Development and Validation of Chinese Character Writing Strategies Inventory for Learners of Chinese as a Second Language (CSL)

by

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Statement of Originality

I, YE, Lijing, hereby declare that I am the sole author of the thesis and the material presented in this thesis is my original work except those indicated in the acknowledgement. I further declare that I have followed the University's policies and regulations on Academic Honesty, Copyright and Plagiarism in writing the thesis and no material in this thesis has been submitted for a degree in this or other universities.

Abstract

Among the widely adapted Chinese language learning strategies (LLS), there is no much study about the learning strategies of Chinese character writing (CCW) (Simplified Chinese character handwriting in this thesis) for Chinese as second language (CSL) learners. There is even no established effective instrument to measure CCW learning strategies. In addition, the complex learning process involves not only learning strategies but also motivation, which has been identified as another critical learner variable and could affect learners' LLS as well as learning outcomes. It is a challenge to integrate CCW learning strategies with the variables simultaneously to understand the CCW learning process.

The primary goal of this research aims to investigate learning strategies for CCW among CSL learners and develop a valid and reliable instrument, *Chinese Character Writing Strategies Inventory* (CCWSI), to quantify CCW strategies. Based on the literature review, a 31-item CCWSI is initially generated and first examined among 43 students in a Hong Kong international school in the pilot phase. The Exploratory Factor Analysis (EFA) result shows there are 2 factors, F1 indirect strategies and F2 knowledge-based strategies, reflecting the cognitive process of writing and the linguistic features of Chinese characters. This two-factor structure is further examined and verified by EFA and Confirmatory Factor Analysis (CFA) in the main phase of the study undertaken the data with 339 students from 4 universities in Vietnam. The two subscales, the form-based and sound-meaning-based strategies, are identified under F2, implying the basic processing routes for CCW. The finalized CCWSI includes 20 items with a two-layer internal structure: the upper-level layer 2 factors (10 items for each factor) and the two-subscale layer (5 items for each subscale). This internal structure reflects the cognitive process of CCW and reveals the linguistic features of Chinese characters.

Furthermore, we investigate the role of CCW strategies in the CCW learning process taking account of CCW motivation, strategies, and performance simultaneously. To achieve the goal, we adopt and modify the Biggs' 3P model to integrate these variables as a dynamic system. The instruments, CCW motivation Questionnaire (modified from Biggs' R-SPQ-2F) and CCWSI, are employed to measure the 2 scales of CCW motives (Deep and Surface) and the 2 factors of CCWS (F1 and F2). Meanwhile, we use the dictation task to measure the performance of CCW of CSL learners. The correlation analysis demonstrates the significant direct effect of learning strategies on CCW performance, and motivation on learners' learning strategies. The variables of the CCW learning process are interrelated and interacted. Our formulated hypotheses are approved that Deep Motives promote CCW learning strategies, especially the indirect strategies, and foster a better result in CCW performance, though the mediation analysis of CCW learning strategies via Structural Equation Modelling (SEM) does not show a significant indirect effect of motivation. Except the mediating role of CCW learning strategies in the learning process is still questionable and requires further investigation, educators should consider that motivation effectives on CCW learning strategies. From the pedagogical perspective, instructors' interventions should increase learners' intrinsic motivation, promote their use of effective strategies, and help them to achieve a better performance in CCW.

Keywords: Chinese character handwriting; Learning strategy; CSL learners; Learning motivation

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List of Abbreviations

CCW	Chinese Character Writing
CCLS	Chinese Character Learning Strategies
CCWSI	The Chinese Character Writing Strategy Inventory
CFA	Confirmatory Factor Analysis
CSL	Chinese as second language
DM	Deep Motives
EdUHK	The Education University of Hong Kong
EFA	The exploratory Factor Analysis
ESF	English Schools Foundation in Hong Kong
ESL	English as a Second Language
IB	The International Baccalaureate
LLS	Language Learning Strategies (L2 Language learning Strategies)
LLM	Language Learning Motivation
L2	Second Language
SEM	Structural Equation Modeling
SILL	Strategy Inventory for Language Learning
SM	Surface Motives
S^2R	The Strategies Self-Regulation Model
SPQ	Study Process Questionnaire
R-SPQ-2F	Revised Two-Factor version of the Study Process Questionnaire

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Chapter 1: Introduction

Due to the unique properties of Chinese characters, the students with Chinese as a second language (CSL) must develop specific learning behaviors to cope with Chinese character writing (CCW) learning tasks. However, there is no established instrument for effectively measuring CCW learning strategies. The present research aims to develop and validate Chinese Character Writing Strategies Inventory (CCWSI) to assess Chinese character writing strategies (handwriting in this thesis). Based on CCWSI, we further investigate the learning process of Chinese character writing (CCW), which include CCW motivation, CCW learning strategies, and CCW performance. In the first chapter, we introduce: 1) what trigged the research; 2) why is it important to investigate CCW learning strategies; 3) why and how to integrate learning strategies into the learning process of CCW; 4) what are the research purpose and questions of the present study; 5) the organization of the whole thesis; 6) terms and Definition.

1.1 Background and statement of the problem

The basic unit of written Chinese is character. In the past decades, despite the overall interest in CSL learning and teaching, the literature involving CCW among CSL learners are relatively limited, although CCW has been identified as an important and difficult task for CSL learners (Everson, 1998; Hu, 2010; Ke, 1996; Samimy & Lee, 1997; Xiao, 2011; Yang, 2018; etc.). With the development of electronic devices, CCW is greatly overlooked by many students and instructors. Some of them suggest using a computer-assisted writing system (Ye, 2013) and some even state that learning CCW is a waste of time (Allen, 2008).

As well known, the using of learning strategies in second languages (L2s) certainly affects proficiency or achievement (Park, 1997; Wharton, 2000; Oxford, 2011a; etc.), and these strategies could be taught to learners for improvement, (Oxford, 1990& 1996; Chamot

& El-Dinary, P.B., 1999; Harris, 2003; etc.). Applying it to CCW, once we understand how CCW is learned and identify CCW strategies, those strategies could be available for CSL learners to assist them in CCW learning.

In addition to the learning strategies that learners prefer to use (learning strategies), another one factor that significantly impacts students' learning outcomes is the underlying intention or reasons why learners use specific strategies (learning motivation). They both are inevitably considered in a learning task (Yan, 2012), such as learning CCW. Comprising motivation with learning strategies, an effective learning approach, known as Student Approaches to Learning (SAL) (Marton & Saljö, 1976; Biggs, 1987a & 2001), could be investigated among learners. The role of motivation in determining the L2 learning strategies and their correlation with L2 performance has been commonly agreed (Cohen & Dörnyei, 2002; Hung, 2007; Oxford & Shearin, 1994; etc.). A task learning process, such as CCW learning process, incorporates learning motivation, learning strategies, and performance.

While CSL learning strategies and CSL learning motivation have been well documented, much less research has been focused on Chinese character learning and writing. Research integrating the three key elements of the learning process of CCW (motivation, strategies, and performance) are even more rare.

Compared to the strategy research on CSL learning in English, only a small portion has involved Chinese character learning strategies (see Jiang and Cohen, 2012, for a comprehension review through the major data bases for the past decades). As CCW transforms the knowledge about the orthographies into a motor activity of the hand, this decoding process required specific learning strategies. The limited studies of CCW strategies are either qualitative research involving writing error analysis (Good, 1998; Ma, 2007; An & Shan, 2007; Zhang 2019; etc.) or quantitative research which grouped together with character comprehension and recognition (McGinnis, 1999; Everson, 1998; Ke, 1998; Jiang & Zhao,

2001; Tseng, 2000; Zhou & Yu, 2004; Shen, 2005; Sung and Wu, 2011; etc.). Qualitative research is usually time-consuming, and many of them may involve interview, observation, and writing error analysis. It is rare to see quantitative research that addresses CCW strategies specifically, and none of the previous studies develop a valid and reliable instrument to qualify CCW strategies.

Moreover, there is no shortage in respect to CSL motivation, but the studies involving CCW motivation are sparse. Same as the studies of CCW strategies, they are often embraced in CSL learning motivation. Few studies on Chinese character learning strategies briefly surveyed motivation with one or two fixed-options or open-end questions for which the purpose was more like to obtain learners' background information, rather than reveal CCW motivation specifically (Chen，2009；Chen，2011；He，2008; etc.). In other words, very few studies attempted to explore CCW motivation and strategies, and they didn't integrate CCW learning strategies with motivation simultaneously to understand students' approach to learning that directly influence and impact the learning outcomes, neither inspected the interrelationship of the factors in CCW learning process.

In summary, the importance of CCW is often overlooked for CSL learning and teaching. Quantitative research on CCW strategies is rare. There is lack of a quantitative instrument for CSL learners or teachers to qualify CCW strategies. The role of motivation in determining the L2 learning strategies and its correlation with L2 performance has been commonly agreed (Cohen & Dörnyei, 2002; Hung, 2007; Oxford & Shearin, 1994; etc.) but has still not become widespread in the literature on CCW learning. None of them integrate CCW with motivation as a learning approach and identify the correlation between them and CCW performance comprehensively.

1.2 **Significance of CCW learning strategies**

CCW is important and should not be overlooked, as the features of Chinese characters contribute to the importance of CCW. The scripts of Chinese, so-called “Fangkuaizi” (方塊字), are composed by unique patterns of strokes and sub-character components that must be contained in a box or an imagined square (Hoosain, 1992; Tan, et all, 2005; Hsiao & Shillcock, 2006; Lam et al., 2011). This two-dimensional writing system is very different from a one-dimension writing system, such as many alphabetic languages, in which scripts or letters are arranged on a line (Li, 2014).

To read the language, Chinese character maps to a morpheme/word in principle (Perfetti and Dunlap, 2008). Because the majority of Chinese morphemes are morphosyllabic, each character usually represents a morpheme and thus corresponds to a syllable in Chinese (Chao, 1970; Zhang & Lin, 2017). However, the mapping features induce many homophones because the number of characters/morphemes is much more than the number of syllables. There are 7000 characters in the List of Commonly Used Characters in Modern Chinese (现代汉语通用字表)，but only about 1200 distinct syllable-tone combinations（Shu, 2003; Wenling, et al, 2002; Zhou, 2015). In average, more than 5 morphemes per syllable. Because of most characters are monosyllabic morphemes (Guojia Yuyan Wenzi Gongzuo Weiyuanhui 1989 cited from Duanmu, 1999), some syllables can correspond to more than 10 different characters, with each having different meanings. For example, there are 49 Chinese characters vocalized as /ji/ (He, 2000, pp.274), such as 鸡/ji1/ (chicken)，机/ji1/ (machine)，or 姬/ji1/ (a surname or a beauty). Therefore, the phonological information may not be sufficient to access the semantic meaning of Chinese that bring difficulties to identify the specific Chinese characters (Tan, et al, 2005; Yang 2018). Consequently, teachers and learners often adopt the two-syllable words to bring further context information. Although

disyllable words help to reduce the size of homophones, but limited syllables in Chinese still restrict the number of distinctive words (Zhou, 2015). There are still disyllable words with the same pronunciation, such as 盲人/mang3ren2/(blind) vs.忙人/mang3ren2/(busy person). This multiple correspondences between characters and sounds causes opaque in Chinese. Learners cannot write characters based on how they are pronounced, vice versa. Different from English and other languages with alphabetic writing system, which the orthographic representations of a word are intimately tied to the phonological representations, and phonological decoding is a critical comportment in learning process (Rayner, et al., 2001; Share, 1995; Ziegler & Goswami, 2005; ect.), Chinese is ambiguous, and the correct interpretation is unthinkable to get without further context or written information.

Whereas learners need to develop a cognitive process that simultaneously involves sound, shape, and meaning of Chinese characters in order to read and write (Xie, 2019), phonological knowledge tends to be less important in Chinese reading, compared with transparent languages, such as Spanish and Finnish (Tong et al, 2011). On other sides, studies show that orthographic and morphological knowledge of Chinese characters are essential to Chinese reading development (Ku & Anderson, 2003). Researchers believe that CCW not only promotes orthographic recognition, but also affects orthography-semantics and orthography-phonology links (Tan et al., 2005; Cao et al., 2012; Guan et al., 2011; Hsiung et al., 2017). Accordingly, CCW is given credit for improving the development of Chinese reading and recognition (Chan et al., 2006; Guan et al., 2011; Tan et al., 2005).

Understanding CCW learning strategies among CSL learners provides direct insights into how students learn CCW. As such, the present study contributes to the field of CSL education by developing a pioneering, useful and convenient tool, *The Chinese Character Writing Strategy Inventory* (CCWSI), using quantitative method. It also separates CCW strategies with character recognition strategies from the prior quantitative research about CSL

Chinese character learning strategies. Practically, CCWSI is expected to be a convenient and valuable tool for teachers, researchers, and learners to evaluate CCW learning strategies. It can contribute to acquiring qualitative information and provide a holistic view of individual learners. As learning strategies are learners' goal-directed actions to improve their study (Oxford,1990, 2011a & 2011b), CCWSI provides those daily CCW practices information from the learners' side that help teachers understand the CCW learning process of students and enhance their Chinese character instruction. Teachers could incorporate strategies with motivation into their Chinese character teaching and design an appropriate instructional curriculum and class activities in order to teach effective CCW learning strategies and boost CCW learning motivation. For learners, this study's findings help them reflect the learning process of CCW and inspire or adjust their CCW learning strategies. Since effective strategies improve performance which further boost learners' interesting in learning, the positive influence could be circulated in CSL learning. For researchers, the data collection about CCW learning strategies could be easier and faster. Via online CCWSI, a large group could be recruited, and participants may not need to be available for a long time in a specific place.

In summary, there is no established instrument for effectively measuring CCW learning strategies. This research gap promotes us to develop CCWSI, which is specific for investigating CCW learning strategies.

1.3 **Rationale of integrating learning strategies into the learning process of CCW**

A fundamental and common feature of studies on second language learning strategies (LLS) is the belief that LLS certainly affects the performance of language learning (Park, 1997; Wharton, 2000; Oxford, 2011a; etc.) and, once identified, LLS also can be taught to less skilled learners for improvement (Oxford & Leaver, 1996; Chamot & El-Dinary, P.B., 1999;

Harris, 2003; etc.). Thus, numerous studies have been devoted to LLS in the past decades. Although they have provided valuable insights for L2 teaching and learning, no stereotype about successful learning ways has been found (Rao, 2016). The different findings indicate that the complex learning process involves not only learning strategies, but also other factors, which could affect learners' LLS and learning outcomes. Researchers have attempted to explore those factors. On the other hand, researchers state that motivation directly influences the frequency of strategies using among L2 learners (Oxford & Shearin, 1994), and motivation could predicate learning efforts and strategies in L2 learning (Hung, 2007; Oxford & Shearin, 1994; Wen, 2011). Many researchers found that LLS are not only shaped by learners' motivation, but also learners' language proficiency (e.g. Cohen & Dörnyei, 2002; Dornyei and Skehan 2003; Gan et al., 2004; Wharton 2000; etc.). In a word, motivation and learning outcome could affect learning strategies, and they interact with each other in the learning process. To extend this circumstance in CCW learning process, it also involves these three main elements (motivation, CCW strategies, and performance) which interrelate and interact with each other. Hence, we want to take into account CCW motivation and CCW strategies relating to learners' CCW performance in order to gain a more coherent and insightful picture for CCW learning strategies.

Given the above concerns, an integrative approach is needed to synthesize factors of CCW learning process. Student Approaches to Learning (SAL) (Marton & Saljö, 1976; Biggs, 1987b & 2001) which combines motivation and strategies was introduced to the present study. SAL distinguishes cognitive processing into deep and surface approach. Numerous studies present solid evidence that different approaches affect significantly on learning outcome. In a general trend, researchers find that learning outcomes are positively correlated with deep approach and are negatively correlated with surface approaches (Gijbels et al. 2005; Snelgrove and Slater 2003; Yonker, 2011; Zeegers 2001; ect.). Specifically, deep

learners with deep or intrinsic motivation, which seek for meaning in the learning subjects, adopt high level strategies and often get "higher quality learning outcomes" (Gijbels et al. 2005). On the other hand, surface learners with surface or extrinsic motivation, which focus on fulfilling task requirements or passing examination, commonly adopt learning strategies as survival techniques to pass course with minimal learning, consequently, get ''lower quality learning outcomes'' (Gijbels et al. 2005). In short, deep approach learners are expected to perform better than surface learners (Biggs, 1987b). To sum up, SAL has been well-documented and its' determinant role for learning outcomes has been commonly agreed (Biggs, 1999 & 2001; Kember & Watkins, 2010; Yan, 2012; etc.).

To further examine different levels of the learning process, Biggs (1978) established the framework of 3P (Presage, Process, Product) learning model based on the concept of SAL. "Presage" of 3P model includes personal characteristics (learner side) and institutional characteristics (teaching context); "Process" consists of "students' motives for undertaking learning" and "the strategies adopted in approaching learning"; "Product" is the learning outcomes. Those parts interact with each other to help describes learners' learning complex (Yang, 2012). 3P model treats learners' learning as taking place under a dynamic learning system. It explains that the factors interact with each other to contribute to learners' learning processes. Meanwhile, Biggs' 3P model has been widely operationalized in various cultures (Zhang, 2000) and different learning subjects, such as ESL (Rao, 2016), accounting (Mladenovice, 2000), and math (Reid et al., 2005), etc. It appears to be one of the most prominent learning models in the education field (Kanashiro, et. al., 2020).

In accordance with the present research purpose, 3P model has been adopted and provided us with an inherent integrative framework in which effective learning of CCW is expected to require congruence between CCW motivation and CCW strategies. The multi-level and interdependent characteristics of the model provide a practocal framework to guide

our thinking about CCW and give insight into why learners use certain CCW strategies and why some CCW strategies are more effective among CSL learners. A detailed description of conceptual frameworks and the 3P model of CCW learning, which is adapted and modified according to Biggs' 3P, will be presented in Chapter 2.

1.4 **Research purposes and research questions**

As mentioned above, this study states that CCW learning process includes motivation, strategies, and performance. We hypothesize that the strategies and motivation of CCW are closely related, and both impact the performance of learners' CCW. In an attempt to address the research needs, which are discussed in the section of statement of problem, there are 4 objectives of this research. The primary one is to investigate learning strategies for CCW among CSL learners and consequently to develop a valid and reliable instrument, CCWSI (*Chinese Character Writing Strategies Inventory*), to quantify CCW strategies. After the CCWSI is constructed, its' reliability and validity are assessed. The study is intended to investigate the underlying structure of CCW strategies. Further, the study attempts to understand the role of CCW strategies through investigating the relationship among CCW strategies, CCW motivations, and CCW achievement. Lastly, the study also attempts to provide information for Chinese character teaching and learning for CSL teachers and learners. Altogether, the presented study promises advances in investigating the approaches to CCW among CSL students. Particularly, the following research questions will be addressed in this study:

(1) What are the strategies used by CSL learners in CCW?

(2) What is the CCWSI internal structure? Whether the CCWSI structure is supported by statistical data?

(3) What is the role of CCW strategies in the CCW learning process for CSL learners?

(4) What do the results of this study inform the CSL classroom teaching of CCW?

1.5 **Organization of the thesis**

This section outlines an overview of the thesis structure and summarizes each chapter to show how the present study has been organized. There are total of six chapters in this thesis, as follows:

Chapter 1 introduces the research background, significance, theoretical rationale, and research purpose of the present research. Also, a list of terms and definitions are given that will be used and discussed throughout the present study.

Chapter 2 reviews theories, instruments, and previous studies related to the key components of the CCW learning process. The final part of this chapter describes the conceptual frameworks and the model of CCW learning process.

Chapter 3, and 4 demonstrate the two phases of how the present empirical study is carried out. Chapter 3 mainly presents two parts. The first part is the phase one pilot study which was conducted in a Hong Kong international school in order to develop the instrument, CCWSI. The second part of chapter 3 provides the detailed experimental designs and procedure of phase two main study, Chapter 4 presents the data analysis and results for the main study. The finalized CCWSI and its internal structure are also offered. Moreover, Chapter 4 investigates the key features of approaches to CCW and its interrelationship with CCW performance which are based on the 3P model of CCW learning process.

Chapter 5 discusses the findings of the present study and offers recommendations for improvements based on theoretical and practical implications.

Chapter 6 gives a summary of this work as well as highlights the contribution and limitations of the present work. Following that, the final part of the chapter outlines the directions of the future study.

Last but not least, the entire instrument (CCWSI) and other required supplemental information are contained within the Appendices.

1.6 **Terms and Definitions**

The terms and definitions in this study have been clarified as following:

(1) Chinese Character Writing: the act or process of one who transform knowledge of Chinese character into a motor activity of hand movement (only focus on handwriting and individual Chinese characters).

(2) Learning strategies: "specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferable to new situations" (Oxford, 1990, p8).

(3) CCW strategies: goal-directed actions consciously taken by learners to improve CCW proficiency or achievement, to complete CCW learning task, or to make CCW learning more efficient, more effective, and easier.

(4) CCW Motivation: the intention or reasons learners have for acting or behaving with regard to learn CCW , and services as the learner's inner drive to initiate the learning (Biggs, 1987; Lu & Li, 2008; Ushioda, & Dörnyei, 2012; Wang, 2014).

(5) CCW learning process: includes CCW motivation, strategies, and performance.

(6) The students' approaches to learning (SAL): is comprised with the intention of learning (motivation) and strategies used to carry out the task (Biggs, 1987) and and identified two

groups learners who tended to adopt different levels of processing approaches, named surface and deep approaches (Marton & Saljö, 1976).

(7) Surface approach: focus on “the sign”, or the learning material itself (Marton & Saljö, 1976).

(8) Deep approach: focus on “the underlying meaning of the text” (Marton & Saljö, 1976).

(9) CCW Learning approach: adopted from SAL, including why learners learn CCW (a motive) into what they do for learning CCW (a strategy).

Chapter 2: Literature Review

In this chapter, we are to review the L2 learning strategies and motivation development, including the definition and factors which influence strategies and motivation in the previous instruments. Then we critically check the strategy and motivation studies in the CSL, particularly in CCW. Finally, we present a theoretical framework for the study. The present research is based and designed on the reviewed studies, theories, and instruments.

2.1 L2 Learning Strategy (LLS)

2.1.1. Definition of LLS

Before the 1960s, researchers focused more on teaching context in the L2 education field, but soon they realized that it was insufficient to explain L2 learning without concerning learners' characteristics and their effect. L2 learning strategies (LLS) have received increasing attention since the mid-seventies in the field of language education, and it boomed in the mid-nineties. Most previous researchers believed LLS was characteristic of good language learners. As one of the pioneers in the field of LLS, Joan Rubin (1975) broadly states that LLS is "the techniques or devices that a learner may use to acquire knowledge/language" (Rubin, 1975 & 1981, cited from O'malley and Chamot, 1990, p.3). During the same period, Stern defined LLS as "broadly conceived intentional directions" (Stern et al., 1992, p. 261). But the problem is that Stern (1975) had included "personal learning style" in her learning strategies list (Griffiths, 2004). According to Willing (1998), learning styles involve a learner's preference for a certain mode "to learn or to deal with new information". Compared to learning strategies, learning styles are much more general. Naiman et al. (1978, p.4) also tried to find common characteristics of good learners. The work used a very broad definition of LLS: strategies are "general, more or less deliberate approaches". Another earliest piece of LLS research was by Bialystok (1978, p. 71), which

defined LLS as “optional means” to exploit information in order to improve competence in L2. It is clear that these definitions of LLS are too broad, and terminology seems embrace different elements, such as learning style, is used inconsistently.

