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A study on Chinese-character learning strategies and character learning performance among American learners of Chinese

Abstract: This study investigated Chinese-character learning strategies employed by 74 first-year American college learners of Chinese. This study attempted to answer the following research questions: (1) what Chinese-character learning strategies are most frequently used by first-year Chinese language learners?; (2) what are the factors underlying the most frequently used strategies?; and (3) are there any linear trends between the most frequently used strategies and character learning performance?. The results found seven most frequently used strategies. Furthermore, four of these strategies were stroke-orthographic-knowledge-based while the remaining three were phonological-semantics-knowledge-based. The stroke-orthographic-knowledge-based strategies accounted for 6.8% of the learners' character learning performance.

Keywords: Chinese Writing, Chinese-Character Learning Strategies, Chinese-Character Learning Performance

1 Introduction

Student enrollment in Chinese classes is showing the fastest growth among foreign language courses in U.S. higher education. The Modern Language Association (2009) conducted a foreign language enrollment survey of more than 2,500 U.S. colleges and universities, about two-thirds of all institutions of higher education in the nation. That survey found that enrollment in Chinese grew by the highest percentage after Arabic and Korean, with about 61,000 U.S. students studying Chinese, an increase of 18% since 2006 (Modern Language Association 2009). In addition to pursuing Chinese language study in U.S. institutions, many Americans are heading to China or Taiwan to study. In 2006, more than 11,000 students went to China and more than 400 students went to Taiwan, an increase of 25% and 27% respectively since 2005 (Open Doors, 2008). Moreover, the same study showed that the majority of these students engaged in Chinese language study (Open Doors 2008).

This flourishing interest in learning Chinese in the U.S. and overseas has resulted in an increased need for emphasis on understanding Chinese language learners' language developmental processes and learning phenomena in order to better assist learners of Chinese as a foreign/second language. Due to the complex nature of the Chinese written language to speakers whose native language shares few common features with Chinese, recognizing and producing Chinese characters have been identified as some of the most difficult Chinese language skills to acquire. However, the knowledge of Chinese characters is the foundation of Chinese reading and writing skills (Shen 2004). Without the knowledge of Chinese characters, developing Chinese language proficiency becomes a more difficult task. Hence, in order to enhance the effectiveness of learning Chinese characters, it is essential that Chinese language educators understand how their students try to learn Chinese characters, and which strategies are most effective in acquiring the characters.

2 The Chinese writing system

The Chinese language is a logographic language that is conceptually different compared to alphabetic language systems such as English. In an alphabetic language system, pronunciation and writing are linked by systematic patterns and associations. In contrast, in a logographic language system, each symbol represents an idea that has little correspondence to its pronunciation (Sung and Wu 2011). Even though approximately 90% of modern Chinese characters consist of phonetic radicals, which cue the pronunciations of the characters, only about 26% of the characters are actually pronounced like their phonetic radicals due to Chinese language evolution (Zhu 1987). Learners of Chinese who speak an alphabetic native language have to make a lot of effort to master the language because of the fundamental differences between alphabetic and logographic languages. The following section identifies and explains specific challenges English-speaking learners of Chinese face when learning Chinese characters.

2.1 Challenges of learning Chinese characters

Several challenges can be identified when learning Chinese characters. One challenge is the large number of characters to be learned to become a functional reader and writer in a Chinese-speaking community. In order to be fully literate in Chinese, learners need to have the knowledge of three thousand commonly used characters (Wong, Li, Xu and Zhang 2010). Second, it is time-consuming to learn

how to read and write Chinese characters as there is little correspondence between a character and its pronunciation (Sung and Wu 2011). Another feature of Chinese which may present a challenge to learners is the large number of homophones in Chinese (Wong, Li, Xu and Zhang 2010). Characters with different meanings may share the same sounds, which creates difficulty for learners to accurately recognizing or producing characters. For example, 14 distinct characters among the 3000 most commonly used characters share the pronunciation /li/, but present different meanings: 力 (strength), 利 (benefit), 立 (establish), 歷 (history), 例 (example), 麗 (beautiful), 粒 (grain), 勵 (encourage), 厲 (formidable), 莉 (jasmine), 栗 (chestnut), 瀝 (drop), 俐 (clever), 隸 (slave). Due to these challenges, learning how to read and write Chinese characters can be frustrating to many learners (Wang 1998).

