multilingual L1 and L2 Cantonese Chinese speaking children in Hong Kong. *Frontiers in Psychology* 13: 1039461.

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Appendix A: Bootstrap Results of Regression Model Parameters ($N = 54$)

Outcome variable: Single-character word meaning inferencing				
	Coeff	BootMean	BootSE	BootLLCI	BootULCI
Constant	5.9794	5.8584	1.4058	2.4278	8.1299
PS	.0969	.0988	.0469	.0192	.2049
PRK	−.0302	−.0293	.0447	−.1221	.0520
SRK	.0211	.0245	.0653	−.1051	.1423
Outcome variable: Single-character word meaning inferencing				
Constant	7.0514	6.9736	2.3228	2.3957	11.5162
PS	.0687	.0664	.0517	−.0443	.1599
SCWMI	.3655	.3887	.1941	.0289	.8351
PRK	.0414	.0392	.0614	−.0823	.1606
SRK	.1751	.1703	.0571	.0556	.2802

拼音拼寫在中文作爲外語自我教學中重要嗎？

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摘要

　　拼音在中文作爲外語的教學和學習中是否產生作用，目前學界仍存在著爭議。 本研究試圖研究拼音拼寫與母語為非拼音文字的中文學習者，詞義推斷之間的關聯。54 名日語為母語的大學一年級中文學習者完成了一次測試，包括五項任務，分別是拼音拼寫、聲旁知識、部首知識、單字詞義推斷和情境化多字詞義推斷。 根據相關性和迴歸分析的結果，本研究有三個主要發現：（1）拼音拼寫與單字詞義推斷準確度顯著相關，且超過了與聲旁和部首知識的關聯性。（2）部首知識與情境化多字詞義推斷準確度是直接相關。（3）拼音拼寫通過單字詞義推斷，間接影響情境化多字詞義推斷準確度。結果表明，對於母語為非拼音文字的中文外語學習者而言，拼音拼寫在他們的自我教學過程中產生重要的作用。

關鍵詞：中文　外語　自我教學　拼音　詞義推斷