Till the mid-eighties, Weinstein & Mayer (1986, p.315) stated that LLS are “behaviors or thoughts that a learner engages in during learning that are intended to influence the learner’s encoding process”. O’Malley et al (1985) defined learning strategies as “operations or steps used by a learner that will facilitate the acquisition, storage, retrieval or use of information”. Later, in 1990, O’Malley and Chamot detailed the definition of learning strategies as “the special thoughts or behaviors that individuals use to help them comprehend, learn, or retain new information” (O’Malley & Chamot 1990, p1). These definitions exposed that learning strategies interact, integrate, and comprehend information in language learning.

In the early 1990s, researchers connected LLS with the cognitive theory of learning. According to the cognitive theory, a language learner is “an active participant in the learning process” and uses LLS to learn the target language (Williams and Burden, 1997, p. 13). Cohen（1990）pointed out that learning strategies are a learning process which should be consciously selected and controlled by learners. The element of choice is important here because this is what gives a strategy its special character. The learners are at least “partially aware of, even if full attention is not being given to them” (Cohen, 2000. p.4). In other words, consciousness should be part of the definition of LLS. Similar to O’Malley et al (1985) and Cohen (1990), Oxford thought that learning strategies are “steps taken by students to enhance their own learning”, “tools for active, self-directed involvement, which is essential for developing communicative competence (Oxford, 1990. p.1)”. Learning strategies are “specific actions, behaviors, steps, or techniques — such as seeking out conversation partners, or giving oneself encouragement to tackle a difficult language task—used by students to enhance their own learning” (Scarcella & Oxford, 1992, p. 63). Ellis (1994)

thought that LLS is “the particular approaches or techniques that learners employ to try to learn an L2”. She emphasized the mediating role of LLS between learner and situational factors and learning outcomes (Banisaeid & Huang, 2014). Although the definitions were more or less different in 1990s, they were more detailed than the previous ones, and the researchers generally agreed that learning strategies are actions and behaviors, which learners consciously employ.

From 2000s, some researchers proposed using self-regulation and motivation control to replace LLS because of inconsistent LLS definitions and classification (Dörnyei, 2005; Rose, 2012; Tseng et al., 2006). Dörnyei (2005, p.170) discarded LLS in the past decades and claimed a new theory, which considered and was based on the education psychological concept of self-regulation in his previous model of motivation control strategies. He believed that self-regulation provided a dynamic concept and a more general term for learning strategies. However, Rose (2012) says that Dörnyei proposed this reconceptualization which “might be a matter of throwing the baby out with the bathwater, in that it throws out a problematic taxonomy and replaces it with another one, which is also problematic—including the same ‘definitional fuzziness’ for which previous taxonomies have been criticized”. Oxford (2011) also includes a self-regulation model for L2 learning. But different from Dörnyei, Oxford defined her new “self-regulated second language (L2) learning strategies” as “goal-directed attempts to manage and control efforts to learn L2...teachable actions that learners choose from among alternatives and employ for L2 learning purpose” (Oxford, 2011, p.7). She took a position that “learners actively and constructively use strategies to manage their own learning” (Oxford, 2011, p.7). This compromise position perhaps provides “an umbrella notion when referring to language learners and to also include the strategies that they use for both learning and performing in L2” (Cohen, 2014, p.35), but it seems to shift the focus away from LLS to “manage their own learning”.

To summarize, the early works of the LLS have focused more on which characteristics good learners have, which caused the definitions of LLS seems pretty vague and inconsistent. The argument was raised again in the 2000s as some latter definitions of LLS embraced the concept of self-regulation. In this study, we adopt Oxford (1990)'s early definition of LLS for CCW learning strategies. This is because self-regulation includes various perspectives, such as motivation, goals, and self-efficacy, which drive learners' efforts to "search for and then apply" personalized learning strategies (Tseng et al., 2006,p.79), while the present study aims to understand specific strategies L2 learners employ to learn Chinese characters production.The motivation is separated from the CCW strategies so that we can discuss the relationship between CCW motivation and learning strategies to reveal the underlying driving forces for CCW achievement.

2.1.2 Identification and Classification of LLS

2.1.2.1 Identification of LLS

In June 2004, a group of international representatives, including 23 scholars, attended the International Project on Language Learner Strategies (IPOLLS) at Oxford University. One of their main subjects was to define language learner strategies. Although the scholars had a consensus that "strategies enhance performance in language learning and use", they had two opposite views about strategies that emerged (Cohen, 2011). Some scholars reported that "strategies need to be detailed, specific, small, and most likely combined with other strategies in sequences or clusters for completing given tasks". Others stated that strategies should be "more global, flexible, and general level." Cohen is one of the scholars who preferred the first view. He summarized several ways to classify strategies (Cohen, 2011 & 2014, p.12-24).

The first way is classified by language learning or language use strategies. Language learning strategies are for learning new materials. They are attempts to "develop linguistic

and sociolinguistic competence in the target language" (Tarone, 1980, p.419). For example, grouping Chinese characters using phonologic and semantic radicals and repeating writing. Language use strategies are strategies for using material that has already been learned or known, for example, compensation strategies in Oxford (1990)'s *Strategy Inventory for Language Learning* (SILL), and communication strategies (Rubin, 1981) are categorized as language use strategies. Tarone (1980, p.419) also proposed a strategy of language use that included communication strategy (e.g., avoidance, transfer, and paraphrasing) and production strategy (e.g., discourse planning, simplification, and rehearsal). Communication and production strategy is very similar. The only difference is that communication strategies are used for the negotiating meaning, but production strategies are not. By using production strategies, such as the rehearsal, a listener can understand without negotiation of meaning. However, there is an argument about whether communication strategies are a type of language use strategies. Communication is output, but learning is input (Brown, 1980, p.87 cited from Griffiths, 2004). Communication strategies are used to avoid problems and express the meaning in other ways. For example, if a learner doesn't know the word "rooster", he/she may replace it with "male chicken". Hence, Ellis (1986) pointed out that successful use of communication strategies may affect language learning, and skillful compensation strategies can prevent the learning. In the present study, if learners use *Pinyin* to replace CCW, that does affect CCW learning in a negative way.

The second distinction is relevant to linguistic skill areas. Language learning includes four skill areas: listening, speaking, reading, and writing. Each skill area has specific strategies. LLS can be classified by different skill areas. The present study focuses on CCW area in Chinese language learning.

Language strategies can also be classified by functions, such as planning learning or practicing using, mainly including metacognitive, cognitive, affective, or social strategies.

Oxford (1990)'s SILL adopted these types of strategies. Metacognitive strategies are "thinking about thinking" (Anderson, 2002). Metacognitive strategies are valuable because they allow learners to manage and control their language learning by planning, monitoring, and evaluating their learning process. Cognitive strategies are related to how learners think and understand their learning. Social strategies involve interacting with others, such as asking questions and cooperating with others. For example, "I ask other people to verify that I have understood or said something correctly" (Oxford, 1990) and "I ask my teachers, classmates, language partners, or friends for help and discuss with them how to write Chinese characters" (CCWSI, Q31) are social strategies. The last effective strategies related to emotion regulating, such as self-encouragement.

Besides the above three ways to classify language strategies, language strategies can also be classified by age, proficiency level, gender, or specific language or culture. Different groups intend to use different strategies. For example, learners from alphabetic language backgrounds may have different CCW strategies from Japanese learners; learners of different ages and proficiency levels tend to choose different strategies; and male and female learners also use different LLS. All these variables are important to classify L2 strategies.

However, learning strategies are not developed in isolation, and they may interact with each other (Cohen, 2011). Due to these cumulated and complicated impacts, the classification of L2 strategies is not straightforward and easy. In fact, there is a lack of consensus about the definition and classification in the language learning strategy field. The following paragraphs are tried to describe the different classification of L2 learning strategies (LLS).

2.1.2.2 Classification of LLS

In the early stage, the researchers defined LLS as the characteristics of "good learners". Stern (1975) is one of the earliest scholars in the field of LLS. He listed ten language learning

strategies (Table 2.1) which were used by successful/good language learners to cope problems. But Stern's study only listed out LLS and included "learning style" at the top of his list. That isn't a real classification system and created a terminology inconsistent problem.

Stern (1975)	
1	a personal learning style or positive learning strategies
2	an active approach to the learning task
3	a tolerant and outgoing approach to the target language, which is empathetic with its speakers
4	technical know-how about how to tackle a language
5	strategies of experimentation and planning with the object of developing the new language into an ordered system with progressive revision
6	constantly searching for meaning
7	willingness to practice
8	willingness to use the language in real communication
9	critically sensitive self-monitoring in language use
10	an ability to develop the target language more and more as a separate reference system while learning to think about it

Table 2.1: Stern (1975)'s list of ten language learning strategies
(source from Stern, 1975, p. 311-316)

At the same time, Rubin (1975) also reported seven good learners' characteristics: a good learner "is a willing and accurate guesser"; "have a strong has a strong drive to communicate, or to learn from communication"; "is often not inhibited. he/she is willing to appear foolish if reasonable communication results"; "is prepared to attend to form…and is constantly looking for patterns in the language"; "practices"; "monitors his own and the speech of others"; "attends to meaning" (Rubin, 1975, p.45-47). Later, she used varied methods to identify learning strategies, such as classroom observations and videotapes, students' diaries, self-reports, and categized learning strategies into two dimensions: direct and indirect (Rubin, 1981). The direct strategies are those directly contribute to language learning, vice versa, the indirect strategies contribute to learning indirectly. She further divided direct learning strategies into six types and the indirect learning strategies into two types (Table 2.2). Rubin included the communication strategies, such as using a synonym and

gestures, under production tricks in the indirect strategies. Some researchers argued that communication strategies are not LLS because they may prevent language learning.

Rubin (1981)	
Direct Strategies (processes which contribute directly to learning)	Clarification/Verification
	Monitoring
	Memorization
	Guessing/Inductive Inferencing
	Deductive Reasoning
	Practice
Indirect Strategies (processes which contribute indirectly to learning)	Create Opportunities for Practice
	Production Tricks: learners use communication strategies

Table 2.2：Rubin's Strategy Classification System
(source from Griffiths, 2004 and Hsiao & Oxford, 2002)

In these early studies, the researchers focused their studies on describing the language learning strategies as learners' characteristics, which involved learning strategies and learning styles. Stern (1975) only listed out the strategies of the good language learners. Compared to Stern, Rubin (1981) identified more specific learning strategies. Overall, the learning strategies in this stage are used in a broad sense.

O'Malley et al. (1985) defined learning strategies from cognitive aspects. Based on Brown (1982)'s cognitive and metacognitive strategies, they proposed the classification of LLS. The cognitive and metacognitive strategies are similar to Rubin's direct and indirect strategies (Griffiths, 2004). In addition to cognitive and metacognitive, O'Malley et al. (1985) suggested one more category, the social medication strategy which also called social/affective strategies in O'Malley and Chamot (1990)'s classification. Adding this social medication strategy was important because the researchers recognized the "importance of interactional strategies in language learning" (Griffiths, 2004). This study reported that language learning

strategies could be classified into three categories: cognitive, metacognitive, and social mediating strategies. Table 2.3 shows the classification and subdivisions of each category.

O'Malley et. al. (1985)	
Cognitive Strategies (Specific to distinct learning activities)	Repetition
	Resourcing
	Directed physical response
	Translation
	Grouping
	Note-taking
	Deduction
	Recombination
	Imagery
	Auditory representation
	Key Word
	Contextualization
	Elaboration
	Transfer
	Inferencing
	Question for clarification
Metacognitive Strategies (Knowing about learning)	Advance organizers
	Directed attention
	Selective attention
	Self-management
	Advance preparation
	Self-monitoring
	Delayed production
	Self-evaluation
	Self-reinforcement
Social Mediation Strategy (Social)	Cooperation

Table 2.3：O'Malley et. al. (1985)'s Strategy Classification System (source from O'Malley et. al., 1985, p.33-34)

Oxford (1990) expanded O'Malley et al. (1985)'s work, including not only social aspects but also emotional strategies of language learning. There is a total of six categories that underlie her SILL. She further divided these six strategies into direct and indirect strategies. The direct strategies include cognitive strategies, memory strategies, and compensation strategies, which directly involve the target language. The indirect strategies which support

for language learning include metacognitive strategies, social strategies and affective strategies (Table 2.4). Ellis (1994, p. 539) thought that Oxford's classification is the most comprehensive one for learning strategies. No doubt, Oxford's study had a profound impact in the field of LLS.

Oxford (1990) SILL	
Direct Strategies ("involve direct learning and use of the subject matter, in this case a new language")	cognitive strategies (how learners think about their learning, i.e. analyzing and reasoning)
	memory strategies (remember language)
	compensation strategies (learners make up for limited knowledge, such as guessing a word)
Indirect Strategies ("contribute indirectly but powerfully to learning")	metacognitive strategies (how learners manage or regulate their learning)
	affective strategies (relating to emotion or feelings)
	social strategies (interaction or cooperation with others)

Table 2.4: Oxford (1990)'s Classification System
(source from Oxford, 1990)

In Oxford (2011)'s book, *Teaching and Researching Language Learning Strategies*, she offered a new theory of language learning strategies, which integrated sociocultural and information-processing concepts. She considered self-regulation and introduced "The Strategies Self-Regulation (S^2R) Model". In this S^2R model, Oxford disregarded 3 strategies in her 1990's SILL (memory, compensation, and social strategies), and classified strategies into 3 dimensions: cognitive, affective, and sociocultural-interactive dimension (Table 2.5). The compensation and social strategies were grouped into a sociocultural-interactive dimension, which used to "deal with sociocultural contexts and identities". Each of the three dimensions includes metacognitive strategies. This S^2R model offers a new perspective for investigating LLS, but the main point of the dimensions concern "the importance of communication and cultural identity for language learning (Reed, 2012)". Compared to Oxford (1990)'s SILL, the model hasn't been tested by enough research, though some studies

have tried to adopt the model (e.g., Griffiths et al., 2014; Harish, 2014; Ma & Oxford, 2014; etc.).

Oxford (2011)	
Cognitive dimension (for remembering and processing content)	Metacognitive Strategies: "paying attention to cognition"
	Cognitive Strategies: "Using the senses to understand and remember"
Affective dimension (related to emotions, beliefs, attitudes and motivation)	Metacognitive Strategies: "paying attention to affect"
	Affective Strategies: "Activating supportive emotions, beliefs and attitudes"
	Affective Strategies: "Generating and maintaining motivation"
Sociocultural-interactive dimension (emphasize the role of culture)	Metacognitive Strategies
	Direct level Strategies

Table 2.5: Oxford (2011)'s Classification System
(source from Oxford, 2011)

All in all, different researchers have various considerations and criteria for LLS, resulting in a lack of consensus and standardization on the identification and classification of LLS. Most research classified LLS into 2 or 3 primary categories with several underlying subcategories. Regarding what strategies are used especially for CCW, we set to develop the CCWSI to cover possible strategic learning behaviors for CCW employed by CSL learners. Self-regulation is not integrated into the CCWSI, but the motivation of CCW is considered in the framework for discussing the CCW process. Referring to these classification systems, we might expect our CCWSI to have 2 or 3 primary categories. The tasks in Chapter 3, 4 and 5 allow us to examine the structure of CCWSI.

2.1.3 Variables that impact LLS

The vast literature on LLS indicates that LLS is not isolated, and there are a number of variables impacting the selection and usage of LLS among L2 learners (Ehrman & Oxford, 1990; O'Malley, et al., 1985; Oxford & Nyikos, 1989; etc.). Oxford and Nyikos in 1989

already summarized and listed 14 factors that affect learners' choice of LLS, including: 1) which language they are learning; 2) which level of language they are learning; 3) their awareness level of metacognitive; 4) gender; 5) affective/ emotionally related variables, such as attitudes and motivation; 6) learners' specific personality traits; 7) personality type; 8) learning style; 9) their field of specialization/career orientation; 10) national origin; 11) aptitude; 12) L2 teaching methods; 13) task requirements; 14) type of strategy training. These variables are generally from 4 aspects: 1) language learning level; 2) individual level; 3) culture level, and 4) teaching level. Among them, the present study involved an individual levels such as proficiency level, duration of learning, gender, and motivation. Because motivation is a significant part of learning approaches, a comprehensive review will be addressed in section 2.4.

Gender:

Although most researchers generally agree that gender is one of important factors which affects learners to employ LLS, it is not clear what different strategies are employed by male and females. Oxford and Nyikos (1998) reported that female university students used more strategies than male students. Similar findings were revealed in other studies (Oxford, 1994; Dreyer and Oxford, 1996; Green and Oxford, 1995; Hong-Nam and Leavell, 2006; Liu, 2004; Salahshour, et al., 2013; etc.). Hong-Nam and Leavell (2006) found that females tend to use social and metacognitive strategies most and memory strategies least; males use metacognitive and compensation strategies most, and affective strategies least. Some other researchers reported that female students used more cognitive strategies (Salahshour, et al., 2013), direct strategies (Li et al., 2011), compensation strategies, and affective strategies than males (Goh & Foon, 1997). Oppositely, Radwan (2011), Tran (1988), and Wharton (2000) found that male students use more strategies than female students. Some studies even demonstrated no significant difference between males and females in terms of strategy use

(Ehrman and Oxford, 1990; Griffiths, 2003; Kaylani, 1996; Liang & Ye, 2019; Riazi and Khodadi, 2007; Sung, 2009; etc.). Overall, the findings of research on the relationship between LLS and gender are inconsistent.

Age & Duration of study:

Compared to other factors, not many studies have investigated age impacts in LLS, and the results are inconsistent. Bialystok (1981) found that older students (age 16-17) adopted more strategies than younger students (age 14-15). Adults usually have higher efficiency in deploying more flexible, general, and updated strategies. They can deploy simple and easy strategies (Oxford & Ehrman, 1995). But, more recently, Sadeghi and Attar (2013) reported that younger children used more LLS than older learners in their study.

Related to the conflict findings, a question is raised: Is there any impact from learners' age or years of study? Ok (2003) reported no significant difference for learners to use LLS during a certain school year. According to Skehan (1989, p.91), learners need time to become familiar with the target language as well as LLS. Some strategies may require more extended amounts of time than others. In other words, that take time for some strategies to become effective. For example, some metacognitive strategies, such as planning, monitoring, and reflecting, take a certain amount of time to see their effectiveness. Moreover, the study of Taguchi (2002) indicated that the duration of study not only affects which LLS learners used, but also the frequency of strategies using. Commonly agreed, learners' experience and awareness of the learning process have a positive relationship with their LLS use (Oxford and Nyikos, 1989). However, we should be noted that increasing in the year of study doesn't necessarily mean an increase in proficiency level, and learners' use of strategy is dynamic (Schmitt 1997; He 2002; Takeuchi 2003). Even though learners at a different level and age may prefer to use different strategies, increasing their awareness of using efficient strategies facilitates the learning and improves learners' learning proficiency.

Proficiency level:

Different proficiency levels require different strategies. The majority of LLS studies showed that learners in a higher proficiency level use more strategies (both in the frequency of strategy use and range increased) than those at a lower level (Greem & Oxford, 1995; Chamot & Kupper, 1989; Radwan, 2011; Salahshour, et al., 2013; ect). But the findings about which strategies are used by learners are inconsistent. Some researchers stated that learners at a higher proficiency level more tend to use metacognitive and social strategies (Taguchi, 2002; Salahshour, et al., 2013); learners in a lower proficiency level more likely use cognitive and compensations strategies (Taguchi, 2002). Other studies reported that both cognitive and metacognitive have a high relationship with high proficiency level learners (Peacock and Ho, 2003). Liang and Ye (2019) employed Oxfords' SILL to investigate 35 Chinese heritage learners in Italy and found that higher-level use less affective strategies than lower-level learners. The result is opposite to the findings in Shen's (2009) study that also investigated 132 CSL learners at different proficiency levels: higher-level learners used more affective and social strategies. Li et al. (2011) reported that lower-level learners use more memory and social strategies. Notwithstanding differences, some learning strategies require a certain level to execute, for instance, the strategies about grouping Chinese characters with same phonetic or semantic radicals in CCWSI as learners must accumulate certain amount characters and character knowledges before they can efficiently make groups.

Furthermore, several other studies (Phillips, 1991; Hong-Nam & Leavell, 2006) found a curvilinear relationship between strategies and learners' language proficiency levels. In other words, students at the intermediate level use more strategies than beginning and advanced level students. The explanation is that L2 beginning level students may have insufficient knowledge to apply learning strategies. Intermediated level learners have gained sufficient knowledge and competence in L2. They also have a high level of awareness of using

strategies. Once learners reach the advanced level, they don't have to administer strategies consciously. Carl Bereiter (1995) uses the word "automatically" to describe this internalization (Hong-Nam & Leavell, 2006).

Culture:

Culture level could be complicated. Those cultural variables from social, home and language backgrounds obviously influence learners LLS and are worthy to investigate. Students from different countries may employ different LLS. Learners from sinographic East Asia（漢字文化圈）may have different LLS. Jiang and Zhao's (2001) study indicates that CSL learners with a learning duration of 4-9 months in sinographic East Asia, such as Japan and Korea, paid more attention to pronunciation and meaning-related strategies and applied characters often in reading and writing because they had more opportunities to assess the orthography of Chinese characters. But learners from outside sinographic East Asia, such as western countries, usually lack sufficient exposure to Chinese characters before, the orthographic features of Chinese characters are an obvious challenge for them, thus, they are likely to pay more attention to graphic strategies, such as memorizing the character shape as a whole. Yeh, et al. (2003) compared the study of Chinese character in three groups from Taiwan, Japan, and the US. They found that Taiwanese and Japanese tended to review the similarity of character structures, but US learners more consider the similarity of radicals between characters. Likewise, heritage learners also adopt different LLS from other foreign language learners. For instance, heritage CSL learners may adopt more social strategies because they have a chance to use the Chinese language at home and usually have higher communication skills (Liang & Ye, 2019). Hong-Nam and Leavell (2007) also found that Korean-Chinese bilingual students used more LLS in their EFL (English as a foreign language) learning than Korean monolingual learners, and they preferred to use metacognitive strategies most and memory strategies least; Korean monolingual students

preferred compensation strategies and affective strategies least. These examples implicated that different cultural and linguistic backgrounds impact learners' use of LLS. Oppositely, Ke's (1998) finding is contradictory. In this study, the results from 85 heritage and 60 non-heritage learners showed that students' language background had not impacted their Chinese orthographic knowledge learning strategies as well as character recognition and production performance. Again, the findings are not always consistent.