2.2 Models of processing and learning Chinese characters

Scholars have developed models relating to the processes of recognizing and producing Chinese language to facilitate more understanding of the nature of the language, and aid the teaching and learning of Chinese as a foreign/second language. For instance, Perfetti and Tan (1998, 1999) proposed the *lexical constituency model* to illustrate how one processes the mental representation of a Chinese character. The model consists of three constituents: orthography, phonology, and semantics (Perfetti and Tan 1998, 1999). As conceived, this model suggests that, for a Chinese reader, analyzing stroke types and how they are positioned in the character are the first steps in character recognition. Once the reader detects the information of stroke features, the orthographic analysis is activated in which the character as a whole is identified. Next, the reader activates the phonological and semantics system in order to identify the pronunciation and the meaning of the character. In sum, the process of recognizing a character involves the analysis sequences of stroke information, followed by orthographic information, then phonological and semantics information.

While Perfetti and Tan's (1998, 1999) model focused on the acquisition at the single character-level, Lin's (2004) model explains how a second language learner acquires Chinese words, which contain one to multiple characters. Lin (2004) proposed the *hierarchical continuum of vocabulary knowledge* in which four types of Chinese vocabulary acquisition were identified: (1) phonological comprehension, (2) orthographic comprehension, (3) phonological production, and (4) orthographical production. Furthermore, Lin (2004) stated that there are different levels of difficulty for the acquisition of proficiency for each of the four types of vocabulary knowledge. Being able to orally understand Chinese words

(phonological comprehension) is considered the easiest, while recognizing written Chinese words (orthographic comprehension) ranked as the second degree of difficulty. The third degree of difficulty is knowing how to speak Chinese words (phonological production), and the most difficult to acquire is being able to write characters (orthographical production).

The two models discussed above inform the steps one needs to take to be able to recognize and produce Chinese. Bearing the acquisition processes in mind, it is important for instructors and researchers of Chinese as a foreign/second language to identify effective strategies that learners can use at each step to successfully improve the learners' processes of character recognition and production. In light of this the next section discusses studies that touch upon learning strategies Chinese language learners used to master Chinese character knowledge at various Chinese character recognition and production stages.

3 Literature review

In the past decade, second language acquisition researchers (Chung 2007, Everson 1998, Ke 1996, Kuo and Hooper 2004, Lin 2000, Shen 2004, 2005, 2008, Taft and Chung 1999, Wang 1998, Winke and Abbuhl 2007) have been focusing on examining the learning of Chinese characters. A few studies drew attention on the relationship between character recognition and production (Everson 1998, Ke 1996). For instance, Ke's study (1996) found correlations between character recognition and production by adult American learners of Chinese. The findings of Everson's (1998) study is in support of Ke's (1996) finding that there is a significant relationship between the ability to pronounce and the ability to identify Chinese words. As a result, the studies suggested that learners acquire firm spoken proficiency as a strategy to aid the learning of characters. Lin's (2000) study took these findings a step further to examine the relationship between Chinese vocabulary acquisition and Chinese language proficiency. Based on the study results, she concluded that higher-level Chinese vocabulary acquisition is the foundation of higher-level Chinese language proficiency.

A couple studies (Chung 2007, Taft and Chung 1999) emphasized the effects of different ways to study Chinese characters to develop character recognition. For example, Taft and Chung (1999) conducted an experiment with Australian learners of Chinese on the effect on character recognition of the order in which radical knowledge, English translation, and characters were taught. The authors found that the participants who studied the nature of radicals before the exposure to the characters and their English translations yielded best learning results in terms of character recognition. In a different study, Chung (2007) focused on

the influence of different presentation modes of characters, their English translations, and pinyin on character recognition. The results demonstrated that presenting a character to the left of the pinyin and English translation resulted in greater retention of its meaning and pronunciation compared to presenting the prompts to the left of the character. Moreover, prompts placed adjacent to the characters rather than at a distance resulted in superior learning. Furthermore, the addition of color-coded prompts also helped increase the participants' character retention rate (Chung 2007).

Some of the studies reviewed above seem to imply that certain ways of learning Chinese characters not only yield better results in learning Chinese characters, but also enhance the Chinese language proficiency level. If that implication is true, identifying what strategies learners use, and more importantly, what specific strategies are effective in aiding the learning of Chinese characters should be an important task for researchers. Many of the existing studies in learning Chinese characters have attempted to identify learners' Chinese-character learning strategies. For instance, Wang's (1998) questionnaire study on first-year American students' character learning strategies reported high percentage of the learners' use of memorization, read-aloud, translation, and association strategies. Winke and Abbuhl (2007) examined strategies used by learners of Chinese as a foreign language based on classroom observations and focus-group interviews data. The results showed that input-based, output-based, and cognition-based strategies were all fundamental to the learners' Chinese character learning. Shen (2005) found that the majority of the 95 learners at multiple Chinese language levels in her study used orthographic knowledge-based cognitive strategies, which utilize three kinds of radical knowledge: graphemics, semantics, and phonetics, to encode characters. In a later study, Shen (2008) investigated word decision strategies, which are strategies learners use to identify whether or not two-character words presented to them are indeed Chinese words. Shen (2008) concluded that learners in the beginning and advanced levels in the study used six types of word decision strategies: guessing based on intuition, matching target items to the existing representations in the mental lexicon, combining the semantic information of each constituent character, deriving word meaning based on the semantic information of the constituent characters, applying knowledge of parts of speech to the target item or adjacent characters, and using contextual information.

While many of the studies mentioned have identified strategies learners used to study Chinese characters, studies which sought to find effective strategies that may have resulted in superior character learning are scarce. One study about strategy effectiveness is Shen's (2004) investigation of the effects of three encoding strategies, rote memorization, student self-generated elaboration, and instructor-guided strategies, on character learning among American college learners of

Chinese. Among the three encoding strategies, Shen (2004) concluded that instructor-guided strategies significantly enhanced retention of character meaning. Another study about strategy effectiveness on learning Chinese characters is Kuo and Hooper's (2004) research in investigating the effects of five different strategies of learning Chinese characters in a high school context. The five strategies were: (1) translation: study characters with their English translations; (2) verbal coding: study characters with their English translations and listen to a brief verbal description of the characters' etymologies; (3) visual coding: study characters, their English translations; and see pictures representing concrete or abstract words; (4) dual coding: study characters with their English translations, corresponding pictures, and a verbal description of their etymologies and (5) self-generated coding: study characters with their English translations, draw pictures, write sentence, or invent stories associating the characters with their meanings. The study results revealed that, in the experiment, the participants who were assigned to use the self-generated coding strategy scored highest in the Chinese recognition posttest. The self-generated coding strategy seemed to be an effective strategy for remembering Chinese characters; however, Kuo and Hooper (2004) pointed out that the participants who used the self-generating strategy spent three to four times longer learning characters than did the participants who used other strategies, raising the concern about the strategy efficiency.

Both studies, which considered strategy effectiveness, were conducted in controlled experiments in which the researchers designed the types of strategies their learners were assigned to use in different treatment groups. There do not seem to be studies that identify effective strategies learners choose to use on a regular basis. Hence, the present study, which attempted to investigate commonly used effective Chinese-character learning strategies, is needed in the Chinese as a foreign/second language research field.

4 Research questions

The present study had three aims. The first aim was to identify first-year English-speaking non-Chinese native learners' most frequently used Chinese-character learning strategies. The second aim was to find possible underlying factors characterizing the most frequently used strategies. The third aim was to investigate whether or not there are any linear trends between the most frequently used strategies and the learners' character learning performance. Hence, the present study posed the following research questions:

1. What Chinese-character learning strategies are most frequently used by first-year Chinese language beginners?

2. What are the factors underlying the most frequently used strategies?
3. Are there any linear trends between the most frequently used strategies and character learning performance?

5 Method

5.1 Participants

This study used a non-probability sample, which was the population to whom the researcher had easy access. The participants were non-Chinese heritage language learners who were true beginners enrolled in the first-year Chinese courses at a university in the United States. The total number of students in the first-year classes was 96. Of these, 74 students voluntarily participated in the study. There were 44 males and 30 females in the study, ranging in age from 18 to 31 years. The average age of the participants was 20. The courses used the textbook, *Chinese Odyssey Volume I* (Wang, Chi and Feng, 2005), which consists of 10 lessons that introduces basic Chinese vocabulary and grammar. By the end of the first 15-week semester, the students were expected to be able to recognize approximately 250 characters and produce approximately 100 characters.