Others:

There are also other individual level variables, such as learning style and personality. They do have a strong link with LLS. Extroverts who favor social and like to work with others may prefer social strategies; and introverts may be more likely to use metacognitive strategies (Ehrman and Oxford, 1990; Rossi-Le, 1995).

Besides the above individual level variables, other variables also affect learners' LLS. From the language level, the language being learned can directly affect the learner's choice of LLS. For example, the grapheme-to-phoneme correspondences are very different between alphabetic language and logographic language. If grapheme-to-phoneme correspondence is transparent, such as in Finish and Italian, learners usually can write or spell according to the pronunciation of words; but if grapheme-to-phoneme correspondence is opaque, such as in Chinese, CCW strategies cannot only rely on sounds or pronunciation of Chinese. For the presented study, the characteristics of Chinese characters are significant factors that impact learners' strategies choosing.

There is a consensus among researchers and teachers that LLS is teachable and benefits L2 learning (Oxford, 1990). It is easy to imagine teaching context, such as teaching method, can affect LLS. The same teaching method is more likely to cause learners to use similar LLS, even from different education backgrounds (Taguchi, 2002). Moreover, different language skills may require a particular set of LLS. The pedagogy of L2 also affects LLS. If a

teacher teaches Chinese speaking first but delays teaching CCW, learners may adopt different LLS from others who learn speaking and writing simultaneously. Wang's (1998) study approved that. Wang used a mixed method (questionnaire, interview, and observation) to investigate year one CSL students in an American university and found the pedagogical implications. Because the instructor emphasized listening and speaking skills and didn't spend much time teaching CCW, those learners tended to treat Chinese character as a whole, without decomposing Chinese character and tackling character components, such as phonetic and semantic radical, as they would with English words.

All in all, learners' LLS can be quite different from one to another, and they might also adopt different LLSs and use them at different frequencies (Chamot & Kuper, 1989). But there is one thing for sure, learners' use of LLS is dynamic and LLS is not isolated from each other. The studies on LLS provide a window to gain insights into the learners' learning process and help to reflect on teaching and curriculum setting. The present study aims to develop a tool, CCWSI, for CSL learners from different CSL learners and advance their CCW learning process. Various factors which impact LLS should be considered on an individual level, such as proficiency level, duration of learning, gender, and motivation. As for the gender, due to the limited number of male participants in the presented study, the result only provides some insight into gender differences in CCW learning approach among CSL learners, so that we put it in the appendix part (Appendix C) as a supplemental information of the thesis.

2.2 Chinese Character Learning Strategies (CCLS) among L2 Learners

With the growing economic status of China in the past decades, there is increased interest in learning Chinese as a L2. Learners usually are eager to study Chinese at the beginning, but when they involve in Chinese character learning, they may encounter challenges and lose

interest. Even advanced-level learners may still have problems to find effective CCLS (Xing, 2003). No doubt, learning strategy is important in L2 learning and plays a significant role in individual differences (Skehan, 1989). Indeed, there is a need to investigate CCLS. However, when we talk about CCLS, it consists of character recognition and production.

2.2.1 Instruments to assess CCLS

The most popular way to assess LLS is to use a summative rating scale, or so called a questionnaire, an inventory, or a survey (Oxford & Burry-Stock, 1995). Oxford's *Strategy Inventory for Language Learning* (SILL) (Table 4) is the most often used strategy instrument in LLS studies. It is also one of the most important instruments in CCLS studies. There are two versions of SILL: Version 7.0 and Version 5.1. Version 7.0 consists of 50 items in total. It was designed to assess LLS for learners who learn English as a second language. Version 5.1 has 80 items and is used with learners who speak English as first language and learn other languages as a second language. Direct strategies consistent with 9 items in memory strategies, 14 items in cognitive strategies, 6 items in compensation strategies; Indirect strategies consistent with 6 items in affective strategies, 9 items in metacognitive strategies and 6 items in social strategies. This version (5.1) is also often used to assess CSL strategies. To give a few examples of the studies, Jiang (2000) used SILL to investigate 107 CSL learners and found they used social strategies, metacognitive strategies, compensation strategies, cognitive strategies, memory strategies and affective strategies, in order from most frequently used to least frequently used. Liang and Ye (2019) and Xie (2012) also used SILL to study heritage learners in Italy and Indonesia in different frequency order (Table 2.6).

	1	2	3	4	5	6
Jiang (2000)	social strategies	metacognitive strategies	compensation strategies	cognitive strategies	memory strategies	affective strategies
Liang and Ye (2019)	social strategies	cognitive strategies	memory strategies	metacognitive strategies	affective strategies	compensation strategies
Xie (2012)	affective strategies	compensation strategies	social strategies	cognitive strategies	metacognitive strategies	memory strategies

Table 2.6: Comparing results of 3 studies using SILL
(source from Liang and Ye, 2019)

Although SILL is a well-known standardized and structured inventory to assess LLS, it is designed and used to assess L2 LLS, including listening, speaking, reading, and writing. It's not particularly for Chinese LLS and not even close to the features of Chinese characters. Thus, it is unsuitable for CCLS and cannot be directly used in the studies of CCLS as an instrument. However, SLL contributes greatly to the development of instruments of CCLS. Many inventories to assess CCLS, more or less, are based or referred to SILL, such as Jiang and Zhao's (2001) strategy inventory for Chinese character learning. They used a mixed research method, which based on classroom observation, interviews with both learners and their instructors, Oxford's (1990) SILL, and the previous researches of CCLS, including McGinnis (1995) and Ke (1998), to develop a Chinese character learning strategy inventory. This inventory has 48 items, which consist of 40 items of cognitive strategies and 8 items of metacognitive strategies. After factor analysis, Jiang and Zhao got 6 subcategories under cognitive strategies and 2 subcategories under metacognitive strategies (Table 2.7). Though some items of Jiang and Zhao's inventory of CCLS can be found in other's work (Liu, 2009; Ma, 2007; Zhao & Jiang, 2002; Wang, 2017; etc.) and some graduates' theses (Chao, 2012; He, 2008; Huang, 2013; Jiang, 2012; Liang, 2015; etc.), the original inventory cannot be found and is not available for public use. However, as the first quantitative inventory for CCLS, it significantly contributed to the education of CSL.

Jiang and Zhao (2001)	
Cognitive Strategies	Paying attention to its strokes (筆畫策略)
	Paying attention to its pronunciation and meaning（音義策略）
	Memorizing the character shape as a whole（字形策略）
	Inducing and using semantic and phonetic radicals（歸類策略）
	Reviewing（複習策略）
	Applying characters in reading and writing（應用策略）
Metacognitive Strategies	Monitoring and reflecting（監控策略）
	Planning（計劃策略）

Table 2.7: Jiang and Zhao's (2001) *Strategy Inventory for Chinese Character Learning*

In addition to Jiang and Zhao's (2001) inventory for CCLS, we have to mention another important instrument to assess CCLS in the field, Shen's (2005) *Character Strategy Inventory*. This inventory was considered as the most comprehensive study "to date in terms of investigating types of strategies learners used and the frequency of using the strategies" (Sung &Wu, 2011). She first used a semi-structured questionnaire which contained 12 open-end questions to elicit character learning strategies. 176 strategies were identified from this survey, and 59 items of these strategies were constructed to the second strategy inventory, *The Character Strategy Inventory*, in order to measure how frequently students use the character learning strategies. Out of these 59, 30 items (containing 25 cognitive strategies and 5 metacognitive strategies) are classified as commonly used strategies. The factor analysis revealed 5 cognitive strategies (e.g., orthographic strategies, create mental linkages among sound, shape, and meaning, use both aural-oral cues and writing in receiving and encoding information, use of sound as cues to make connections to meaning and shape, seek various avenues to understand the syntactic functions of new characters) and 2 metacognitive (preview and review).

However, the factor analysis part of the study causes some confusion. First, according to the factor analysis, Shen stated there were 8 factors (22 items), but "in brief, the factor analysis revealed" that students use 5 cognitive strategies and 2 cognitive strategies. Shen

didn't provide the criteria for obtaining these 7 strategies from 8 factors. On the other side, the criteria for extracting 22 items from 30 commonly used strategies is missing. The table 2 (Figure 2.1) in Shen's work is a rotated component matrix and the total variance is explained by her 8 factors. In common practice, the factor loading of item (>0.3 or >0.5) determines which factor an item belongs to. But it is inconsistent for the 8 factors in this work. For example, Factor 8 has two strategy items: item 11 and 15, which "deal with learning new words by understanding their meanings in different contexts, both written and spoken". But item 11 has a factor loading 0.774 under Factor 7, and zero factor loading under Factor 8. Item 11 was assigned to Factor 8. At same time, item 23 has a factor loading 0.84 under Factor 8, and it didn't assign to any of the factors. Shen only did Exploratory Factor Analysis (EFA) (Principal component analysis along with Varimax rotation method) and missed Confirmatory Factor Analysis (CFA) to verify the factor structure and test the validity of inventory. Excluding these minor questions, Shen's inventory is an English publication and easy to use. Many studies adopted it as a tool to investigate learners' CCLS (Han, 2009; Mason & Zhang, 2017; Sung and Wu, 2011: Sung, 2014; Wang et al., 2009; Xie, 2019; etc.). To all appearances, Shen's (2005) work has greatly promoted CCLS studies and provided a good base for future CCLS studies.

Table 2
Rotated component (Factor) matrix from 30 commonly used strategies by learners of Chinese

Variable (strategy item)	Component							
	1	2	3	4	5	6	7	8
3	0.142			0.359	0.732			0.217
2	0.119	0.135	0.102	0.531	0.211	0.434		−0.153
48	0.156	0.752			0.218			−0.123
7	0.209	0.219	0.315	0.151	−0.369	0.230	0.417	−0.106
9	0.148	0.240	−0.166	0.689		0.171		0.229
17	0.160	0.178				0.508	0.270	−0.260
49	0.126	0.534					0.459	0.102
57	0.129	0.707						0.228
5	0.559	0.195	−0.178			0.225	0.345	0.176
11	0.101			0.252	0.119	−0.110	0.774	
59	0.309	0.438	0.425	0.361		0.161		−0.109
19	0.607	0.409	0.185	0.127	0.125	0.164		
33	0.252	0.437		−0.169	0.568	0.309		
4	0.726			0.158	−0.152	0.290		
24	0.309	0.141	0.141		0.437		0.520	−0.181
1	0.288	0.294		0.284	0.153	0.388	0.184	−0.149
6	0.796			0.172			0.243	0.150
10	0.171			0.786	0.105	−0.143		
15			0.478		0.113	0.279	0.183	0.562
13		0.195	0.630		0.136		0.327	0.293
21	0.110	0.242	0.248		0.666	0.153		−0.132
23				0.109		−0.124		0.848
18	0.715	0.194	0.185		0.276	0.107	−0.182	
26	0.842			0.133	0.258			
14		0.125	0.252			0.586	0.164	
55	0.116	0.486	0.260	0.243			0.213	−0.405
22			0.793			0.115	0.114	
8	0.412	−0.163			0.116	0.639		0.111
36	0.131	−0.320	0.633		0.122	0.175	−0.239	
43			0.187			0.261	0.814	
Variance explained (%)	24.52	7.51	6.69	6.39	5.67	4.77	4.14	3.90

Extraction method: principal component analysis.
Rotation method: Varimax with Kaiser normalization.

Figure 2.1: Shen's (2005) Rotated Factor Matrix from 30 Commonly Used Strategies by Learners of Chinese
(source from Shen, 2005, Table 2, page 58)

Although there are few other questionnaires for CCLS, such as Wang (1998), Tseng (2000), Yin's (2003), and so on, they often missed a multivariate statistical procedure and didn't test reliability or validity. The above motioned three inventories, SILL (Oxfor, 1990), Chinese Character Learning Strategy Inventory (Jiang & Zhao, 2001), and The Character Strategy Inventory (Shen, 2005), play a substantial role in CCLS studies and have the most significant impacts in Chinese character learning.

In addition to the quantitative studies of using questionnaire instruments, other studies of CCSL strategies often use qualitative research methods involving writing error analysis. Ma

(2007) did the first case study for Chinese character learning strategy. She observed a Nigerian student's study progress 9 months study and compared the changes about using character learning strategies in the 4 stages, which were divided according to the character error rate from the student's notes, assignment, and the questionnaire. Zhao and Wang (2012) also did a similar case study for a Kazakhstan student who learned Chinese for a year. The analysis data come from daily notes, assignments, and the interview. An and Shan (2007) observed and interviewed 4 students in order to analyze the process of writing and self-correcting Chinese characters. These cases studies involved the analysis of writing errors from spontaneously writing; few other studies designed exam or dictation tasks in order to discover the types of writing errors and investigate the learning strategies behind as well as effective of learning (Good, 1998; Liu & Jiang, 2003; Zhang, 2019;). Liu and Jiang (2003) did an experimental study to explore the effects of learning methods/strategies on the acquisition of new Chinese characters. Zhang (2019) collected 4082 characters from class dictations from 8 first-year students and 5 second-year students during a semester. Good (1998) designed 5 tasks, including 100 characters writing test and essay writing, to explore strategies in the writing of characters by intermediate and advanced CSL students in US. These experimental studies prove valuable in CCSL, but were rather sparse in the field.

Compared to quantitative studies, those qualitative studies elaborate CCW performance and are more directly related to CCW though they still do not deliberately exclude CCW strategies from CCLS. However, qualitative research often requires the coupling of a longer period and a particular technique for analysis. Thus, for frontline CSL teachers and learners, a quantitative instrument which minimizes time and work could be more efficient and feasible. As CCLS are mixed for Chinese character reception and production, and none of the studies developed a valid and reliable instrument to qualify CCW strategies specifically, there is a need to develop a reliable and validate quantitative instrument for CCW learning strategies.

2.2.2 **Effectiveness of CCLS**

The effectiveness of strategy use is a research tendency and impacts directly to the teaching instrument.

One of the early studies which involve the effectiveness of CCLS is Ke (1998). This study investigated 145 first year CSL students in an American University, including 85 heritage learners and 60 non-heritage learners. These participants were asked to evaluate the learning strategies according to a selected list of character learning approaches. There were total 11 pairs on this list. The participants were required to judge which of the two statements was more effective for learning characters. They reported: 1) the knowledge of radicals is more useful than creating stories about the appearance of Chinese characters; 2) the role of sound in character learning didn't appear to be as valuable; 3). practicing characters in the context of vocabulary and associating new characters with characters already known are the two strategies with a significant impact on their Chinese character recognition.

Shen (2005) identified that the most commonly used strategies are the orthographic knowledge-based cognitive strategies, which encode Chinese characters by utilizing character radical knowledge (phonetics, semantics, and graphemics), and followed with metacognitive strategies, which related to structured preview and review. Shen conducted a regression analysis and found that learners in different learning levels have different perceptions of the usefulness about the commonly employed strategies. The perception of the usefulness of orthographic-knowledge-based strategies and metacognitive strategies became stronger as the learning level increased. This linear trend between learning levels and learners' perceptions of usefulness may be caused by the learners' orthographic knowledge and self-awareness related to processing Chinese characters. The beginning level learners have limited orthographic knowledge and need time to develop their self-awareness related to the cognitive process. As the learning advances, learners accumulate more knowledge of Chinese

character and their character learning, and the perception of the usefulness of the strategies becomes stronger. However, Shen's research mixed Chinese characters and Chinese words, (e.g., Item 27. I try to make a story of the character or word), that may cause a difference in choosing strategies. Later, in Shen's (2008) study, she focused on the investigation of learning strategies for bi-character compound words. The awareness should be raised for this point when we adopt Shen's study and her inventory.

Following Shen's study, Sung (2012 and 2014) took a step further. She adopted Shen's inventory to assess learner CCLS. Sung "not only investigated the most frequently used Chinses character learning strategies and factors underlying those strategies, but also the relationships between learners' strategy use and their language performance" (Sung, 2014). In Sung's (2012) study, Sung found 7 most frequently used strategies by investigating CCLS employed by 74 first-year college students in the USA. The 7 strategies included 4 stroke-orthographic-knowledge-based and 3 phonological-semantics-knowledge-based. But the stroke-orthographic-knowledge-based strategies seem ineffective because they only "accounted for 6.8% in learners' character learning performance". Sung (2014) replicated her study in 2012 and ensured the previous results that are reliable, valid, and general. The study again investigated the most frequently used Chinese character learning strategies reported by 88 first-year college students in USA. She excluded all Asian background students. The result found 20 most frequently used strategies. The multiple regression analyses showed that students who reported frequently using phonological strategies did better on the phonological comprehension part of the test; and those who reported frequently using orthographic strategies performed better on the graphic comprehension, graphic production, and phonological production in the test. The study also found a lack of strategy used to review Chinese characters. Actually, the students reported to place emphasis on studying the aspects of characters and how they are used in sentences and conversation. The findings of Sung's

two studies are in line with Shen's (2005) and Ke's (1998) studies that "learning the orthographic and phonological features, and meanings of characters are important to gain character knowledge" for learners.

Another study about the effectiveness of CCLS is Zhao and Jiang's (2002). They used the inventory which they had developed before (Jiang and Zhao, 2001) to investigate 124 CSL learners who had learned Chinese for 4-9 months in Beijing and did the correlation analysis between CCLS and the sore of a character test. The test contained two parts: 30 characters recognition and 30 characters production, including both semantic-phonetic compound characters and non-semantic-phonetic compound characters. The results showed that studying characters with phonetic-semantic compounds more relies on the strategies than that of the characters with non-phonetic-semantic compounds. Applying Chinese characters in reading and writing and using radical components to learn Chinese characters are effective in learning Chinese characters, but memorizing the characters shape as a whole or writing characters mechanically are not. That is consistent with Yum, et al.'s (2014) study, which investigated CSL learners' cognitive activities by using the brain electrical activity under laboratory-controlled conditions. They found that the fast learners attended to integrate parts of characters, but the slow learners learned each character as a whole. Liu and Jiang (2003) further explored the effects of metacognitive strategies which they called the recall method and the mechanical repetition strategy on acquiring new Chinese characters among European and American learners. The results showed that the recall method is more effective than the repetition method in learning the form of new characters, but the two methods don't have significant differences in learning the pronunciation and meaning of characters. The study demonstrated memory process and meta-memory strategies. It suggests that the deeper level of processing Chinese characters and using the meta-memory strategies are helpful in new character acquisition.

There are also a few studies that investigated the effectiveness of CCLS. First, Jin's study in 2006 compared three CCLS: paying attention to radicals, focusing on character stroke, and studying pinyin pronunciation. She found that among these strategies, learners who used the strategies of paying attention to character radicals did better in a Chinese character recognition exam than learners who adopted other two strategies. The result aligns with Ke's findings that radical-related strategies are more effective than sound-related strategies. Also, Taft and Chung's (1999) study revealed that learning radical information at the beginning level and while a new character is introduced, can yield the best learning result.

In recent years, a few computer-based studies about CCLS (Xu & Jen, 2005; Zhu & Hong, 2005) tested the effectiveness of computer related or assisted CCLS. Xu and Jen (2005) developed a Chinese character input software that reinforces learners' pronunciation (Pinyin) and character knowledge. They compare the experiment group, which is assigned to use the software to study Chinese character, with the control group, which study Chinese character under a traditional mode. The results illustrate that the experiment group scores higher than the control group for the oral and Chinese character recognition as well as production test, indicating that the phonological knowledge influences the CCW performance, and the phonological strategies are more effective than the simple graphic strategies. Another study is Zhu and Hong' (2005). This study investigates the effect of the learning strategies by comparing 4 types of computer-assisted flashcards: 1). Character only; 2). Character with voice; 3). Character with stroke order animation; 4). Character with voice and stroke order animation. The result points out that the group that used the flashcards with voice performed better than other groups in the Chinese-character recognition and written production test. These findings from Xu & Jen (2005) and Zhu & Hong (2005) are in support of Everson (1998) study, which claims that there is a strong relationship between knowing the meaning of a word and knowing its pronunciation. Unlike Zhu and Hong (2005), Kuo and

Hooper (2004) studied 92 high school learners in a computer-based environment. Hopper compared 5 different CCLS in five different groups: Group 1: “a translation group given characters with English translations”; Group 2: “a verbal coding group given both English translation and a brief verbal description of characters’ etymological origins regarding their components”; Group 3: “a visual group given an English translation of the characters and pictures of the concepts”; Group 4: “a visual and verbal coding group combining the strategies of the two previous groups;” Group 5: “a self-generated mnemonics group encouraged to create their own memory aids”. The results showed that Group 5 outperformed than other groups; and compared to other groups, Group 1 performed worse. However, the usefulness of creating mental linkages or the generated own mnemonic strategy is inconsonant in different studies and the authors also pointed out it spent more time than other strategies. Although those computer-related CCLS provide insights into Chinese character learning process, but the computer-assisted writing system may lead to the decline of CCW, which in turn affects learners’ attitude and teachers’ perspective towards CCW.

From the studies mentioned above, we can have a general idea about CCLS and its effectiveness. CSL learners may develop various CCLS, such as self-generated mnemonic strategy or using flashcards, but CCLS usually involves the properties of Chinese characters, which include orthographic, phonologic, and semantic aspects, and also reflect cognition of the learning process of Chinese characters. On the other hand, CSL learners frequently used or perceived strategies may be ineffective ones, such as treating or memorizing the characters shape as a whole and repeating or writing characters mechanically. Therefore, the present study aims to identify not only the CCW strategies, but also the factors underlying them. Using CCWSI and integrating CCW learning process with learning strategies and motivation, we can further explore what CCW learning strategies are effective in a specific context and examine whether the usage of CCW strategies is affected by other variables in the process.

2.3 Learning strategies for Chinese character writing (CCWLS)

2.3.1 Chinese character recognition and production

The learning of Chinese characters consists of character recognition and character production. Recognition is based on the graphic form of the target character and requires learners to know its meaning and pronunciation. Production involves writing the form of the target character based on its meaning and pronunciation (Hayes, 199; Sergent & Everson, 1992; Ke, 1996). Both recognition and production processes involve the properties of Chinese characters. Although they are correlated (Ke, 1996), each of them involves different cognitive abilities (Packard et al. 2006). The following sections summarize and discuss the process and relationship of Chinese character recognition and production.

2.3.1.1 The process of Chinese character recognition and production

In order to read and write Chinese characters, learners do not only rely on simply memory or single skills, such as motor skills and visual-perception skills, but also integrate different kinds of systematic knowledge contained in the writing system, including orthography, phonology, and morphology of the scripts (Ho, Yan & Au, 2003). In the past decade, many researchers have pointed out that awareness of orthographic regularity, phonological regularity, and morphological regularity are important for learning to read and write in Chinese (Biederman & Taso, 1979; Chen & Juola, 1982; Ho, Ng, & Ng, 2003; McBride-Chang & Ho, 2005; Chan, et al., 2006; Shu, et al., 2006; etc.).