5.2 Questionnaire

This study adopted the questionnaire, the *Character Learning Strategy Inventory*, designed by Shen (2005) to investigate how frequently students use the 59 character learning strategies listed in the questionnaire. The 59 strategies were among the 176 initially identified strategy items from Shen's (2005) *Character Learning Strategy Survey* and were identified as used by more than 5% of Shen's (2005) 95 participants. The 59 strategy items were placed on a 5-point Likert scale with "1" being "Never or almost never true of me", "2" being "Generally not true of me", "3" being "Somewhat true of me", "4" being "Generally true of me", and "5" being "Always or almost always true of me". For the ease of participants recalling their character-learning strategies, the 59 items were categorized into five sections by the following character learning sequence: (1) strategies used when characters are first introduced, (2) strategies used to increase understanding of new characters after they have been introduced, (3) strategies used to memorize newly learned characters, (4) strategies used to practice new characters and (5) strategies used to preview or review new characters (Shen 2005). Shen's (2005) carefully designed survey has an overall Cronbach's Alpha value of very close to 0.8,

which indicates that the survey has a reasonable degree of reliability and is worthy of adopting.

5.3 Lesson quizzes

This study used the grade average of the 10 lesson quizzes as the participants' Chinese character performance data. The quizzes were usually given the day after the instructors finished teaching each of the lessons. The purpose of the 10 quizzes was to evaluate the participants' knowledge of the Chinese characters learned in each of the 10 lessons. In particular, the quizzes mainly focused on the learners' orthographical written production, which is ranked as the most difficult acquisition task in character learning. Each quiz consisted of three parts (See Appendix). Part A, in which the participants were asked to write down the pinyin and characters of the five vocabulary words their instructor read aloud, accounted for 50% of the quiz grade. Each vocabulary word usually consisted of two characters. The words selected consisted of characters the participants were expected to know how to write in the lesson. Even though Part A is intended to test the participants' orthographical written production level, in order to do well in this part, participants are required to comprehend the sounds and meanings of the words read to them. In other words, both orthographical written production and phonological-semantics knowledge would be required to do well in Part A. In Part B, the participants were shown a character and were asked to demonstrate how to write the character in the correct stroke order. In Part C, the participants were asked to identify and write down the radical in each of the characters shown to them. Parts B and C accounted for 50% of the quiz grade. Each lesson quiz accounted for 1% of the final course grade. All participants took the same quizzes even though they were enrolled in different sections of the first-year course.

5.4 Procedures

The *Character Learning Strategy Inventory* questionnaire was collected during the final instructional week of the 15-week semester when the participants had completed the study of the 10 lessons in the textbook. Prior to distributing the survey to the students, the purpose of the study and the potential benefits derived from the study were explained. All participants agreed to participate in the study by signing a consent form. The respondents were anonymous. A total of 74 surveys

were complete and used for the data analysis. In addition, the 74 participants' lesson quiz grades were gathered approximately when the semester ended. The instructors sent the grades to the researcher in excel files, which showed the participants' grades of each quiz.

6 Data analysis

The questionnaire data was analyzed through SPSS statistical software. All the statistical tests run in this study had a minimum conventional level of significance, $p = .05$. In addition, the null hypothesis was assumed in the tests. For the first research question, "What Chinese-character learning strategies are most frequently used by first-year Chinese language beginners?", the mean and standard deviation of the 59 character learning strategies were compared. Seven strategies which had a mean between 4 ("Generally true of me or above") and 5 ("Always or almost always true of me") were considered as most frequently used strategies by the participants.

Since there seemed to be multidimensionality within the seven most frequently used strategies identified, for question 2, "What are the factors underlying the most frequently used strategies?", the use of factor analysis was necessary to see the commonalities among the seven strategies. Hence, the use of factor analysis in this study helped to identify underlying factors in a set of variables so that the entire set may be better understood conceptually (Coolidge, 2000). In regard to the sample size for factor analysis, Coolidge (2000) recommended ten subjects per item in order to yield reliable research results. Following Coolidge's (2000) recommendation, the total number of participants ($N = 74$) in this study exceeded the minimum requirement ($N = 70$) to run factor analysis using the seven most frequently used strategies.

For the third research question, "Are there any linear trends between the most frequently used strategies and character learning performance?", the null hypothesis indicated that there was no significant relationship between learners' most frequently used character-learning strategies and their character learning performance. Multiple regression was used to determine whether or not the null hypothesis should be rejected. The criterion variable was the learners' average grade on the lesson quizzes, and the predictor variables were the two groups of learners' most frequently used strategies extracted from the factor analysis test. Multiple regression can help determine the extent to which the predictor variables predict the criterion variable and the strength of each predictor variable in the prediction of the criterion variable (Coolidge, 2000). Coolidge (2000)

recommended that the total number of respondents be at least ten times the number of predictor variables, which is two in this study, in order to run the multiple regression analysis. The total number of respondents ($N = 74$) in this study exceeded the minimum recommendation ($N = 20$).

7 Results

The *Character Learning Strategy Inventory* questionnaire was employed to understand more about what strategies the respondents most frequently used to learn Chinese characters. The seven most frequently used strategies are given in Table 1. It appears that when a character or word was first introduced to the participants, the participants frequently used strategies to get familiar with the stroke order (item 10), the orthography of the character/word (item 9), the pronunciation (item 3), and the meaning (item 11). These strategies match perfectly with the character recognition processes identified in Perfetti and Tan's (1998, 1999) *lexical constituency model*, in which sequences of stroke information, orthographic information, and phonological and semantics information are essential for Chinese recognition. Regardless of how effective the strategies described in items 3, 9, 10, and 11 are, the participants seemed to know the kinds of character knowledge they needed to acquire in order to acquire Chinese characters. When practicing newly learned characters, the participants commonly used two drill-based strategies (items 23 and 57) and a translation strategy (item 17). In addition, six of the seven most frequently used strategies (items 3, 9, 11, 17, 23, 57) are considered cognitive strategies, that is, "strategies involved during the cognitive processing of characters such as those used for enhancing attention, perception, memorization, and comprehension of characters, as well as their retrieval" (Shen 2005: 56), while one strategy (item 10) is considered a metacognitive strategy, which is used to organize learning so that learners may more easily coordinate the learning process.

7.1 Factor analysis

Factor analysis was conducted to check if there was any multidimensionality within the seven most frequently used strategies and see which items might be varying together. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.76, which supported the factorability of these data. The significance level of

Seven Most Frequently Used Strategies	N	M	SD
9. When a new character (or word) is first introduced, I write the character (or word) down.	74	4.32	0.81
17. In order to increase my understanding of new characters (or words) after they have been introduced, I convert the word to my own native language and find an equivalent in meaning.	74	4.19	0.66
23. In order to memorize newly learned characters (or words), I usually say the character (or word) to myself as I write it repeatedly.	74	4.14	1.00
57. I review characters by writing the characters many times.	74	4.11	1.12
3. When a new character (or word) is first introduced, I try to repeat the character (or word) several times aloud (or silently to myself).	74	4.08	1.06
11. In order to increase my understanding of new characters (or words) after they have been introduced, I look in the textbook or dictionary to check the character's (or word's) meaning that I am not sure of.	74	4.03	1.16
10. When a new character (or word) is first introduced, I observe the character (or word) carefully and pay attention to stroke order.	74	4.00	1.15

Table 1: Descriptive statistics: Most frequently used Chinese-character learning strategies

Bartlett test of sphericity = .000 indicated that these data did not produce an identity matrix and were thus approximately multivariate normal and acceptable for factor analysis. The output of factor analysis revealed two components with eigenvalues exceeding 1.

A Varimax rotation was performed in order to aid in the interpretation of the two components. The rotated result showed that each item moderately or strongly loaded on one of the two components. The subsequent two-component solution explained 65% of the variance, with Component 1 contributing 45%, and Component 2 contributing 20%. As shown in Table 2, Component 1, which includes four strategy items (9, 10, 23, and 57), is loaded heavily on learning characters through stroke order and orthographic knowledge.