The classic dual-route model of reading and spelling (Figure 2.2) gives a general set of ideas about how recognition and production process. Reading and spelling generally have direct and indirect two ways. The direct way connects writing a word (orthography or print) with its meaning directly. The indirect way is called the phonological route, which first associates sound with grapheme (letters in alphabets) for spelling or reading. However, these

two routes are for alphabetic language and are viewed as independent ones, and there is no interaction between them. Chinese characters are not equivalent to alphabetic words. For example, the phonetic or semantic radicals of Chinese characters, as an integral part of the CCW compound, could be considered as a part of orthographic knowledge; the process of the radicals could be explained in the direct route. However, in addition to their visual patterns or the orthographic form, phonetic or semantic radicals also carry clues to the sound or meaning of many Chinese characters; thus, they are involved as functional processing units in CCW process (Law, et al., 2005). Because of Chinese character features, the process route of Chinese character recognition and production can be more complicated than this.

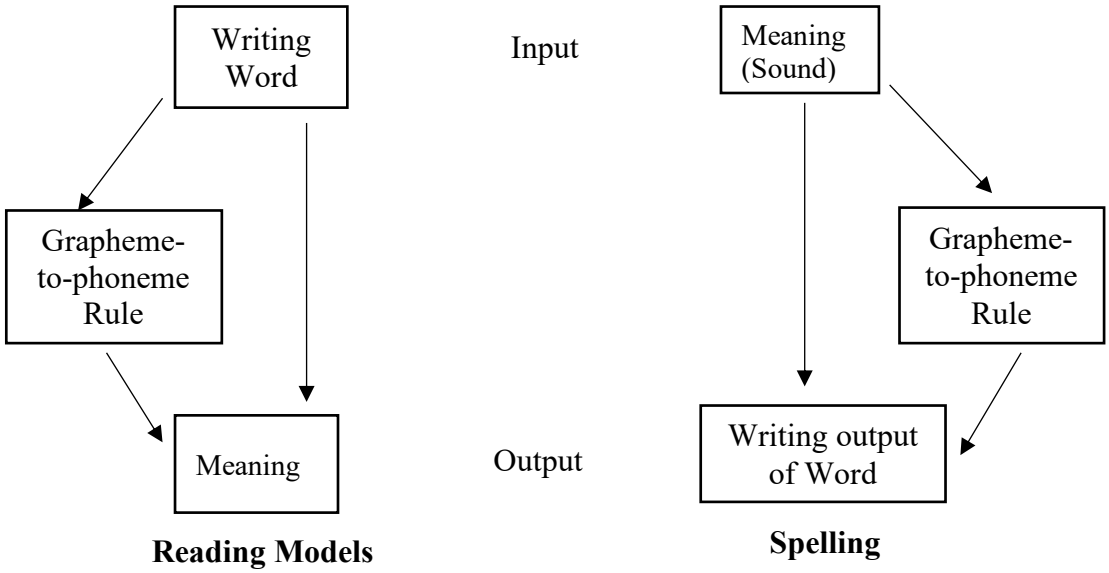

Figure 2.2: Dual-Route Models for Reading and Spelling
(source from Good, 1998, Figure 2.1 page 21)

The orthographic regularity in non-alphabetic scripts, such as Chinese, is much more complex. Orthographic knowledge includes the ability to identify the constituents of Chinese characters and their inherent properties (Leong et al., 2011), the positional and functional conventions of semantic and phonetic radicals (Tong et al., 2017), as well as

component/lographeme knowledge (Loh et al., 2018). Ho and her co-workers (Ho, et al., 2003) proposed the sequence of orthographic knowledge development (Figure 2.3).

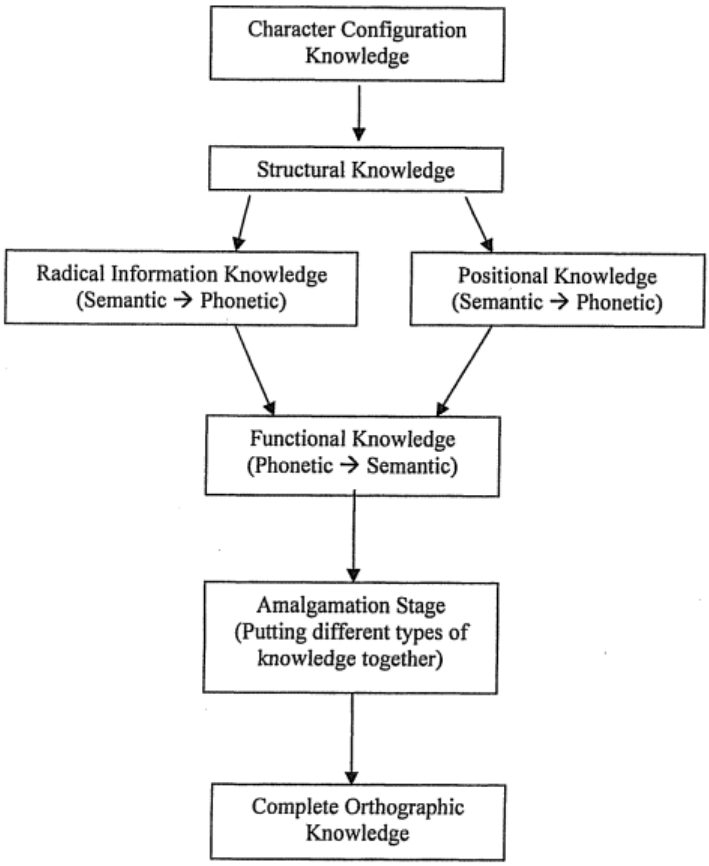

Figure 4.2. A model of orthographic knowledge development in Chinese.

Figure 2.3: Model of Orthographic Knowledge Development in Chinese (source from Ho, et al., 2003, Figure 4.2)

Accordingly, the development starts from (1) character configuration knowledge to (2) structural knowledge; then, followed by (3) radical information knowledge and (4) positional knowledge; finally, (5) functional knowledge of semantic and phonetic radicals. Although the model of orthographic knowledge development in Chinese is based on children in Hong Kong with a small sample size, it inspires us to understand Chinese character recognition and writing development.

In addition, Perfetti and Tan (1998) developed a heuristic model for the recognition process of Chinese characters. They called it A Model of Visual Chinese Character

Identification (Figure 2.4). They assume that the metal representation of a Chinese character entails three lexicons: 1) The orthographic lexicon; 2) The phonological lexicon; and 3) The meaning system or semantical lexicon. When a Chinese character is presented to a reader, he/she is going through three steps: the starting point is to analyze the smallest units of a character, which are strokes, and their spatial relationships; then, this early information activates a cohort of orthographic units or characters which in the orthographic lexicon; after the identification of an orthographic character, the phonological lexicon or the meaning system or both are activated. This recognition process depends on the integration of the pattern of activation between three lexicons. If two lexicons have the same excitatory strength, the intense competition between them may lead to a difficulty for recognition. However, there is a key assumption for this model. Each of orthographic unit (character) "connects to one phonological unit, but many meaning nodes (more meanings a character has, more nodes it has)", then, phonological names could be retrieved earlier than meaning. This process was further stated in Wang, Perfetti & Liu (2003)'s Lexical Processing Model of Chinese Characters (Figure 2.5).

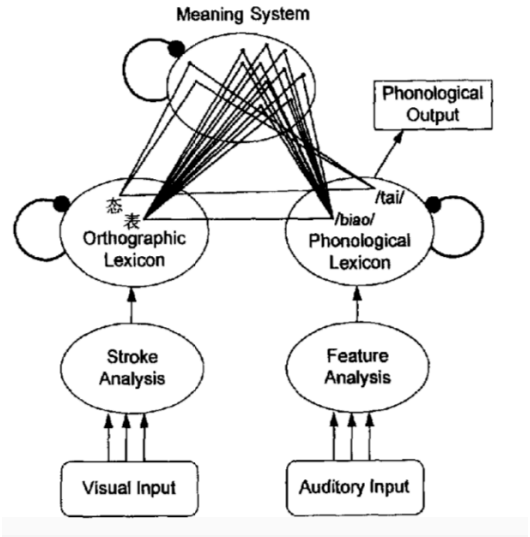

Figure 2.4: A Model of Visual Chinese Character Identification
(source from Perfetti & Tan,1998, Figure 2, Schematic model of Chinese single-character identification)

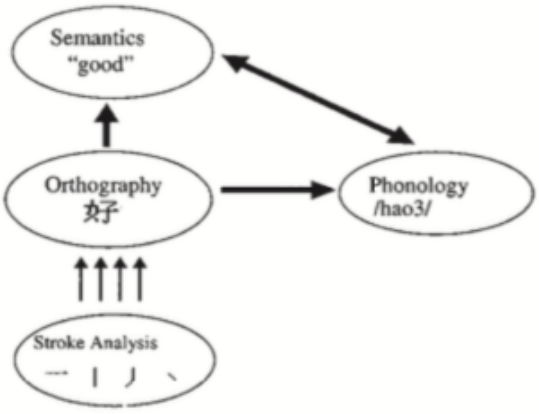

Figure 2.5: Lexical Processing Model of Chinese Characters
(source from Wang, Perfetti & Liu, 2003, Figure 2, Lexical Processing Model of Chinese Characters)

These recognition process models show one of the lexicons is retrieved earlier than the others. However, two lexicons may be mixed in the recognition encoding process. In 1998, Hayes did two experiments to investigate the different processing strategies of Chinese character recognition between Chinese native and non-native speakers. The first experiment required the subjects to circle out the correct characters that had been showed to them on 15 slides (4 seconds for a slide). The answer sheet consists of graphic, phonological, and semantic distractors. And the second experiment asked to judge true or false (validated and invalidated) for Chinese sentences. The false or invalidated sentences contain graphic, phonological, and semantic distractors. The results from the two experiments indicate: 1) at the character level, native speakers use phonological encoding as their primary recognition strategy, and non-native learners tended to use a mixed strategy of phonological and graphic encoding; 2) at the sentence level, native speakers use a mixed graphic and semantic strategies, while non-native speakers still attended to use graphic features, and neither groups seemed using phonological encoding as predominate one. The study shows that the Chinese character recognition process may be involved with different routes, such as a mixed strategy

of phonological/semantic and graphic encoding. But compared to native speakers, graphic encoding is superior in non-native learners because it emerges at both the character and sentence level.

Similar with the recognition process, the main processing routes of writing Chinese characters also involve the orthographic, phonological, and semantical systems (Han, Song & Bi, 2012). Referred to the study of Good (1998), which revised the Dual-Route Model for Chinese character writing, the basic processing routes of writing is shown below (Figure 2.6). There are three indirect ways and one direct way. However, Figure 2.6 illustrates that all strategies are separate and independent. In other words, the 4 routes (direct, phonological, semantic, and visual/graphic) are equal. In reality, that could not be true. Good also pointed out that the potential assembled-rout strategies in Chinese character writing could be rich. Learners may integrate different types of information (phonological information, semantic information, and graphic information), mix various strategies, and use several routes in production of writing Chinese characters.

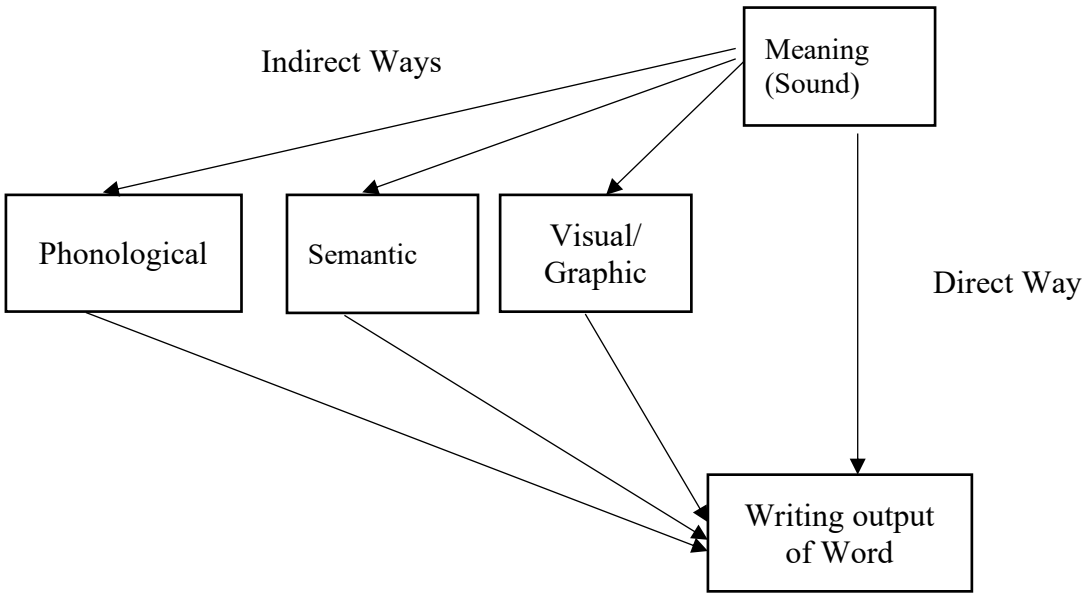

Figure 2.6: The Basic Route for Writing Chinese Character
(source from Good, 1998, Figure 2.2. Schema of Multiple Separate and Equal Writing Strategies, page 37)

In summary, Chinese character learning incorporates recognition and production. Recognition requires to comprehend phonological or semantic knowledge with the character form input, while production demands writing out the target character based on its meaning and pronunciation. They both are influenced by these properties of Chinese characters. Although the process integrates the three different kinds of systematic knowledge of Chinese characters (orthographic, phonologic, and semantic knowledge), the decoding process of CCW could be trigged by either of these systematic knowledge or several (2 or 3) of them together, but they are synchronized and integrated at various levels to produce a character.

2.3.1.2 **The relationship between Chinese character recognition and production**

Although both Chinese character recognition and production require orthographic, phonological, and semantic knowledge of Chinese characters, character production, i.e., CCW, is more difficult than the character recognition. Lin (2004) in her PhD study finds that CCW is considered as the most challenging part in the Chinese character learning process. Lin states that the acquisition of Chinese characters at the vocabulary level has 4 types: phonological comprehension (PC), graphic comprehension (GC), phonological production (PP), and graphic production (GP). The order to acquire Chinese words is also from PC to GC, to PP, to GP. For learners, GP is the last one to master in the process of Chinese character acquisition. Partial information of a character can lead to successful recognition but not accurate production. To produce or write a Chinese character, learners must have complete and comprehensive knowledge of the target character, including the graphic form, pronunciation, and meaning; then, learners need to transform such knowledge into a motor activity of hand movement (Ke, 1996). Learners who are good at character recognition are

not necessarily good at character production, but those who are good at character production are also good at character recognition (Ke, 1996 & 1998).

It is easy to understand that Chinese character recognition and production are closely related to each other. In fact, an increasing number of researches point out that CCW is strongly associated with recognition and reading, and recognition and reading also depend on writing (Chan, et al., 2006; Tan, et al, 2005; Tse, Kwan, & Ho, 2010; Guan, et al. 2011;). Tan, et al. (2005) did two experiments about writing and how writing would mediate reading development. 131 children from a Beijing primary school were tested. They reported that CCW promoted reading performance because CCW develops orthographic awareness and forms long-term motor memories of Chinese characters, especially at beginning and intermediate levels. Chan, et al (2006) conducted a comparative study about dyslexia children in HK and found a similarly substantial correlation between reading and writing, i.e., CCW promotes reading proficiency. Guan, et al. (2011) used a group of adult CSL learners in a U.S. university as subjects and reported 2 experiments. In the first experiment, there are two tutors for comparison: an online writing tutor who requires handwriting practice, and a second instructional tutor who requires reading only. In the second experiment, the researcher added a Pinyin-typing tutor in the handwriting tutor. The results imply that CCW affects orthographic recognition as well as orthography-semantics and orthography-phonology links, which indicates that CCW strengthens visual-spatial information and enhances neuromotor memories. In 2015, Guan and her coworkers (Guan et al., 2015) examined the "importance of manual character writing to reading". They compared two groups CSL learners who were taught character in either "writing-to-read" or "an alphabet typing-to-read condition", and "engaged in corresponding handwriting or typing training for five consecutive days". The outcomes show that pinyin-typing help to improve phonological knowledge, and handwriting improves semantic knowledge. The study concludes that CCW

played a significant role in predicting reading. Moreover, Cao et al. (2013) did a functional magnetic resonance imagining (fMRI) study to examine the writing-on-reading effect. They recruited 17 CSL learners aged 19-24 from a college Chinese class to learn Chinese characters under a character-writing or pinyin-writing/typing condition. The data collected by fMRI "during passive viewing showed different networks for reading Chinese characters and English words". The findings suggested that CCW "established a higher quality representation of the visual-spatial structure of Chinese character and its orthography". The findings also showed that CCW facilitated the connection with semantics and supported the facilitative effect on Chinese character recognition and reading. These studies consistently suggest a correlation between CCW and character recognition in both native and non-native Chinese learners. The evidence supports that CCW strengthens the orthographic representation and Chinese character recognition through character production knowledge.

To conclude, in order to read, learners are required to establish a memory representation of a character form in order to access its' meaning and pronunciation (Perfetti, Liu, & Tan, 2005), but CCW contribute significantly to acquiring an orthographic form, and CCW is more difficult and supports character recognition.

2.3.2 Development of CCWLS

As we know, each content area requires specific strategies and skills. There should be a particular set of core strategies underlying CCW. Each Chinese character has shape, sound, and meaning, corresponding to orthography, phonology, and semantics of Chinese characters, respectively. There is no obvious link between sound and script for most Chinese characters. In order to learn Chinese characters, learners have to master the three linguistic components (Shen, 2005). Accordingly, some Chinese character learning and writing strategies relate to orthographic, phonological, and semantic knowledge of characters. Because of the

relationship between recognition and production, there is a great overlap between CCLS and CCW strategies.

For CSL learners, the strategies which target to the orthographic aspects are important (Sung & Wu, 2011). The orthographic knowledge that involves visual patterns of the characters, such as "the constituent *bujuans* constituting the characters, their positional constraints, and the character themselves" (Leong et al., 2011) is important for CCW. According to the orthographic developmental trajectory (Jackson, Everson & Ke, 2003), CSL learners likely perceive Chinese characters as a whole at the beginning of their Chinese study, e.g., those beginners may not be able to distinguish the three components "木", "又", and "寸" from a whole character "树". They would perceive it as a whole picture. With the increasing exposure to Chinese characters, they will develop radicals and logographemes awareness and learn to discompose characters. Thus, it is no surprise that one of the most frequently used strategies is the whole character strategy, which involved memorizing the character shape as a whole and mechanically repetition of characters among CSL learners (Jiang & Zhao, 2001; McGinnis, 1995; Tseng, 2000; Yin, 2003; etc.). Other graphic strategies include stroke-related and radical-based. Learners in year one already paid attention to character strokes and used stoke-orthographic-knowledge-based strategies (Jiang & Zhao, 2001; Sung, 2012). Utilizing orthographic knowledge to decompose characters into radicals or other logographemes has been demonstrated in many studies (Jackson, Everson & Ke, 2003; Tseng, 2000; Shen & Ke, 2007; Zahradníková, 2016; etc.). Compared to the whole character strategy, those strategies associated with radical knowledge are not the most used among learners (Zhang, 2019), but they can help beginners to memorize character form (Shen, 2000; Shen & Ke, 2007;). Developing radical awareness can enhance the orthography knowledge-based learning strategies (Xie, 2019) and is more helpful than creating stories based on the form of characters (Ke, 1998; Tseng, 2000, Zhao & Jiang, 2002). Orthographic

strategies for learners are effective (Zhou & Yu, 2004) and promote learners to perform better in character production (Sung, 2014).

Meanwhile, the role of sound, such as pinyin, in character learning is mainly for memorizing pronunciation (Yin, 2003), which does not appear to be as significant as practicing characters in the context of vocabulary and associating new characters with characters already learned (Ke, 1998). Although learners rely on sound as a cue to link character meaning and shape (Shen, 2005), sometimes, learners tend to omit the phonologic information and focus more on orthographic and semantic information in CCW (Zahradníková, 2016). Actually, many studies revealed that learners use a mixed strategy to learn Chinese characters. Hayes' (1998) study showed that CSL learners use a strategy that mixed the phonological and graphic encoding at the character level of processing. Also, paying attention to characters' pronunciation and meaning is one of the frequently used strategies in Jiang and Zhao's (2001) study. Sung (2014 & 2012) confirmed phonological-semantics-knowledge-based strategies and indicated that the students "place emphasis on studying the aspects of characters and how they are used in sentences and conversation". McGinnis (1995) (as cited in Everson, 1998) and Zhou & Yu (2004) found that learners utilized the character pronunciation to create their own idiosyncratic stories for Chinese characters of mnemonic associations. Learners may also create mnemonic linkages with other properties of Chinese characters. Overall, learning the orthographic features, phonological knowledge, and meanings of characters are important to CCW because learners assemble more than one knowledge-based strategies while they wrote Chinese characters (Good, 1998).

In addition to the strategies that directly relate to three linguistic components of character (orthographic, phonological, and semantic strategies), a few other strategies are revealed by the previous studies of CCLS, such as applying strategies and metacognitive strategies. No

doubt, applying Chinese characters in reading and writing is greatly helpful in learning Chinese characters. The people with a good grade tends more to apply Chinese character in their daily study and life (Zhou & Yu, 2004; Zhao & Jiang, 2002). Researchers agree on the importance of metacognitive strategies for language learning, which are related to structured preview and review, such as planning, monitoring, reflecting, and managing learning (Chamot, 2004). Shen (2005) indicates the second most frequently used strategy is metacognitive strategies. But Sung's (2014) study indicates that there is a lack of strategies used to review Chinese character. Liu and Jiang (2003) did an experiment and found that metacognitive strategies are more effective than the repetition method for Chinese character production. CCW required a deeper level of memory process and metamemory strategies. No doubt, the metacognitive strategies influence students' achievement results, and "students should be encouraged to analyze their own learning processes in order to improve their metacognitive learning strategies" (Wang, Spencer, & Xing, 2009).

Altogether, the studies regarding Chinese character learning provided rudimentary findings that orthographic, phonological, and semantic strategies help in learning characters. As the majority of studies didn't separate learning strategies for production and recognition of characters, we are not sure which strategies are used and used effectively for CCW specifically. Further studies are needed to identify the learning strategies of CCW in order to obtain a deep understanding of CCW and the learning strategies of CCW.

2.4 LLS and Language Learning approaches to CCW

Learners' approach to learning plays a significant role in determining the learning outcomes (Ahmed and Ahmad, 2017; Hasnoor, et al., 2013;). The approach integrates learners' strategies and motivation from their learning perspective and is based on Biggs' systematical model of learning, which is called Presage-Process-Product (3P) Learning Model (Biggs,

1987b). The approach attempts to explain the learning process in terms of influences from 3P factors, such as motives, strategies, and learning products.