The three strategy items (3, 11, and 17) loaded in Component 2 are strategies related to remembering phonological and semantics information of characters. In brief, the factor analysis results illustrated that the participants used strategies that require stroke, orthographic, phonological, and semantics knowledge as cues in learning new characters. Following the factor analysis, the analysis of internal consistency reliability was conducted in which Component 1 was 0.85 with $F(73, 3) = 3.09, p < .05$, indicating respectable reliability of Component 1. The

	Item-total correlation	Factor loading	h^2	M(SD)
Component 1 Stroke-Orthographic-Knowledge-Based		Cronbach's alpha = .85		
9. When a new character (or word) is first introduced, I write the character (or word) down.	.790	.901	.815	4.32(0.81)
57. I review characters by writing the characters many times.	.775	.891	.794	4.11(1.12)
23. In order to memorize newly learned characters (or words), I usually say the character (or word) to myself as I write it repeatedly.	.593	.769	.599	4.14(1.00)
10. When a new character (or word) is first introduced, I observe the character (or word) carefully and pay attention to stroke order.	.656	.740	.665	4.00(1.15)
Component 2 Phonological-Semantics-Knowledge-Based		Cronbach's alpha = .60		
11. In order to increase my understanding of new characters (or words) after they have been introduced, I look in the textbook or dictionary to check the character's (or word's) meaning that I am not sure of.	.526	.821	.681	4.03(1.16)
17. In order to increase my understanding of new characters (or words) after they have been introduced, I convert the word to my own native language and find an equivalent in meaning.	.316	.739	.547	4.19(0.66)
3. When a new character (or word) is first introduced, I try to repeat the character (or word) several times aloud (or silently to myself).	.416	.613	.480	4.08(1.06)

Table 2: Principal components analysis with varimax rotation of two-factor solution for the seven most frequently use Chinese-character learning strategies

Cronbach's alpha for Component 2 was 0.60 with $F(73, 2) = 0.775$, $p < .000$, suggesting the internal reliability of the factor is middling. The middling value of Cronbach's alpha in Component 2 could be explained by the limited number of items loaded in the component. In summary, based on the results of the analysis, the internal consistency reliability level of the items included in the factor analysis is fair.

7.2 Multiple regression

The results of factor analysis extracted two meaningful components involving seven strategy items. The next step was to examine whether these strategies were equally effective in learning Chinese characters. A regression analysis was conducted to answer this question. The result showed that linear trends exist only for Component 1, $R = .26$ [$F(2) = 5.226, p < .05$] indicating a significant moderate positive relationship between the predictor and criterion variables. Therefore, it is concluded that the null hypothesis is rejected. $R^2 = .068$ indicating that 6.8% of the variance in the participants' character-learning performance is accounted for by the stroke-orthographic-knowledge-based strategies. The direction of influence for the variable is positive. The B value shows that the participants who more frequently used the stroke-orthographic-knowledge-based strategies scored higher in their lesson quizzes.

8 Conclusions

The present study concluded with three major findings. The first finding answers the first research question, what Chinese-character learning strategies are most frequently used by first-year Chinese language beginners. This study found that the most frequently used Chinese-character learning strategies by the first-year learners of Chinese were six cognitive and one metacognitive strategies which focused on the memorization of characters' stroke, orthographic, phonetic, and semantics information. This finding can be explained by Perfetti and Tan's (1998, 1999) *lexical constituency model* in which stroke, orthographic, phonological and semantics information need to be activated in order to cognitively process characters. Also, this finding is consistent with Shen's (2005) finding in which the most frequently used character learning strategies by learners of Chinese were mostly cognitive. Shen (2005) explained that this result could be attributed to the amount of cognitive processes needed to acquire logographic scripts such as Chinese. However, the learners in the present study seemed to use relatively few kinds of cognitive strategies. Among the six most frequently used cognitive strategies, four (items 9, 23, 57, 3) are drill-based strategies, such as repeatedly reading aloud or writing characters, and two (items 17 and 11) are translating strategies. Even though according to Oxford (1990), both repeating and translating strategies are among the most important types of cognitive strategies for second language acquisition, there are other types of useful cognitive strategies the participants could have tried such as making associations between sound and symbol (item 2) or practicing naturalistically (item 40). The lack of use of some types of cognitive