As discussed in the above sections, learning CCW is multifaceted and complex that requires systematic and steady learning strategies to facilitate student learning. Besides learning strategies, motivation is also significant in the CCW learning process. Historically, motivation is an important factor in the L2 learning process (Gardner, 1979; Whartorn, 2000). Numerous researches have indicated the crucial relation between LLS and motivation, as well as L2 proficiency (Oxford and Nyikon, 1989; Oxford & Shearin, 1994). Motivation advances learners' learning strategies and, in turn, improves the learning achievement (Marton & Sajlö, 1997; Watkins, 2007). There is a congruence between learning motivation, strategies, and effective learning.

However, less is known about learning strategies, motivation, and their relation in specific aspects of Chinese character learning and CCW. A prominent area of research in the present study is the exploration of the CCW strategies, attempting to demonstrate the importance of the CCW learning process by investigating the relationship between students' learning motivation and strategy. The intent of adding motivation to review learning approaches to CCW require an inherent integrating framework. Taken together, the Student Approaches to Learning (SAL) and 3P model were adopted as our conceptual framework to fulfill the major purposes of the research. We believe that the Student Approaches to Learning play a significant role in determining the learning outcomes (Ahmed and Ahmad, 2017; Hasnoor, et al., 2013; Marton & Saljö, 1976).

In the following sections, we review the development and importance of motivation as well as its relationship with strategies which take considered and conceptualized appropriately into the SAL and 3P learning model.

2.4.1 **Language learning motivation (LLM)**

L2 language learning motivation (LLM) has been long associated with L2 language learning (Gardner, 1979 & 1985; Oxford & Shearin, 1994). The same as L2 learning strategy, there are also disagreements on the definition of motivation. The variances of motivation concepts are often raised from the components of motivation and the roles they play in learning additional languages.

In the early stage, motivation was influenced by Piaget's cognitive developmental theory, and researchers were inclined to study what learners do. Motivation was seen as a "built-in unconscious striving towards more complex and differentiated development of the individual's metal structures" (Oxford & Shearin, 1994). Till the 1970s and 1980s, the cognitive approaches were more developed and researchers introduced new cognitive concepts into the field, such as self-efficacy (Bandura, 1977 & 1986), learning helplessness (Seligman, 1972), and causal attributions (e.g., Frieze and Weiner, 1971; Weiner, 1972). Late on, researchers shifted their concentration toward education psychology and tried to understand more about the learners' role in his/her learning behaviors and explain why they choose to engage in the learning tasks (Rueda & Dembo, 1995; Weiner, 1994). Thus, the research of motivation field was attentive to conscious concepts of drive, that became more relevant to learning goals and level of aspiration. The psychological concepts, such as anxiety, achievement needs, and locus of control, were used to highlight individual differences in learning (Dörnyei, 1990; Fazey and Fazey, 2001; Rubin, 1993).

2.4.1.1 **Motivation development**

Since the 1970s, researchers have increased interest and carried out their research on learners' aspects in L2 acquisition. While Rubin (1975) and Stern (1975) focused on the learning strategies of good language learners, Gardner and Lamber's (1972) pointed out the

importance of learners' motivations. They defined motivation as "combination of effort plus desire to achieve the goal of learning the language plus favourable attitudes towards learning the language" (Gardner, 1985, p.10). Accordingly, Gardner and his associates developed one of the most influential models of motivation in L2 learning, which is called the Socio-education model (Gardner, 1985; Gardner & Lambert, 1997). The model includes two orientations, which are integrative and instrumental motivation. The integrative motivation is "the student wishes to learn more about the other cultural community because he is interested in it in an open-minded way to the point of eventually being accepted as a member of that other group" (Gardner & Lambert, 1972, p. 3). The instrumental motivation indicates the factors related to benefits deriving, such as future career, making new friends, or traveling needs (Csizér & Dörnyei, 2005).

The concepts of orientation and motivation are confused, and the term of orientation can also imply attitude and inclination. Gardner and his coworkers tried to clarify that orientation and motivations are different (Gardner, et al. 2004). Orientation refers to learners' reasons or beliefs toward the L2 and the L2 community which was developed in a social-cultural context, such as integrative and instrumental orientations. On the other side, motivation is focused to strengthen and drive learners towards the goal of learning the target language, including those driving forces involving learning effort, desire, and enjoyment (Lu & Li, 2008; Liu, 2014; Masgoret & Gardner, 2003). They explained that motivation integrates motivational intensity, desire to learn, and attitudes toward learning the language (Gardner, et al. 2004). Gardner and his coworkers also developed several versions of AMTB (Attitude/Motivation Test Battery) to examine different attitudinal and motivational levels. The AMTB assesses motivation and attitudes from four composite indices: 1) Attitudes toward the Learning Situation; 2) Integrativeness; 3) Motivation, and 4) Language Anxiety

and Instrumentality (AMI) (Gardner, 1985 & 2005). Attitude or inclination also means the term orientation.

Although the socio-education model has an acknowledgeable contribution to the L2 motivation research field, it receives some criticism by a group of researchers. One of the criticism is raised against the concept of integrative motivation because of inconsistent understanding from different researchers (Au, 1988). The difference between integrative motivation and instrumental motivation is not clear or inconsistent. For example, some motivations, such as traveling or having friends who speak the language, can be either instrumental or integrative depending on the intention and understanding of respondents (Keblawi, 2009). Integrative motivation may also be unimportant or only plays a minor role in language learning (Clement and Kruidenier, 1983; Kruidenier and Clement, 1986), such as ESL (English as a second language). English is one of the most important international languages, it may be not inseparably and intimately connected to one or two specific countries (Shaw, 1981). Most ESL learners do not even have opportunities to interact with a native English speaker. ESL learners in China have a totally different context than ESL learners in Canada. The integrative motivation does not pay enough attention to these effects of the learning context. Meanwhile, there are questions about individuals' identities as if it really implies successful learning in language acquisition (Tollefson,1991; Webb, 2003) and whether integrative and instrumental motivation capture the full picture of L2 learning (Ely, 1986). Thus, some researchers think that the socio-educational model relates more to sociology, but not or not enough to education (Dickinson, 1995). Those motivation studies under socio-education model often focus more on learners' socio-cultural influences in their language learning and "explained why learners decide to learn L2 in specific sociocultural texts" (Crookes & Schmidt, 1991; Dörnyei, 2001). As a result, the frontline teachers can't

find the significance of the research, and the applications in the classroom are often not positive (Huang, 2007).

Therefore, many researchers and studies have expanded and rectified the socio-education model since the late 1980s. The theories from educational psychology (Keblawi, 2009) have broadened the research scope of motivation in L2 education (e.g., Csizér & Dörnyei, 2005; Dörnyei, 1994 & 2005; Dörnyei & Ottó, 1998;). For example, in 1985, Deci and Ryan introduced the self-determination theory and suggested there are two motivations: intrinsic and extrinsic motivation (Ryan and Deci, 2000). Learners may be driven by internal rewards such as personal satisfaction, joy, and pleasure; thus, intrinsic motivation refer to activities done "for their own sake" or for learners' interest and enjoyment. Often contrasted with intrinsic motivation, learners' behaviors may be driven by other than inherent satisfaction and be pertained by extrinsic rewards such as good payment and praise or by externally imposed punishments to avoidance of failure, shame, and anxiety (Ryan and Deci, 2020). Another important theory is the goal theory which focuses on the reasons that learners perceive for achieving. The attribution theory hypothesizes that individual past experience shapes their motivational disposition. These two theories can be easily linked. They suggested two aspects of goals and reasons: internal and external, which overlap with intrinsic and extrinsic motivation in the self-determination theory. However, there are more theories in motivation psychology (see a review, Keblawi, 2009). We will not discuss all of them in detail since the present study primarily wanted to focus on the CCW learning strategies. Motivation was adopted in the learning process of CCW as one of the factors. In the future study, it is hoped that further systematic investigations of this important factor will broaden our current research scope to understand the motivation of CCW.

Since the 1990s, motivation studies have shifted from the social-educational orientation to the educational psychological orientation in this phase. The motivation studies are often

influenced by the above theories. One of the representative examples is Dörnyei. Dörnyei (1990) did an empirical study and investigated 134 ESL learners in Hungary. The results suggest that instrumental motivations, which involved extrinsic motives, played a significant role in motivation in L2 learning contexts. Dörnyei and Otto's study in 1998 developed a cyclic model which is based on the relationship between motivation and achievement. In the recent study, Dörnyei (2009) focused on the psychological concept of "selves" and developed a self-system in L2 motivation, which included 3 parts: ideal L2 self, ought-to L2 self, and L2 learning experience. The first one, i.e., the ideal L2 self, indicates what learners would ideally like to be. The ought-to L2 self is "the attributes that one believes one ought to possess to meet expectations and to avoid possible negative outcomes" (Dörnyei, 2009, p. 29). And the last one refers to the situational and environmental aspects of the L2 learning process. Although other studies have different names for their components, the main motivation factors of the studies in this phase can be similarly categorized into intrinsic and extrinsic motivation (e.g., Dörnyei, 1990 & 1994; Oxford & Shearin, 1994; Wen, 2011), self-concept related (e.g., Busse and Walter 2013; Cho, 2013; Csizér & Dörnyei, 2005; Dörnyei, 1990 & 1994), and goal-related motivation(e.g., Nunn, 2008; Oxford & Shearin, 1994; Schmidt, Boraie & Kassagby,1996) (see a review, Dörnyei & Clement, 2001).

In brief, the study of L2 motivation has bloomed since the 1970s, almost in the same period as the study of L2 strategy. Although the concepts and theories of L2 motivation were abundant and confused, L2 motivation researches are mainly based on two streams. Before the 1990s, Gardner and his associates' social education model dominated in L2 motivation studies. Late on, the new agenda for the field were introduced educational/psychological theories, such as the self-determination theory and the goal theory. The studies in this stream are more focused on motivation factors that describe cognitive traits of L2 learning motivation which were lacking in social education model. No matter which stream to adopt,

we must keep in mind that learners' motivation may not fix in different time periods, and the various elements could influence their motivation from time to time.

2.4.1.2 **CSL learning motivation**

Motivation studies on CSL are based on both the socio-education model and educational psychology models. Wen (2011) studied attitudes and motivation by comparing 317 CSL learners from 3 groups: bilingual group, heritage motivated group, and non-heritage group. This research was based on Gardner's (1985) "socio-educational model, the internal structure model (Csizér & Dörnyei, 2005), and the attribution theory" (Weiner, 1985). She reported three findings: 1) positive learning attitudes and experience predict learning efforts and strategies; 2) instrumentality is "the second significant predictor for intended continuation of study in future" for heritage learners or non-heritage learners; 3) learners from different heritage backgrounds have different motivations. Heritage learners may desire to learn Chinese due to socio-cultural influences. Lu and Li (2008) inspected the relationship between motivation and their language achievement. After comparing the effectiveness of different motivational factors, which include integrative, instrumental, situational, and learner traits, Lu and Li stated that integrative and instrumental motivations were important to students' self-confidence for on heritage and non-heritage learners, but instrumental motivations impacted more to heritage learners than those from non-heritage background. Yang (2003) has an inconsistent finding that integrative motivation was more important than instrumental motivation for Chinese and other East Asian language learners. For the above studies under or partially under the socio-education model, both integrative and instrumental motivation have been reported as significant predictors for language proficiency (Lu & Li, 2008; Wen, 1997 & 2011), but there are also inconsistent findings about which one of these two motivation orientations (instrumental motivation or integrative motivation) is more important,

that may be caused by the sample size, location, and the learning situation (Lu & Li, 2008;Wen, 2011; Yang, 2003).

On the other sides, some studies adopted the educational psychology models. Wen (1997) investigated Chinese heritage learners in US universities and found that "intrinsic interest in Chinese culture" and "the desire to understand the cultural heritage" are the initial motivation to study Chinese. Also, taking Chinese courses helped learners to fulfill academic requirements. Comanaru and Noels (2009) examined whether intrinsic and self-determined extrinsic orientations predicted motivated engagement in heritage and non-heritage Chinese learners. They found that the more participants reported that they more engaged in the learning process if they felt that learning Chinese was personally meaningful and fun. Rueda and Chen (2002) studied 150 college students who enrolled in Chinese language classes in US and found that self-efficacy and task value significantly predicted learning effort. Wang (2014) investigated 219 adolescents' motivation in the Southwestern United States. She found five motivation factors expectancy or ability beliefs, intrinsic value-linguistic interests, utility or attainment value, and task difficulty perceptions. Chow (2001) found that Chinese-Canadian adolescents, who raised awareness and had positive learning experiences about Chinese culture in Chinese community schools, had positive feeling toward "ethnic pride, sense of Chinese cultural belonging, exposure to Chinese media, and self-assessed proficiency". The above studies are generally consistent that positive learning experiences and personal feelings about meaningful learning can lead learners to engage in the learning process for both heritage and non-heritage learners.

Compared to those studies under the socio-education model, the studies under the educational psychology models had a more consistent finding that the intrinsic motivation seems to be more positively related to learners' intended efforts and continuation of study. The preponderance of intrinsic motivation among CSL learners echoed the researchers' belief

that learners with intrinsic motivation prefer fairly complex learning tasks (Ochsenfahrt, 2012) and have the prevalence of learning across their life span (Ryan & Deci, 2017). This has immense value for the learning complex of CCW. The inherent interest and enjoyment make CSL learners not only maintain the motivational engine to go a longer period, but also self-starting behaviors or actions (learning strategies) toward a goal. In our case, CCW.

2.4.1.3 Chinese character learning motivation

There are notable limitations of the existing literature regarding Chinese character learning motivation, which often are embraced in CSL learning motivation. Research on CCW motivation is even more sparse. Most of them focus on Chinese character learning strategies and briefly investigate motivation with one or two fixed options or open-ended questions. Jiang and Zhao (2001) used a simple question to compare two groups for motivation on Chinese character learning: learners from Sinographic east Asia and learners from other countries (汉字文化圈 vs.非汉字文化圈). Following the high to low sequence, learners from Sinographic east Asian are motivated by: future career > interest in Chinese language > tourism > parents' requirement > interest in Chinese cultures > have Chinese friends; learners from other countries are motived by: interest in Chinese language > interesting in Chinese cultures > future career > tourism > have Chinese friends > parents' requirement. Hu (2011) investigated the intrinsic and extrinsic motivation of foreign students in learning Chinese calligraphy. He found that learners from Sinographic East Asia had higher extrinsic motivation than learners from other countries. Other few studies involved Chinese heritage learners and non-heritage learners. The results showed that the main motive for non-heritage learners to learn Chinese characters is their interest in Chinese, while heritage learners often reported motives such as "parents' hope" or "requirement" (Chen，

2009；Chen，2011；He，2008). The starting points of these studies are often based on social cultural impacts on Chinese character learning motivation. However, the findings are consistent. Learners from Sinographic east Asia and learners with Chinese heritage backgrounds more tend to fall into extrinsic motivation.

It is shown by the literature that none of the previous studies particularly has investigated Chinese character writing; CSL motivation studies involve both socio-education model and educational psychology theories, and the majority of motivation studies on CSL used Chinese heritage learners as their objects. In the context of heritage learning, the studies have revealed that learners study Chinese because of their Chinese ethnic identities and search for the roots of their Chinese heritage (He, 2008). However, these studies only examine motivation factors on language proficiency but ignore these mediating effects, such as strategies. Motivation of a language learning is not a simple or single condition of learners. It is usually expressed by learners' learning behavior in the classroom (Ho, 1998).

2.4.2 **Motivation and strategies**

To aid the learning and contribute to students' language attainment, both motivation and strategies are important (Csizér & Dörnyei, 2005; Wen 2011). Researchers commonly agree that motivation has a close relationship with LLS and highly motivated learners use more LLS than low-motivated learners (Oxford & Nyikos, 1989; Okada et al., 1996; Oxford, 1994; etc.). Numerous studies have already shown that motivation is one of significant factor contributing to learners' LLS. One of pioneer studies was carried out by Gardner and Lambert's (1972). They did a longitudinal research to investigate the relationship between motivation and L2 acquisition, and the study suggested that motivation have a positive correlation with L2 learning. After 1980s, researchers began to study the relationship between

motivation and LLS choice. For example, Oxford and Nyikos (1989) investigated variables which affect learners' choice of LLS by university students and found that motivation had a pervasive influence on LLS. McIntyre and Noels (1996) also concluded that highly motivated learners adopted more types of LLS and used them more often. These strong positive relationship support Gardner' view that L2 motivation are important and is the prime determining factor because "they can determine the extent to which the individuals will actively involve themselves in learning the language" (Gardner, 1985b). Oxford and her coworkers disclosed that motivation and the frequent use of strategies significantly predicted the learning language achievement (Oxford, Park-Oh, Ito and Sumrall, 1993). Some researchers pointed out that strategies may be a medicator between motivation and LLS performance (Wen, 1999 and 2011).

No doubt, there is a relationship between learners' motivation, LLS, and performance/ learning outcomes, but how they interrelate and interact on each other in learning CCW is under-examined. In the present study, to better understand and synthesize these two essential components of CCW learning process, the students' approaches to learning (SAL) are adopted which is comprised with the intention of learning (motivation) and strategies used to carry out the task. SAL will be discussed in the following section.

2.4.3 The students' approaches to learning (SAL)

Due to the complexity of CCW learning, an integrative approach is particularly needed to incorporate the factors. Two Swedish educational psychologists, Marton and Saljö, developed the SAL from their clinic study to investigate processing approaches of reading tasks in different levels of university learners in 1976. In SAL, the researchers incorporated why learners learn (a motive) into what they do (a strategy) (Biggs, 1987) and identified two

groups of learners who tended to adopt different levels of processing approaches, named surface and deep approaches. The learners using the surface approach focus on "the sign", or the learning material itself, while learners using the deep approach focus on "the underlying meaning of the text" (Marton & Saljö, 1976). These two cognitive processing approaches have significantly different influences on learning outcomes (Biggs, 1987a, 1987b, & 1993; Biggs, Kember & Leung, 2001; Zeegers, 2002). For example, in the surface approach, learners tended to cope with the assigned task and try to use strategies, such as memorization, which may lead to limited learning and undemanding. Those in the deep approach group were more engaged in the learning process and tried to integrate information in order to undemand learning materials.

This conceptual framework has been broadly used to understand how students perceive the task of learning (Biggs 1993; Entwistle & Waterston, 1988). Although SAL theory develops sub-theories (it has divided into two directions: "phenomenography" and "constructivism and systems theory"), the common idea of SAL theories is that center of teaching and learning are students' perceptions and learning-related activities (Biggs, 1999 & 2001; Dart & Boulton-Lewis, 1998; Marton, 1981; Prosser & Trigwell, 1998). In a word, SAL examines students' learning experience and demonstrates that students' learning is different, and the perceptions of the way how they handle the learning will also be different. Consequently, the learning-related outcomes will differ (Choo, 2006; Biggs, Kember & Leung, 2001). The surface or deep level of cognitive processing approaches directly leads to different learning outcomes.

2.4.4 **Biggs' Presage-Process-Product (3P) Learning Model**

In order to investigate different levels of task processing for learners, Biggs took SAL into his framework and proposed Biggs' 3P learning model in 1978. In the 3P model, variable

factors (student factors, teaching context, on-task approaches to learning, and the learning outcomes) mutually interact, forming a dynamic system (Figure 2.7) (Biggs, 1987a & 1993; Biggs, Kember & Leung, 2001). "Presage" factors are those existing prior to the learning engagement that affects learning, including the student side and the teaching context, such as students' existing knowledge, preferred approaches of learning, teaching methods, and assessment. "Process" indicates the learning experiences capture tool. And "Product" is "the overall student learning outcomes".

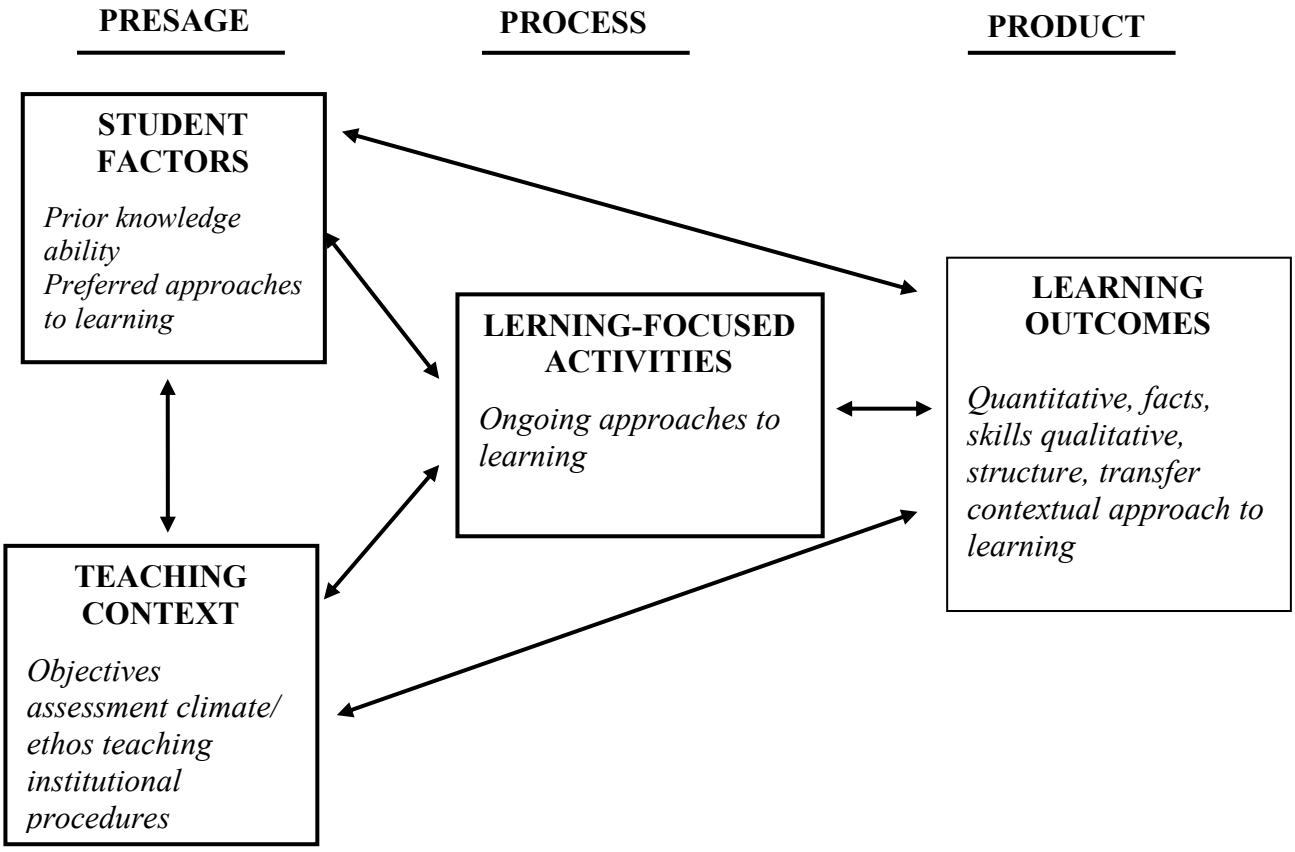

Figure 2.7. The "3P" model of teaching and learning
(source from Biggs, Kember & Leung, 2001, Figure 1, page 16)

Biggs' 3P model explains students' learning complex and provides a holistic and deeper understanding of students' contextual, process, and product of learning (Biggs, 1987a; Biggs,

Kember & Leung, 2001). The 3P model has been widely studied in different areas. For example, the model was tested in undergraduate business students by using a structural equation modeling approach (Hamilton & Tee, 2009); cross-cultural studies used 3P in Hong Kong, mainland China, USA (e.g., Kember & Gow, 1990; Tang & Biggs, 1996; Zhang, 1999); studies tested among the variables in 3P model, such the presage and process (e.g., Biggs, 1988; Watkins & Hattie, 1981), or the process and product (e.g., Albaili, 1997; Watkins, 1998).

SAL is a major process variable in Biggs' 3P model (Yang, 2012), with two components, motive (why the learner wants to approach the task) and strategy (how the learner approaches the task) (Biggs, 1987). Based on the 3P model, Biggs (Biggs, Kember & Leung, 2001) produced an updated two-factor version of the Study Process Questionnaire (R-SPQ-2F) which is "suitable for use by teachers in evaluating the learning approaches of their students". The SPQ questionnaire is extensively used in education psychology (Biggs, 1987a; Biggs, Kember & Leung, 2001). The R-SPQ-2F assesses deep and surface approaches. The deep approach describes "the intention to understand", and the surface approach involves "the intention to reproduce information in compliance with externally imposed task demands" (Chan, 2003). The R-SPQ-2F has 20 items includes has two main scales, Deep Approach (DA) and Surface Approach (SA), with four sub-scales, Deep Motive (DM), Deep Strategy (DS), Surface Motive (SM), and Surface Strategy (SS). The each of sub-scales has 5 items. Extrinsic motivation had contributed to the original surface motive scale while intrinsic interest had contributed to the deep motive scales in Biggs' SPQ (Table 2.8: Biggs' Motives) (Biggs, Kember & Leung, 2001). In addition, the relationship between motive and strategy of each approach is compatible and congruent.

	Surface	Deep
Motive	to meet requirements minimally; a balancing act between failing and working more than is necessary.	intrinsic interest in what is being learned; to develop competence in particular academic subjects.

Table 2.8: Biggs' Motives (Biggs, 1987a, pp. 10 & Biggs, Kember & Leung, 2001)

The surface motives are "extrinsic to the real purposes of the task" and "avoid failure but don't work too hard" (Biggs, 1993). For example, "I chose my present subjects mainly to help me get a good job when I leave school, not because I'm particularly interested in them." On the other hand, the deep motives are "to engage the task properly, on its own terms" and "satisfy curiosity about topic" (Biggs, 1993). For example, "I find that many subjects can become very interesting once you get into them" (Biggs, 1992).

In line with the previous studies, learners' level of learning motivation and strategies play a significant role in their learning outcomes (product) (Marton & Sajlö, 1997; Watkins, 2007;). Students who take the deep approach with intrinsic motivation and strategies maximize their understanding and learning. By changing learners' motivation and strategies, we can improve their learning outcomes.

To conclude, in order to understand students' learning, SAL stands on student perspectives rather than teacher or researchers' perspectives. Aligning with SAL, the 3P was developed to provide a deeper and broader understanding of students' learning, integrating presage, process, and product factors in order. SAL is constituted in the process and comprised of two levels of motives and strategies: surface and deep motives and strategies. Motives and strategies interact with each and influence learning products/outcomes, constituting a dynamic learning system. Change motives and strategies can directly influence the learning outcomes. Given the importance of motives and strategies as well as the

interrelationships of motives, strategies, and learning outcomes, a path model will be prosed based on the 3P to investigate CCW motivation, CCW strategies, and CCW performance among different level CSL learners in our main study.

Chapter 3: Methodology

In chapter 2, we have reviewed the learning strategies and motivation, the two components of the learning approaches to writing Chinese characters. Although there are various studies of the two variables in the L2 field and some studies also involved Chinese character learning, less is known about them in specific aspects of CCW, and none of the previous studies have attempted to undertake learning strategies for CCW simultaneously with its motivation in order to investigate the influence of learning approaches on the learning process of CCW. To provide an effective instrument for measuring CCW learning strategies, and to generate a better understand about CCW learning approaches, the two-phase studies are conducted in the present research. In phase one, the pilot study was carried out in a Hong Kong international school for the development of CCWSI. The CCWSI was further modified to be used in the phase two study. In the phase two, which was the main study for the present study, the CCWSI internal structure was examined, and the 3P model was modified as the theoretical framework in order to evaluate the interrelationship of CCW motivation, strategies, and performance.

There are four parts in this chapter. The first part is devoted to the procedures and outcomes of the phase one pilot study. The second part is the theoretical framework and presents the modified 3P learning model of CCW as well as the analytical model of CCW, which were derived from the pilot study. This is followed by details about the research design and the procedures of the main phase of the study. Finally, the chapter concludes with an overview of the data analysis for the main study.

3.1 Phase one: the pilot study

Note that this pilot study investigates learning strategies among second-language students in a Hong Kong international school. It first developed the inventory, CCWSI, for identifying

CCW strategies. It was submitted to the *International Journal of Chinese Language Education,* The Education University of Hong Kong Press (Ye and Liang, 2022).

3.1.1 Location and participants

International school students in Hong Kong were selected as the subjects for the pilot phase of the study. International schools in Hong Kong include schools that "follow a non-local curriculum and whose students do not sit for the local examinations (e.g., Hong Kong Certificate of Education Examinations). They are operated with curricula designed for the needs of a particular cultural, racial or linguistic group or for students who wish to pursue their studies overseas." (Yamato, 2003). According to Hong Kong Education Bureau (EDB) (February 2017), there was a total of 51 international schools in 2015/16, which provided 22430 primary places and 18676 secondary school places. 16281 non-local students and 4158 local students enrolled in international primary schools. 13599 non-local and 2931 local students enrolled in international secondary schools. The demand for international primary school places and secondary school places is projected to increase by 5% and 23% in 2022/2023. The supply of international primary school places and secondary school places also is projected to increase +21% and +11% in 2022/2023.

The majority of those international schools offer International Baccalaureate (IB) curriculum. At the same time, many of them are under the affiliation of different nationality groups and follow respective national curriculum, such as British National Curriculum and Australian National Curriculum. Chinese curriculums of the international schools have to map both IB and their national curriculum. In brief, international schools in Hong Kong provide an English-medium education, among which Chinese is only one subject that receives a different degree of attention. Chinese course teaching could be very different from school to school, but it is rarely put as a major part of the school curriculum. Consequently,

the teaching time for Chinese may not be enough; more or less, Chinese teaching may tend to emphasize language ability and require character recognition more than production. As a result, the majority of students in the international schools, even those local students, learn Chinese as their second language. They usually perform well in speaking but have poorer in reading, and the worst in writing proficiency of Chinese. Using them as the subjects in the pilot phase can lower the limitation from meaning and pronunciation of character learning and focus more on CW.

As the largest international school organization, English School Foundation (ESF) operates 22 schools in Hong Kong and has 17,770 students from 75 different nationalities in ESF kindergarten, primary, secondary and special schools (ESF, 2020). ESF offers a fully English-medium learning environment. Chinese is a mandatory core subject in kindergartens and primary schools and a core subject in secondary schools. A three-pathway Chinese program is in all primary and secondary schools which cater to CSL students with varying levels of Chinese proficiency and language background. Students learn Chinese as a foreign, second, or near native language. Usually, the schools offer 4 to 5 Chinese lessons per week. However, the teaching and learning hours and materials are different for students at varying levels. There are 3 Chinese benchmark tests for ESF students, in year 6, 9 and 11, respectively. These tests provide information for placement in the suitable pathways or suitable courses for the IB Diploma. In secondary school, "students will be assigned to the suitable IB Middle Years Program (MYP) Chinese language class from Year 7, and the IGCSE (British National Curriculum) Chinese language class for Years 10 and 11 (except the two IB all-through schools Renaissance College and Discovery College)" (ESF, 2020). Figure 3.1 shows an example curriculum map from one of ESF secondary schools that shows the external academic requirements, e.g., GCSE, in the Chinese course (Cheung, 2016). ESF has a long history with

diverse students and an established Chinese curriculum. It is reprehensive of international schools in Hong Kong.

Department of Chinese Key Stage Four Curriculum Map Year 10-11, 2012-2014

Contact time
Year 10-11: Four 40-minute slots a week

Learning materials: 快乐汉语第一册 Kuaile Hanyu Book 1, Peoples' Education Press, China.
Edexcel GCSE Chinese, A Pearson Company
A+ Chinese II GCSE Revision Book, Carol Chen, Beijing Language and Culture University Press

	2012-2013
Term One	**Kuaile Hanyu Book One** Unit Eight Transport & Travel **Edexcel GCSE Chinese** Unit One My life (I like, My parents, My friends, Hobbies, Nationalities) Unit Two School (My school, My school day)
Term Two	Unit Two School (Comparing schools, School uniform, School life) Unit Three Leisure (The sports centre, Activities outside school)
Term Three	Unit Three Leisure (Hobbies and interests, Exercise) Unit Four Media (Television, Surfing the net, Film and music, Celebrities, Different lives)
	2013-2014
Term One	Unit Five Where I live (My house, My town, My local area, Where things are, Finding the way, Exchange visits) Unit Six Holidays (Holiday experiences, Holiday plans, Booking a hotel, Making travel arrangements) Unit Seven Food and drinks (Healthy eating, eating habits, food and festivals)
Term Two	Mock exam and orals Unit Eight Lifestyle (Shopping) Unit Nine The world of work (Work experience, Future plans, Ideal jobs, Applying for a job) **A+ Chinese I** Part three Unit 13 Health
Term Three	IGCSE 0547 Exam

*subject to change without prior notice.

Figure 3.1: A curriculum Map from One of ESF Secondary Schools (source from Cheung, 2016)

Chinse course is taught for 4-5 hours per week by using simplified Chinese characters in the school, with no standard textbooks. Teaching materials are prepared by Chinese teachers. The primary school used the inquiry-based learning mode. Chinese teaching materials are designed to match the school inquiry topics. The high school uses some textbooks, such as the Singaporean textbook *Chinese Language for Secondary Schools and Higher Chinese,* as supplementary teaching material. For Chinese character teaching, the school adopts a meaning-centered approach mainly based on dispersive learning of character (分散識字). Chinese characters are taught when encountered within texts. The Chinese class was divided into 3 levels in this school. Therefore, there is a large group of CSL learners in ESF who can speak well but perform poorly in CCW. All participants in the pilot study were from the highest-class

level. Using them as our pilot study subjects helped us to focus more on CCW with a lower constraint from meaning and pronunciation of character learning.

3.1.2 Measures: CCWSI development

One of the most popular assessment tools for language learning strategies is the summative rating scale, which is known as a questionnaire, survey, or inventory. There are two approaches to conducting a questionnaire/survey: taking an existing questionnaire or a self-designed one. Because there is no standard instrument for CCW strategies, we develop a questionnaire, the *Chinese Character Writing Strategy Inventory (CCWSI),* to collect data for this study. CCWSI is developed and tested in this phase prior to the performance in the main study. There were 4 steps to developing the CCWSI.

Step 1: As previous studies provide comprehensive CCLS in which CCW strategies overlap vastly with recognition strategies, a broad literature review is conducted in order to collect CCW items from the existing studies (Ke, 1998; Tseng, 2000; Yin, 2003; Shen, 2005; Sung, 2012; Jiang & Zhao, 2001; Lu & Peng, 2007; Liu & Jiang, 2003; Zhou & Yu, 2004; Ma, 2007; etc.). The questionnaire items are extracted and put together (more than 400 items). Then similar items within one category are grouped, while multiplex item is rewritten and separated. For example, the items from Ke (1998) are paired for the participants to judge which are more effective, and those items are edited as single statements, for example, “learning character components (logogrpheme and phonetic radicals) is more effective than learning stroke order” is rewritten as two items, “learning character components (logogrpheme and phonetic radicals)” and “learning stroke order”.

Step 2: The repetitive and impracticable items are deleted. For example, the item “I go to the language lab and listen to the new words right before class” (Shen, 2005) is deleted because the language lab might not be available for some schools and learners.

Step 3: The items with similar "keyword" are categorized into different groups. For example, the items with "radical" and "review" are put into "radical" and "review" groups. The items within the same groups are then evaluated, and the items with similar meanings are combined. At the end of step 3, a total of 33 items are collected (Appendix A).

Step 4: The remaining items are consulted and discussed with 4 experts (two professors from Chinese Language Studies and Curriculum and Instruction Studies, a CSL instructor from a university, and a senior teacher from an international school). At the end of this step, two items Q3 and Q13 are deleted. (To keep the item number consistent, Q3 and Q13 are kept in the questionnaire in Appendix A). Q3 ("When I write Chinese characters, if I forget the stroke order halfway through, I will guess") is originally designed to check if learners choose to guess strokes or the shape of a target character in order to finish writing when they forget the details of the character. However, the English description of Q3 is not precise enough. The statement "I will guess" can be understood from a different perspective, such as phonological or semantical perspectives, but not necessary as guessing the strokes or the shape of the target character. Then, learners may write a homophone or a related character in a bi-character word instead of the target character. For example, students may write "沟" to "够" and "铁" to "钢" (Liang, 2019). Thus, it should be deleted. Q13 ("When I write Chinese characters, I use pinyin if I don't know the character") is also deleted because it is arguable. According to Oxford's (1990) definition of L2 learning strategies, "operations employed by the learner to aid the acquisition, storage, retrieval, and use of information…", Q13 is not a learning strategy of CCW. Using pinyin to replace writing characters doesn't aid CCW learning, it deviates from the acquisition of CCW.

Finally, a total of 31 items are used in CCWSI. To form the questionnaire, the part for general information collection, such as age, grade level, gender, home language, and so on, is also needed. An optional open-end question that requests the students to write down additional

information about their CCW learning strategies is also attached at the end of the items. Accordingly, the CCWSI contains two parts. Part 1 is the survey of demographic information, and Part 2 contains 32 questions about the learning strategies of CCW. Except the final open-end question, the 31 items in part 2 are to be rated by using 5 Likert Scale, which is adopted from Oxford SILL (Oxford, 1990).

1–This item is *never* or *only rarely* true of me.

2–This item is *sometimes* true of me.

3–This item is true of me about *half the time.*

4–This item is *frequently* true of me.

5–This item is *always* or *almost always* true of me.

The CCWSI has been written in English, Chinese, and Vietnamese (for the main study). It is sent to four experts for translation: two are proficient in both English and Chinese (one is a Chinese native speaker, and one is English speaker); two are proficient in Vietnamese and Chinese (two Vietnamese native speakers who teach Chinese in Vietnam National University). They cross-check for each other to ensure versions are consistent. Before it is used in the formal study, it is reviewed and pre-tested by several bilanguage speakers of different ages.

3.1.3 Data analysis for the pilot phase of the study

3.1.3.1 Descriptive Statistics

CSL students from ESF were invited to evaluate their CCW learning through using paper-based or web-based CCWSI. 26 total hard copies of CCWSI were distributed to the primary students via their parents, and 19 responses were collected. The web-based CCWSI was available for high school students, and 24 high school students responded online. Together, we obtained 43 CCWSI responses from the primary and high school groups. Participants were required to finish the questionnaire independently. However, younger

children from the primary group may need some help to explain the meanings of some words from their parents. The adults were reminded that they should not interfere in any of the participants' choices. The 43 participants included 21 females and 22 males with age from 7 to 17. They were separated into two groups: the primary group of students from Year 3 to 6 (age 7-10) and the high school group of students from Year 7 to 13 (age 11-17), which included junior high and senior high, as the list in Table 3.1. Participants are from various nations, including China, US, Canada, European countries, Australia, Korea, and India, but at least one of their parents are native Putonghua speakers. Thus, they are bilingual speakers though they are more comfortable to speak English in their daily life. Also, the participants are from high education families, in which at least one of the parents had a master or Ph.D. degree. They have similar family and educational backgrounds.

Grade		**Students**	**Age**
Primary Group: Year 3 to 6		19	7-10
High School Group	Junior high school: Year 7 to 10	19	11-14
	Senior high school: Year 11 to 13	5	15-17
		Total number of students: 43	

Table 3.1: Participants details in the pilot phase

Among the 43 CCWSI responses, few missing values from the paper based CCWSI are substituted by the mean values. Data analysis is carried out by SPSS 25 (IBM, New York). A Cronbach's alpha analysis is conducted to check the reliability of the 31 strategy items. As the Cronbach's alpha of CCWSI in this study is 0.929 (>0.7), it is clear that the CCSWI has a satisfactory reliability and high internal consistency (Fayers and Machin, 2007; Cheung, 2013).

Based on the descriptive analysis, the high frequently used strategies and the low frequently used strategies are shown in Table 3.2 and 3.3. If the item listed on CCWSI has a mean above 3 ("true of me about *half the time*"), the mode should be 4 ("frequently true of me") or 5 ("always or almost true of me"). Thus, it may be categorized as high frequently used strategy. Among all the response, we find that the high frequently used items are Q16, Q6, Q9, Q18 and Q10 as list in Table 3.2. Q16 has the greatest number of participants (frequency) who chose options 4 or 5, with a sum of 23 out of 43 people. The mean of low frequently used strategy is below 3 when the item mode is 1 ("*never* or *only rarely* true of me") or 2 ("*sometimes true of me*"). The low frequently used strategies among all responses include Q24, Q27, Q20, Q33, Q21, and Q32, as list in Table 3.3. Q32 has the greatest number of participants (frequency) who chose options 1 or 2, with a sum of 34 out of 43 people.

			Frequency					
Questions	**Mean**	**Mode**	**1**	**2**	**3**	**4**	**5**	**4&5**
Q16	3.37	4.00	4	9	7	13	10	23
Q6	3.30	5.00	8	5	9	8	13	21
Q9	3.30	5.00	8	5	9	8	13	21
Q18	3.19	4.00	3	11	10	13	6	19
Q10	3.12	4.00	6	7	1	14	5	19

Q16. recall specific characters in the context of compounds
Q6. pay attention to the graphic structure
Q9. write repeatedly and learn characters by rote.
Q18. pay attention to semantic radicals
Q10. pay attention to the shape of characters

Table 3.2: The Most Frequently Used Strategies

Questions	Mean	Mode	Frequency					
			1	2	3	4	5	1&2
Q24	2.26	1.00	18	11	5	3	6	29
Q27	2.12	1.00	24	5	3	7	4	29
Q20	2.00	1.00	23	7	6	4	3	30
Q33	2.00	1.00	25	6	4	3	5	31
Q21	1.84	1.00	22	12	5	2	2	33
Q32	1.81	1.00	22	12	4	5	0	34

Q32. play games
Q21. check plan and reflect on the progress
Q33. practice calligraphy
Q20. plan for CCW
Q27. create stories to help memorization
Q24. preview/study before class

Table 3.3: The Least Frequently Used Strategies

3.1.3.2 Factor analysis

The exploratory factor analysis (EFA) has emerged in many fields as a useful tool for determining and assessing latent behavioral constructs. It is also used to uncover the underlying structure of CCWSI and identify the underlying relationships between individual CCW strategies. The EFA is conducted by using SPSS 25 (IBM, New York) on the 43 sets of responses of the 31 strategy items. In such a case, the sample size is not big. However, because the small sample size problem often occurs, recent statistical literature investigated the small sample sizes (N below 50). For example, de Winter, Dodou, and Wieringa (2009) offered a comprehensive overview of the conditions in which EFA can yield good quality results for N below 50. A few earlier studies even recognized that sample sizes of 30 and 25 can be adequate (Bearden, Sharma, & Teel, 1982; Geweke & Singleton,1980). Meanwhile, some researchers focused on the number of cases per variable (N/p), and recommendations range from 3:1–6:1 (Cattell, 1978) or 20:1 (Hair, Anderson, Tatham, & Grablowsky, 1979). According to the literature review, the majority of learning strategies inventories had two to three factors, such as inventories of O'Malley's (1985), Oxford's (1990 and 2011), and

Shen's (2005), etc. Our sample size for the pilot study is 43, which meets the 20:1(N/p), which is acceptable for overall consideration. Moreover, we understand that we should treat with caution when we apply EFA to small sample sizes. Therefore, we repeat the EFA in our main study with a larger number size.

The principal components analysis (PCA) method and Varimax rotation are applied for EFA. The mean values are substituted for the missing values. Both Bartlett's test of sphericity (Bartlett, 1951; Gorsuch, 2014) and Kaiser-Meyer-Olkin measure of sampling adequacy are checked to assess the factorability of the data. A scree plot is employed to help with the identification of factor numbers that could be extracted. The results show that Bartlett's test of sphericity is significant, χ^2 (465) = 859.62, p<.001, and the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO=0.62) is acceptable (Kaiser & Rice, 1974), indicating that the current dataset is suitable for factor analysis.

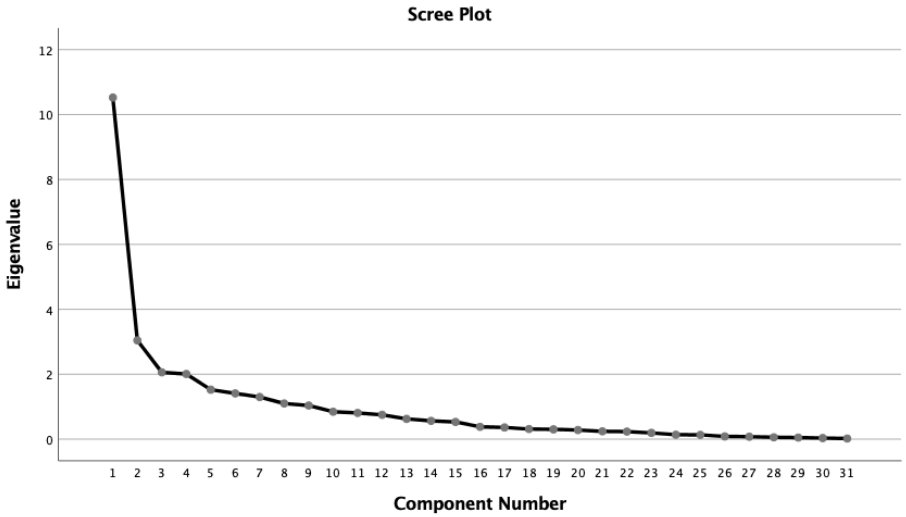

Figure 3.2: The result of Screen Plot

The result of scree plot suggested that the optimal two factors could be extracted (Figure 3.2). The pattern matrix of two-factor solution is displayed in table 3.4 with larger factor loading bolded. Items with factor loading larger than 0.3 were taken as acceptable (Hair, et al., 2010). The first factor contains 16 items (Q2, Q11, Q19, Q20, Q21, Q22, Q23, Q24, Q25,

Q26, Q28, Q29, Q30, Q31, Q32, Q33), with factor loading ranged from 0.31 to 0.79, which explained 22.28% of the total variance. The second factor composes of 15 items (Q1, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q12, Q14, Q15, Q16, Q17, Q18, Q27), with factor loading ranges from 0.34 to 0.80, which explains 21.48% of the total variance.