strategies could be explained by the novice Chinese language level of the learners, who had limited amount of Chinese character knowledge to apply in a natural setting or making associations. Among the seven most frequently used strategies, paying attention (item 10) is the only metacognitive strategy identified. This finding is also consistent with Shen's (2005) study. In fact, not only in Chinese character learning, but also in the learning of other second languages, several studies (Chamot 1987, McGroarty 1987, Nyikos and Oxford 1987) found that the range of metacognitive strategies used by second or foreign language learners was limited. However, metacognitive strategies are useful. These strategies help learners have structured preview and review of characters (Shen 2005). The finding concerning the infrequent use of metacognitive strategies in this study and previous studies mentioned suggest that novice learners may not be aware of, or understand, the importance of using metacognitive strategies. This suggests that learners should be systematically taught metacognitive strategies to learn Chinese characters.

The second major finding answers the second research question, what are the factors underlying the most frequently used strategies. The finding is derived from the results of the factor analysis, which extracted two factors. The participants used the four strategies in the first factor to acquire stroke and orthographic knowledge of characters while the other three strategies in the second factor are related to acquiring phonological and semantics knowledge. These strategies helped learners acquire all four major components of character knowledge, namely, stroke order, character, pronunciation, and meaning; however, according to Taft and Chung's (1999) study, radical knowledge also had positive effect on character learning. To be specific, Taft and Chung (1999) found that radical knowledge aids character learning, especially the learning of semantics knowledge. In Taft and Chung's (1999) study, learners who studied characters and their radicals at the same time were better able to retain the meanings of the characters than ones who studied solely characters. The results of the current study indicate that the learners did not use any strategies related to radical knowledge (items 6, 18, and 26). Shen (2005) explained that due to the novice level of learners, the use of strategies to acquire radical knowledge may be limited. As learners' level advances, strategies related to radical knowledge will be deemed more useful for them (Shen 2005).

Regarding the third research question, are there any linear trends between the most frequently used strategies and character learning performance, the third major finding shows that the learners who more frequently used the stroke-orthographic-knowledge-based strategies scored higher in their orthographical production-based written lesson quizzes. The four strategies emphasize the observation of the structure of characters and the practice of reading and writing

characters repeatedly. However, these strategies only accounted for 6.8% of the learners' character learning performance.

9 Implications

The results of this study yielded several implications. First, the four commonly used stroke-orthographic-knowledge-based strategies only accounted for 6.8% of the learners' character learning performance. Other strategies or other factors, such as motivation, attitudes, gender, the amount of time devoted to practice each day, language awareness, self-confidence, age, and curriculum, which may account for more of learners' character learning performance will need to be investigated in future research. Second, as a limitation, this study only investigated one correlation, which was between the commonly used strategies and the orthographical production-based performance. However, other possible correlations may exist and need to be investigated, such as between strategies and phonological comprehension, orthographical comprehension, or phonological production. In other words, different designs of character learning performance are needed to examine these relationships. Third, current literature suggests that learners at different language levels use different kinds of strategies. It would be useful to research the different strategy uses at different language levels and how the different strategy uses contribute to character recognition and production. Finally, researchers and instructors need to realize that backwash effect of the assessment of learners' performance on their on-going learning process may be possible. For example, a particular type of assessment may influence the strategies learners choose to use to study the language. Using mixed varieties of assessment methods to assess language learners' knowledge would be beneficial to avoid negative backwash effect of the assessment of learners' performance on their long term learning process.

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Appendix: Lesson quiz

A. Listen to the words said by the instructor and write down the characters and their pinyin with correct tones:

1. Pinyin: _____
Characters: _____
2. Pinyin: _____
Characters: _____
3. Pinyin: _____
Characters: _____
4. Pinyin: _____
Characters: _____
5. Pinyin: _____
Characters: _____

B. Write the character “早” in the correct stroke order:

- first stroke: _____
- second stroke: _____
- third stroke: _____
- fourth stroke: _____
- fifth stroke: _____
- sixth stroke: _____

C. Look at the characters below, identify and write down the radical in each of them:

1. 你
radical: _____
2. 好
radical: _____

3. 早

radical: _____

4. 老

radical: _____