	Factor 1	Factor 2
Q1	0.304	**0.464**
Q2	**0.312**	-0.012
Q4	0.222	**0.338**
Q5	0.397	**0.522**
Q6	0.265	**0.593**
Q7	0.071	**0.369**
Q8	0.284	**0.583**
Q9	0.248	**0.444**
Q10	0.199	**0.777**
Q11	**0.648**	0.087
Q12	-0.007	**0.736**
Q14	0.188	**0.529**
Q15	0.131	**0.732**
Q16	0.156	**0.578**
Q17	0.08	**0.796**
Q18	-0.072	**0.745**
Q19	**0.691**	0.507
Q20	**0.709**	0.2
Q21	**0.611**	0.479
Q22	**0.713**	0.249
Q23	**0.685**	0.465
Q24	**0.671**	0.085
Q25	**0.648**	0.216
Q26	**0.525**	0.394
Q27	0.248	**0.524**
Q28	**0.786**	0.241
Q29	**0.746**	-0.089
Q30	**0.39**	0.165
Q31	**0.605**	0.148
Q32	**0.602**	0.291
Q33	**0.389**	0.231
# of items	16	15
Proportion of variance	0.22	0.21
Cronbach's Alpha	0.91	0.88

Table 3.4: Pattern Matrix of Two-factor Solution
Note: 1. Principal Components Analysis and Varimax rotation were used.
2. factor loadings higher than 0.3 were bolded.

Item-total correlation and Cronbach's Alpha if Item Deleted (Table 3.5) are performed in order to ensure that each item is significantly related to the items in its factor. According to Cristobal et al. (2007), the minimum value for retaining each item is 0.30. However, for an exploratory study 0.20 is an acceptable value for item-the total correlation. Q2 in factor 1 is 0.238 for item-total correlation, and Cronbach's Alpha is 0.913 if Q2 is deleted, which is the same as 0.91 of the original Cronbach's Alpha of factor 1. Q2 is bearable to retain. The items in factor 2 have the smallest value of 0.32 for item-total correlation, and if we delete any item in the factor, Cronbach's Alpha of the factor will not be increased. Thus, no item should be dropped.

Factor 1	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Factor 2	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q19	0.779	0.897	Q10	0.744	0.865
Q23	0.761	0.897	Q15	0.703	0.867
Q28	0.76	0.898	Q17	0.687	0.867
Q22	0.728	0.9	Q12	0.609	0.87
Q21	0.682	0.901	Q8	0.578	0.872
Q20	0.648	0.901	Q18	0.573	0.872
Q32	0.634	0.902	Q6	0.554	0.873
Q25	0.62	0.902	Q5	0.543	0.873
Q11	0.601	0.903	Q27	0.521	0.874
Q26	0.597	0.903	Q16	0.508	0.875
Q29	0.579	0.903	Q14	0.508	0.875
Q24	0.574	0.904	Q9	0.461	0.877
Q31	0.559	0.904	Q1	0.458	0.877
Q33	0.385	0.91	Q7	0.369	0.882
Q30	0.374	0.91	Q4	0.323	0.882
Q2	0.238	0.913			

Table 3.5: Item-total correlation and Cronbach's Alpha if Item Deleted

In order to interpret these factors, the content of each of the items has been checked one by one. Factor 1 has 16 items, and all items are loaded to "indirect strategies" except Q2 ("When I write Chinese characters, I follow the stroke order"), including strategies items 2, 11,

19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, and 33. These strategies, except Q2, can be categorized into the metacognitive strategies, affective strategies, social strategies, compensation strategies of Oxford (1990) , and applying strategies (Jiang & Zhao, 2001), which is not directly related to the knowledge of Chinese characters and thus we name factor 1 items as "indirect strategies". The number of factor 2 items is 15 in total. They are item 1, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15, 16, 17, 18, and 27. These items are related to learning CCW by obtaining orthographic, phonologic, and semantic knowledge of Chinese characters, so-called "knowledge-based strategies". The items for two factors are in the following Table 3.6. These two factors imply both the linguistic features of Chinese characters and the cognitive process of writing influence students in employing CCW strategies.

A Cronbach's Alpha analysis is further conducted to check the reliability of the strategy items grouped by these two factors. The result of the Cronbach's Alpha analysis for 16 items in factor 1 is 0.91 and for 15 items in factor 2 was 0.88. There is a clear internal consistency among the strategy items for both factor 1 and 2.

3.1.4 **Summary**

The phase one pilot study is designed to develop and modify CCWSI. This pilot test is done in a small group of international school students in Hong Kong. The CCWSI has a satisfactory reliability, which indicates a high internal consistency. The EFA is used to investigate the internal structure of CCWSI. The result shows two dimensions (the factors) of CCWSI, the indirect strategies and the knowledge-based strategies, that reflect not only the cognitive process of writing but also the linguistic features of Chinese characters, both of which affect learners to employ CCW strategies. This two-factor structure is further examined in the phase two main study.

Factor 1: indirect strategies	
Q2	When I write Chinese characters, I follow the stroke order
Q11	I pay attention to how teachers write Chinese characters in the classes.
Q19	I have clear goals for learning to write Chinese characters.
Q20	I have a plan for writing Chinese characters (e.g. writing 10 characters per day).
Q21	I check my plan for writing Chinese characters and reflect on my progress.
Q22	I notice my mistakes in writing Chinese characters and try not to make the same mistakes again.
Q23	I encourage myself to write Chinese characters.
Q24	I study ahead on how to write the new characters before class.
Q25	I review how to write Chinese characters by testing myself or asking someone to test me.
Q26	I try to find the best way to remember how to write Chinese characters.
Q28	I do what I can to write Chinese characters in my daily life (e.g. I use Chinese to keep a journal or write email, cards, phone messages, and so on).
Q29	I write Chinese characters in my homework and notes (such as in-class notes and study notes).
Q30	When I write Chinese characters, if I encounter a character I don't know how to write, I look it up in a character dictionary or other dictionary.
Q31	I ask my teachers, classmates, language partners, or friends for help and discuss with them how to write Chinese characters.
Q32	I play Chinese character games, including computer games, to learn to write Chinese characters (e.g. games that show the strokes or the stroke order of Chinese characters).
Q33	I practice calligraphy.
Factor 2: knowledge-based strategies	
Q1	When I write Chinese characters, I look carefully at the strokes (e.g. distinguish "乙" and "飞"in "亿" and "气").
Q4	When I write Chinese characters, I compare characters which are similar in form (e.g. "木", "太", and "大").
Q5	When I write Chinese characters, I pay attention to logographemes (e.g. "能" consists of "厶","月","匕", and "匕").
Q6	When I write Chinese characters, I pay attention to the graphic structure (e.g. characters such as "哲","夜","挚", and "势" have an upper and lower structure, but not a left and right structure).
Q7	I practice Chinese characters with kinesthetic methods. (A learner uses a finger or a pencil to trace a character in the air, or above the paper).
Q8	I copy characters in a character copybook.
Q9	When I write Chinese characters, I write characters repeatedly and learn them by rote.
Q10	When I write Chinese characters, I pay attention to the shape of characters, and associate new characters with those I already know that have similar shapes.
Q12	When I write Chinese characters, I pay attention to the pronunciation of characters, and associate new characters with those I already know that have the same or a similar sound (e.g. "耶" (ye1), "爷" (ye2),"也" (ye3), and "叶" (ye4)).
Q14	When I write Chinese characters, I say the character to myself.
Q15	When I write Chinese characters, I pay attention to phonetic radicals of characters, and associate new characters with those I already know that have the same phonetic radicals (e.g. "把", "吧", and "爸" have the same phonetic radical "巴".)
Q16	When I write Chinese characters, I recall specific characters in the context of compounds (e.g. "医生" (doctor) helps me remember "医").
Q17	When I write Chinese characters, I pay attention to the meaning of characters, and associate new characters with those I already know that have the same or similar meanings (e.g. "看", "望", "瞧", and "盯" all mean "look").
Q18	When I write Chinese characters, I pay attention to semantic radicals of characters, and associate new characters with those I already know that share a semantic radical (e.g. "妈", "姐", "妹", "奶", "姨", and "姑" all have the semantic radical "女"; "你", "们", and "他" have the semantic radical "亻").
Q27	I create my own stories to remember how to write characters. (e.g. "楼" (building) is a wooden ("木") building with rice ("米") and beauty ("女") inside.)

Table 3.6: Items of two factors

3.2 **The theoretical framework**

To generate a better understanding of CCW, a part of the purposes of the present study is to investigate the interrelationships among the CCW motivation and CCWS with the CCW performance, as well as to inspect the role of CCW strategies in the CCW learning process. Biggs' 3P learning model (Figure 2.7) integrates various variables and forms a dynamic system that can provide a useful context for understanding the importance of CSL learners' approach to CCW. For fulfilling the purpose, the 3P model is modified (Figure 3.3). Conforming to the SLA and the 3P learning model (in the section 2.4.3 and 2.4.4), different ways of which learners think about CCW (deep or surface motive) carry out their CCW learning (strategies) that produce qualitatively different learning outcomes in CCW.

In the light of the Biggs' 3P model, the variables of the modified 3P learning model of CCW mutually interact and form a dynamic system. As one of the major purposes of the study is to explore CSL learners' approaches in CCW learning process and the CCW learning approaches are considered as forming "Process" part of the system, the model focused on the paths from Process to Product variables. "Presage" factors include CSL student and teaching context (i.e., whether students have heritage background; whether students from Sinographic east Asia or other countries; whether the school adopts the teaching method that is to require characters recognition first, or recognition and writing simultaneously, etc.). "Process" indicates the approaches to CCW learning, including motivation and strategies of CCW. And "Product" is the overall student CCW outcomes. The model helps us understand the importance and function of the approaches to CCW for CSL learners.

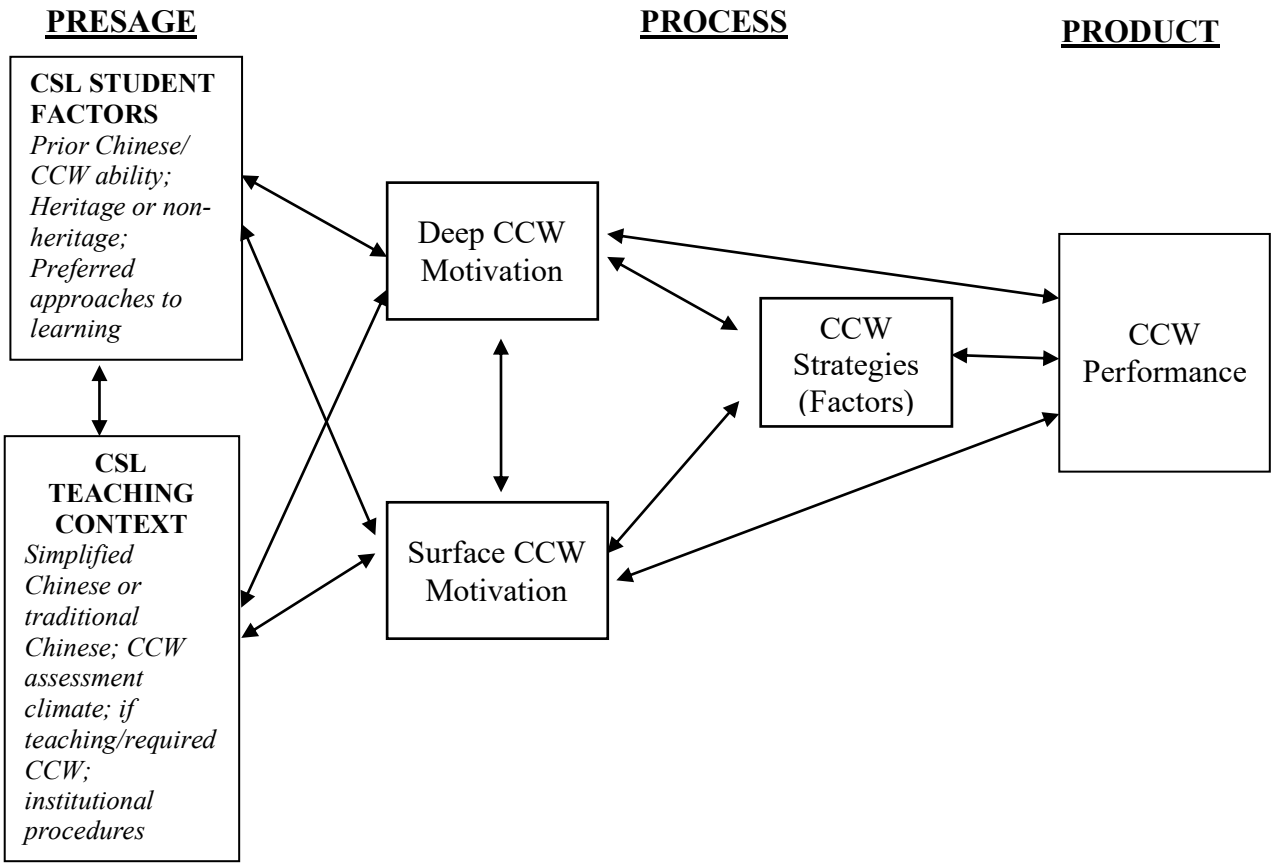

Figure 3.3: The 3P Learning Model of Chinese-character Writing (CCW) modified based on Biggs' 3P teaching and learning model (source from Biggs, Kember & Leung, 2001, Figure 1, page 16), see Figure 1.

Although the 3P learning model of CCW integrates presage, process, and product, the presented study is focused on the Process and its relationship with the Product. The process is comprised of CCW motives and CCW strategies. When learners see learning as an enforced task, they tend to be passive and take fewer types of learning strategies (McIntyre & Noels, 1996). By contrast, deep motivated learners enjoy learning and try to seek to understand the meaning of their learning subject. Accordingly, more types of learning strategies are adopted, and the frequency of using strategies is also higher among those learners. Meanwhile, CCW has its own features that may require specific strategies. From the pilot phase of the study, two factors: Indirect Strategies and Knowledge-based Strategies, were identified. The F1 indirect strategies are mainly composed by metacognitive strategies, which are "thinking

about thinking" (Anderson, 2002) and play an "executive role" to manage, direct, regulate, and guide the learning (Lv & Chen, 2010; Wang, Spencer and Xing, 2009). Those are higher-level strategies. On other sides, the F2 knowledge-based strategies involve that unavoidable knowledge for CCW learners and are aligned with those surface or extrinsic motivation, which focuses on "fulfilling task requirements" (Gijbels et al. 2005). Adapting the Biggs' motivation and combining the specific learning strategies for CCW, a theorized model of the CCW learning approaches is updated, and the analytical model of CCW can be portrayed as below (Figure 3.4).

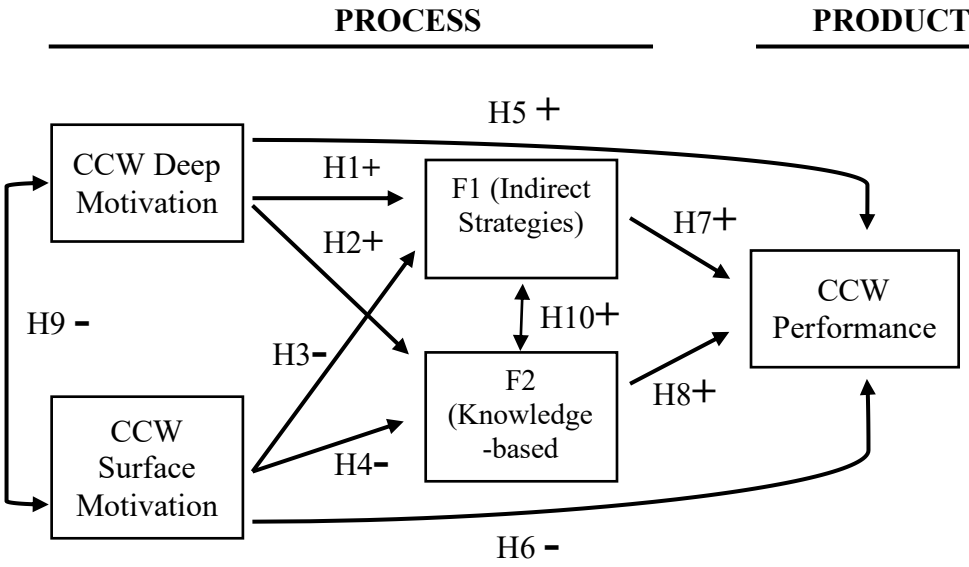

Figure 3.4: Analytical Model of CCW

Based on the relationship of motivation, strategies, and learning outcome, the Analytical Model of CCW proposed for the presented study, the following hypotheses are tested in the main study:

Hypothesis 1 (H1): Deep motivation of CCW has a positive relationship with F1 strategies.

Hypothesis 2 (H2): Deep motivation of CCW has a positive relationship with F2 strategies.

Hypothesis 3 (H3): Surface motivation of CCW has a negative relationship with F1 strategies.

Hypothesis 4 (H4): Surface motivation of CCW has a negative relationship with F2 strategies.

Hypothesis 5 (H5): Deep motivation of CCW positively influences CCW performance.

Hypothesis 6 (H6): Surface motivation of CCW negatively influence CCW performance.

Hypothesis 7 (H7): F1 strategies for CCW has a positive relationship with CCW performance.

Hypothesis 8 (H8): F2 strategies for CCW has a positive relationship with CCW performance.

Hypothesis 9 (H9): Deep motivation and surface motivation of CCW are negatively related to each other.

Hypothesis 10 (H10): F1 and F2 strategies are positively related to each other.

H1 to H10 jointly conceive our main hypotheses: participants with deep approaches of CCW are more likely to use CCW strategies and have better performance of CCW than those with surface approaches.

3.3 **The phase two: the main study**

In the pilot phase, the CCWSI is developed and administered among a small group of international school students in order to test its internal structure of it. To ensure the statistical reliability and validity, a larger group CSL learners are hired in the main phase of the study. Because the CCWSI aims for all levels and ages CSL learners, in the phase two study, it is

retested in the adult learners from four universities in Honan, Vietnam. In addition, although motivation and strategies have been demonstrated to be important variables that influence L2 learning outcomes, there is less effort to input for integrating these variables in Chinese character learning. The present research not only identifies learners' CCW strategies and the internal structure of the CCWSI, but also aims to investigate the role of CCW strategies in the CCW learning process, that attempts to take account of CCW motivation, CCW strategies, and CCW performance simultaneously based on Biggs' 3P model, a well-developed learning model. More specifically, the following points will be examined in the main phase of the study:

1). Reliability and validity of CCWSI: the adequacy of CCWSI is obtained to confirm its internal structure and refine the items. EFA and CFA are performed to validate the CCWSI. A completing model is also constructed to inspect the best structure of CCWSI.

2). CCW motivation: CCW motivation questionnaire is modified from The R-SPQ-2F motive items, and CFA is conducted to confirm the construct.

3). CCW performance: it is assessed by a writing-to-dictation task of Chinese characters.

4). Interrelationships among the learning approaches of CCW (CCW motivation and CCWS) with the CCW performance: the modified 3P model is derived for the theoretical foundation to analyze whether the CCW motivation, CCWS, and CCW achievement conform to the hypothesized structure.

5). The role of CCW strategies in the CCW learning process: mediation analyses with Structural Equation Modeling (SEM) are employed to understand if motivation influences learning outcomes through strategies (if strategies are working as a mediator variable of the underlying CCW learning mechanism.

3.3.1 Location and participants

3.3.1.1 Vietnamese language background

In Vietnam, the language and writing system has been a complicated, politically charged issue. John de Francis (1977) organized his book chapter into 5, corresponding to 5 periods of language and writing system according to colonialism and language policies in Vietnam. That provides us a general impression and a timeline about the development of language and writing systems in Vietnam.

Chapter 1: "Chinese colonialism (B.C. 111-939 A.D.): Two languages: Vietnamese and Chinese; One writing system: Chinese". The recorded history of Vietnam started from B.C.111, after the Vietnamese people were conquered and incorporated into the Chinese empire. In this period, Chinese dominated the area, and Chinese rules, including language and characters, were submitted for the ruling class.

Chapter 2: "Monarchical independence (939-1651): Two languages: Chinese and Vietnamese; Two writing systems: Chinese (Sino-Vietnamese) and ideographic Vietnamese (Nom)". In 939, the Vietnamese people finally got freedom and established a vassal relationship toward China which lasted for almost 1000 years. In this period, the Vietnamese people developed a form of writing from Chinese characters, Nom, to suit their own language. However, the official discourse required Chinese, that resulted the bilingualism. Because of the unifying common element of the Vietnamese spoken language, Nom provided a bridge for people to the educated social elite class. Although the short-lived Ho dynasty (ruled by Ho Quy Ly1400-1401) tried to use Nom to replace Chinese, but it was interrupted by Ming invasion. By giving a politicized character of Nom, the ruling class suppressed to utilize Nom in Le dynasty (1428-1786).

Chapter 3: “Monarchical independence and Catholic separatism (1651-1861) Two languages: Vietnamese and Chinese; Three writing systems: Chinese (Sino-Vietnamese), ideographic Vietnamese (Nom) and romanized Vietnamese”. Combining the invasion from Qing dynasty and Western powers, the internal conflict in Vietnam was increased. Nguyen Hue established the Tay Son dynasty and (1778-1802) favored the western missionary while strongly encouraged to against Chinese and tried to completely replace Chinese by using Nom. In 1802, Nguyen Anh established the final dynasty with the French religious and military supports. The romanizing Vietnamese which was devised by a group of European priests in order to aide for acquisition of the spoken language. The original sound-symbol correspondences were devised between 1627 and 1638. Alexandre de Rhodes, a French Jesuit, published the new orthography in 1651. In the following centuries, the romanizing Vietnamese was circumscribed with the conversation to Christianity in Vietnamese.

Chapter 4: “French Colonialism (1861-1945) Three languages: Vietnamese, Chinese and French; Four writing systems: Chinese (Sino-Vietnamese), ideographic Vietnamese (Nom), romanized Vietnamese (Quoc Ngu) and French”. In 1861, French conquered 3 eastern provinces of Vietnam. Then, the country was progressively divided into three parts (the South Cochinchina, the central parts Annam, and the north Tonkin). Because of French political control and French Catholics domination, Quoc Ngu was extended to schools and printing presses published in French and Quoc Ngu. Chinese and Nom remained in the ascendant and used to give effect to resistance literature in some parts of Vietnam.

Chapter 5: “National independence (1945-Present) One language: Vietnamese One writing system: Quoc Ngu”. In 1945, Ho Chi Minh launched the August Revolution

and established the Democratic Republic of Vietnam. By obtaining the minds and hearts of the masses and aiming the goal of universal literacy, the national system was entirely devoted to Quoc Ngu. This instrument of romanization's ultimate success involved multiple reasons, such as the upheaval brought by French colonialism and division of the nation, the nationalist struggle, and development requirement. (Lo, 2001; DeFrancis, 1977)

To conclude, we can see from John de Francis (1977) that Chinese language and Chinese characters had been used for a long period (from 11BC up to the 20th century) in Vietnam, together with Vietnamese. Chinese was used for High language functions, and Vietnamese was used for the colloquial purpose (Gottlieb & Chen, 2001). The bilingualism lasted till 1980s. Later on, local Nom script was invented by Vietnames scholars, but it was suppressed and limited for its development during the 18th century because of internal political reasons as well as the monopolization of Chinese writing (Gottlieb & Chen, 2001). In 17th century, missionaries first created the Vietnamese national script by using Roman Alphabet to transcribe phonetically Vietnamese (Nguyễn, 2010). Till 1910s, the Latin-script, Quoc Ngu, based Vietnamese alphabet replaced Chinese characters in order to eliminate Chinese influence. Comparing to Chinese characters and Nom scripts which only served a small group of people who held power, Quoc Ngu filled the urgent need for Vietnam as a communication language for the mass. 1938 to 1945, the Association for Dissemination of the Quoc Ngu conducted literacy campaigns. On Sept. 2, 1945, Vietnam declared the independence from France, after that, the government took the Quoc Ngu into the popular education system as Vietnam national script (Gottlieb & Chen, 2001), and Chinese was viewed as a foreign language in Vietnam.

Nom characters or script was adopted or modified from Chinese writing system and self-generated Vietnamese themselves in order to record Sino-Vietnamese language (Nguyễn, &

Ha Vu, 2021). Because it was resulted from cultural contacts of China, many Chinese character features still were observed in Nom, such as the graphic abbreviations (Thị Đỗ, 2020), the phono-semantic characters (Trần, 2021), and the same pronunciation characters were also found (Nguyễn, & Ha Vu, 2021). However, as the current Vietnamese national script, Quoc Ngu is Roman alphabetic and much simple than Nom. It only contains 29 letters. Because it is transparent to phonetically Vietnamese, it is much easy to read or write comparing to Nom or Chinese character. Graphically, Quoc Ngu is quite different from Chinese characters. It is believed that Vietnamese students are struggling hard with CCW, similar with learners from alphabetic language backgrounds.

3.3.1.2 Participants

In recent decades, Vietnam and China have increased cooperation, CSL learning and teaching have been greatly enhanced in Vietnam (Chen, 2014). Till 2020, there were total 31 universities that had Chinese major (8 of them offered a master's degree in Chinese and 1 offered Ph.D. degree in Chinese) (Nguyen, 2020). For those Vietnamese CSL learners, Chinese writing is different from their alphabetic writing, and Chinese is an unfamiliar writing system, which creates difficulties in decimating between visually and similar symbols.

The participants in this phase study are CSL learners from four universities in Honan, Vietnam. The four Universities are:

1. *Thang Long University*: This is a well-known private university in Vietnam offering a bachelor program in Chinese. The program is very young and only has 5 full-time faculties (others are part-time). The teaching effects are good, although the quality of students is relatively low than the other three. The majority of those graduates become foreign company employees, Chinese tour guides or Chinese translators.

2. *University of Language and International Studies, Vietnam National University, Hanoi (VNU-ULIS)*: This university is the most authoritative education institute for training foreign language teachers and foreign language translators in Vietnam. The Faculty of Chinese Language and Culture of this university consists of 60 Chinese teachers, offering most CSL programs (including an affiliated high school, a Chinese undergraduate program, and master's and doctoral programs) for more than sixty years. Most of the graduates of this university work for the government, academic institutions, research institutions, and companies.

3. *Hanoi University (HANU)*: This is the oldest institution for foreign language training and research in Vietnam. It offers both undergraduate and postgraduate programs of various foreign languages, including Chinese. Foreign students make up 10% of the students' population. The Chinese program was established in 1987 and has grown rapidly into the largest Chinese program in Vietnam (Nguyen, 2011). The department of Chinese has 38 teachers and about 1313 students in the academic year 2018-2019 (Jiang, 2019). An average of 170 new undergraduate students are admitted each year (Nguyen, 2020). The graduates work in various fields, such as education, business, and tourism.

4. *Foreign Trade University*: This is a relatively famous university in Vietnam. There are about 25 Chinese teachers. The university offers a Bachelor of Business Chinese and has abundant quality student resource. The employment rate of graduates is high. The graduates mainly work for foreign trade business.

These four universities were chosen because of two main reasons. First, these universities have public and private schools with varied sizes and historical backgrounds. Also, they emphasize different orientations toward vocational training for their students. In this perspective, these four universities well represent the current CSL learning and teaching situation in Vietnam universities. Meanwhile, these universities have similar teaching

contents (using the same textbooks:《汉语教程(修订本)*Hanyu Jiaocheng*》(Yang, 2006)) and teaching approaches. They don't separate Chinese character teaching with Chinese language teaching. In other words, they do not have a separate Chinese character class, but teach Chinese characters under the language context. These universities adopt the meaning-centered approach, which is mainly based on dispersive learning of characters (分散识字法) and often focuses on the development of reading ability; thus, Chinese characters learning is treated as "word by word (词本位)". Although the teaching approach benefits CSL learners to recognize characters quickly and accurately along with the meaningful text, but the process of learning characters is unorganized, and learners may acquire the character meaning partially or incompletely（Zhan & Cheng, 2014）. These similarities allow us to better illustrate learners' CCW learning strategies. In order to investigate the relationship between the learning approach to CCW and the CCW performance, more than three hundred of CSL students from the year 2, 3, and 4 are selected. The year 1 students are excluded, as they have little experience of writing Chinese characters when we conducted data collection in October 2019.

University Name	Participants Number	
Thang Long University	18 (year 2) 28 (year 3)	Total: 46
University of Language and International Studies, Vietnam National University, Hanoi (VNU-ULIS)	73 (year 2) 33 (year 3) 78 (year 4)	Total: 184
Hanoi University (HANU)	40 (year 2) 37 (year 3) 4 (year 4)	Total: 81
Foreign Trade University	29 (year 3)	Total: 29
Total: 340 (excluded 1 heritage learner, 339 in total)		

Table 3.7: Phase 2 Vietnam Participants Details

In total, there are 340 CSL students who participated in this study, including 131 year 2 students, 127 year 3 students, and 82 year 4 students, as listed in Table 3.7. One of the students with Chinese heritage background is excluded from the data analysis. There are 17 (5%) males among 339 students. Our participants have received at least one year of Chinese training and have a certain level in Chinese with the capability to write Chinese characters.

3.3.2 Instruments

The instrument for the main study is a questionnaire package includes 3 parts (Appendix A): Part 1 is the demographic information, Part 2 is the CCW motivation questionnaire, and Part 3 is the CCWSI from the pilot study. The questionnaire is written in both simplified Chinese and Vietnamese. Except for the final open-end question, all items are to be rated by using 5 Likert Scale. Each questionnaire aims to provide both independent and relevant information in our path model. It is used to evaluate the approach to CCW of the students.

Part 1 the demographic information: it is similar to the one in the pilot study and included 10 questions in total. In addition to age, grade level, gender, first language, and other languages, the survey also asks whether participants are heritage learners and why they want to learn Chinese (one optional open-end question).

Part 2 the CCW motivation questionnaire (Table 3.8): with permission from Prof. Biggs, 10 motivation items (DM and SM) of the R-SPQ-2F (Biggs, Kember & Leung, 2001) have been modified in order to aim CCW. In order to fit CCW, we go through and modify each of the items. First, the items have to focus on CCW. The content is modified specifically, and each item has to content “writing Chinese characters”. For example, DM “I find that at times studying gives me a feeling of deep personal satisfaction”, is modified as “I find that at times writing Chinese characters gives me a feeling of deep personal satisfaction.”

Q1 (DM)	我发现书写汉字有时能带给我很大的满足感。 I find that at times writing Chinese characters gives me a feeling of deep personal satisfaction.
Q2 (SM)	我希望尽可能少写汉字而通过中文课程。 My aim is to pass the Chinese course while doing as little as possible in terms of writing Chinese characters.
Q3 (DM)	我觉得只要学习和了解，书写汉字会很有趣。 I feel that writing Chinese characters can be highly interesting once I get into it.
Q4 (SM)	我觉得写汉字很无聊，所以我把书写保持在最低限度。 I do not find writing Chinese characters very interesting so I keep my writing to the minimum.
Q5 (DM)	我觉得写汉字有时就象看一部好的小说或电影一样令人兴奋。 I find that writing Chinese characters can at times be as exciting as a good novel or movie.
Q6 (SM)	我觉得可用强记汉字而不是理解汉字（结构、读音和字义）的方法来通过汉字书写考试。 I find I can get by in most examinations of Chinese character writing by memorizing key Chinese characters rather than trying to understand them (i.e. their structure, sound, and meaning).
Q7 (DM)	我努力书写汉字，因为书写汉字很有趣。 I work hard at writing Chinese characters because I find writing is interesting.
Q8 (SM)	我认为书写汉字没用，我分不清如何书写汉字，而且觉得书写汉字浪费时间，我只需对汉字有简单了解。 I find it is not helpful to write Chinese characters. It is confusing to me and wastes time, when all I need is a passing acquaintance with Chinese characters.
Q9 (DM)	大多数时候，我希望上中文课能学会如何书写汉字。 I come to most Chinese classes with questions in mind about writing Chinese characters that I want teachers to answer.
Q10 (SM)	我觉得没有必要去书写考试中不出现的汉字。 I see no point in writing out Chinese characters which are not likely to be tested in the examination.

Table 3.8: The CCW motivation survey
Motives were modified from the R-SPQ-2F (Biggs, Kember & Leung, 2001)

Then, the content of the items must be suitable for CCW. For example. SM “I find I can get by in most assessments by memorizing key sections rather than trying to understand them” is modified to fit CCW as “I find I can get by in most examinations of Chinese character

writing by memorizing key Chinese characters rather than trying to understand them (i.e. their structure, sound, and meaning)". The modified motivation items are consulted and discussed with two professors from Chinese Language Studies and Curriculum and Instruction Studies. The items also take a 5-point Likert scale, ranging from 'always true of me' to 'only rarely true of me'. The two scales (Deep and Surface) with 10 sub-scales are constructed in our specific domains in the model. Part 3 CCWSI is developed from the pilot study.

3.3.3 Writing-to-dictation

Writing accuracy is the primary and the most important criterion for assessing CCW performance. Researchers usually obtain data from three tasks: free writing assignments or spontaneous writing (Tokimoto & d'Arcais, 2001; Jiang and Liu, 2004; Su, Zhang & Guan, 2007; Yi, 2010; etc.), copying task (Tan et al., 2005; Lam, et al., 2011; McBride-Chang, Chung & Tong, 2011; Tso et al., 2011; etc.), and writing-to-dictation task (Ho et al., 2007; Cheng-Lai et al., 2013; Liang, 2019; etc.). Compared with spontaneous writing, the writing-to-dictation task requires learners to write a same group of characters, and learners could not consciously avoid the use of uncertain characters. With specific designs, the information inherent in Chinese writing can be easily traced, as the writing-to-dictation test incorporates phonological input of compound word to produce a specified character where the sound of stimuli and morphological structure of the word would be activated (Zuo, Shu, & Zhang, 2001; Han, Song, & Bi, 2012). Thus, a writing-to-dictation test is designed to assess the CCW performance of CSL learners in the main study. The process of writing to dictation includes multiple stages. It starts with "the interpretation of sounds as meaningful words", then "followed by the retrieval of the orthographic forms from the metal lexicon" (Rapp & Caramazza, 1997). Both CCW and the recalling ability of learners could be assessed directly.

At the same time, the four Universities use the same textbooks:《汉语教程 *Hanyu Jiaocheng*》(Yang, 2006). The learning content of Chinese and Chinese characters as well as assessment standards are relatively consistent. This learning and teaching environment provides a suitable condition for us to apply the writing-to-dictation assessment as a quick and easy way to reflect learners' writing competence.

3.3.3.1 Complexity

The most obvious feature of the Chinese writing system is its visual complexity of Chinese characters. Strokes in Chinese characters are an adequate proxy for visual complexity (Leong, Cheng & Mulcahy, 1987). Consistent with *the word length constraint hypothesis* from the alphabetic language, the number of strokes impacts the reading in Chinese, increasing the number of strokes also increases the time to identify the Chinese character (Yang & McConkie, 1999; Peng & Wang, 1997; Su & Samuels, 2010; Yu & Cao, 1992 a & b; etc.). Many researchers suggested that orthographic features and the number of strokes are the beginning point for Chinese character recognition (Perfetti & Zhang, 1991; Perfetti & Tan, 1999; Yu & Cao, 1992 a & b; etc.). In CCW, the graphic errors are significantly related to the number of strokes. The studies showed that common errors include incorrect strokes in the wrong direction, incorrect length, improper connection between each other, and deleting or adding strokes (Cheng, 1997; Guo, 2008; Liang, 2019). The learners in lower proficiency lever make more stroke-related errors than those in higher levels. Actually, a large proportion of their errors is in this category (Ku, et al., 2003; Qian, 2002). Thus, the stroke number is part of the psychological representation of Chinese characters (Parkinson, Dyson, & Khurana, 2010). Teaching and analyzing the strokes can help the learning process and increase the effectiveness of learning. According to Su (2001), the stroke numbers ranging from 9 to 12 have the maximum number of characters. Taking the consideration of

CSL learners, who learn Chinese characters from a few strokes to more complex ones, the scope of stroke numbers ranging in this presented study expanded slightly, and it was controlled from 8 to11 for all the stimuli.

3.3.3.2 Frequency

In a writing-to dictation task, learners must incorporate phonological input (sound) to produce an orthographic output (write down a character). Due to the logographic nature of the Chinese characters, learners must know the exact orthographic forms and positioning of logo-graphemes. The frequency of characters significantly impacts learners' memorizing or recalling characters. The study of Zhong, Lei and Ye (2010) indicated that the frequency of characters affected the immediate serial recall scores; high-frequency characters have higher scores; and low-frequency ones have lower scores. Additionally, the frequency of characters directly impacts character recognition errors. Wang et al. (2009) did experiment-based research to investigate the memory conjunction errors of frequency of Chinese characters. The participants are false to recognize the recombined features of the previously studied characters. This result implied that there are more conjunction effects in low-frequency words.

For the frequency of target characters, the Chinese Characters in the HSK Graded Character List (2001) are used to provide a baseline because of the two main functions of the HSK Graded Character List: 1) as the basis of the HSK (Chinese Proficiency Test); 2) as an important basis for CSL teaching, CSL textbook writing, and CSL assessing. The Chinese textbooks used in Vietnam Universities are also based on the HSK Graded Character List. A total 2905 characters in the HSK Graded Character List (2001) are categorized into A, B, C, D, 4 grades. The 800 characters in grade A are categorized as high frequency, the 804 characters in grade B are categorized as middle frequency, and the rest characters in grade C

and D are low frequency. The 24 characters for the diction were chosen from the 3 frequency levels (high/mid/low) first (8 characters per level). Then, the consultation with the teaching faculties from Vietnam Universities further ensured that the 24 characters were in their textbooks for the participants.

3.3.3.3 Regularity

Apart from complexity and frequency (high/mid/low), regularity (regular/irregular), was also considered in the dictation design. According to *Shuowen jiezi* (*c*. AD 100) by Xu Shen, there are six principles（*Liushu* 六書）in Chinese characters formation or construction:

1. pictographic (*xiangxing* 象形: deriving from drawings of objects)
2. indicative (*zhishi* 指事: using symbols to express abstract meanings)
3. semantic-phonetic (*xingsheng* 形聲: combing an existing pictographic form and an existing phonetic form)
4. ideographic (*huiyi* 會意: combining pictographic and indicative principles)
5. phonetic loan/borrowing (*jiajie* 假借)
6. mutually interpretive (*zhuanzhu* 轉注).

More than 80%-90% in modern Chinese characters are semantic-phonetic compound characters (Shen, 2005). The 7,000 commonly used characters in a Chinese dictionary cover about 81% of semantic-phonetic compound characters (Li & Kang, 1993). Each semantic-phonetic compound character includes two major components: a phonetic radical (which provides information or partial information for pronunciation of the character) and a semantic radical (which bears the character's meaning). The regularity of a character is the consistency between a phonetical radical and the pronunciation of the host character.

Radicals (偏旁 *Pianpang*) convey information of the meaning or sound of the host character

(e.g. “妈”, “姐”, “妹”, “奶”, “姨”, and “姑” all have the semantic radical “女”; “把”, “吧”, and “爸” have the same phonetic radical “巴”). Radicals are different from logographems (部件 *Bujians*), which is composed by multiple strokes, recurs consistently and independently as an integral constituent in a radical or character but do not convey information of the meaning or sound of host character (e.g. “能” consists of “厶”,“月”,“匕”, and “匕”) (Liang, 2019). They are two components of Chinese characters with different grain size. Furtherforme, if a character is pronounced the same as its phonetical radical or with a different tone, it is a regular character, such as “桥”[*qiáo*] (it has the same pronunciation with its phonetical radical “乔” [*qiáo*]). In opposite, if a character is pronounced differently from its phonetical radical, it is an irregular character, such as“终” [*zhōng*] (it has a different pronunciation with its phonetical radical “冬”[*dōng*]). In the writing-to-dictation task of this study, half of the characters (12 characters) are regular semantic-phonetic compounds, and another half are irregular semantic-phonetic compounds.

Combined with the above three aspects (frequency, regularity, and complexity control), the below 24 Chinese characters are used for the dictation (Table 3.9).

		Complexity (strokes number: 8-11)
Frequency (high)	Regular	球 、骑、 领、 桥
	Irregular	空 、治、 怕、 店
Frequency (mid)	Regular	疲、 郊、 肤、 萝
	Irregular	终、 浪、 铁、 梯
Frequency (low)	Regular	砖、 舰、 棋、 蚊
	Irregular	鸭、 峡、 屏、 炉

Table 3.9: Chinese characters for the dictation

3.3.4 Procedure of the main study

As such, there are two tasks in the main study, the questionnaire package, and the dictation assessment. The participants for the main study are required to complete a 20-minute questionnaire package in a quiet classroom at an optimal distance from one another.

Before the participants take the questionnaire, they took a 15-minute dictation test which required the participants to write down the target character upon hearing the recording produced by a CSL teacher with standard Chinese. To avoid ambiguity, each target character was presented in a two-syllable compound together with a picture to present the concept of words. For example, the participant heard an utterance of "第 19 题：球，地球的球，地球的球" Question 19: 球[*qiú*] as 地球 the Earth (a sphere or ball) twice and saw a picture of the Earth at the same time, then he/she was required to write down the target character "球" on the answer sheet. When the participants did not know how to write the target character, they could choose to leave it blank but were not allowed to write *Hanyu Pinyin*. (The design of dictation is in the following section.)

The questionnaire and the dictation were taken independently in one 45-minutes class. The details of the process are shown in Figure 3.5 below.

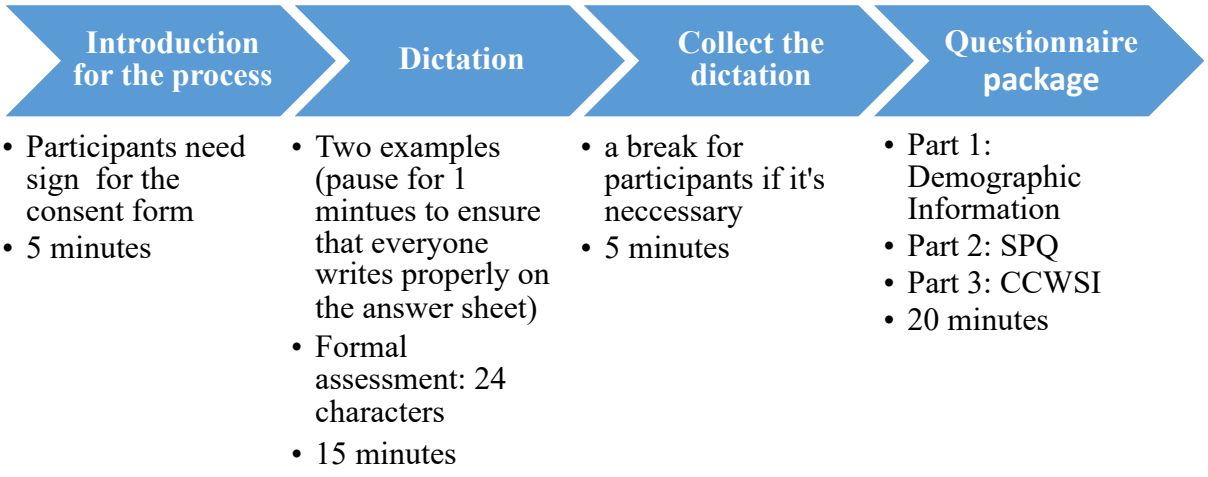

Figure 3.5: The Process Chart for the Main Stud

3.3.5 Data analyses

The statistical software SPSS25 (IBM, New York) is used to conduct descriptive statistics analysis, correlation analysis, and EFA. Moreover, IBM SPSS Amos 26 is used for CFA and the meditation analyses with SEM interpretation. First, the absences and missing data are replaced by the mean values as AMOS required competed data for CFA and SEM. The heritage learners are excluded from the analysis. Among 340 participants, only one heritage learner's response is discarded from the analysis. Second, EFA, by using 50% of the sample size, is repeated for the CCWSI to identify and confirm the latent constructs. CFA takes account of the overall size of our sample to exam the validity and verifies the factor structure. The factor loadings as well as the meaning of the items in each factor are evaluated in order to finalize CCWSI. A competing model is also employed to determine the prior internal structure. Third, CFA is performed to prove the two knowing scales of CCW motivation. Fourth, the dictation results are done in SPSS25 to evaluate students' performance in CCW. However, because of the failures of the sound system of the equipment, there are only 298 validated data from dictation, and those 298 learners' data are used in correlation and mediation analysis. Together with the results of CCW motivation and CCWSI, the correlations of all studied variables are computed. The hypotheses in the analytical model are inspected. Those analyses are jointly applied to our research questions.

3.4 Summary

In this chapter, we introduce the first phase of the present study by recruiting students from a Hong Kong international school as our research subjects. Before we launch our subsequent larger scale study, the CCWSI is prepared and developed in this pilot study. The EFA provides a basic two-factor internal structure of CCWSI. The two factors of CCWSI (the

indirect strategies and the knowledge-based strategies) are assembled with CCW motivation and performance in the theoretical framework, which is adopted and modified from Biggs' 3P model to investigate the interrelationship. Accordingly, our ten formulated hypotheses are derived from the Analytical Model of CCW. In the following main study, the internal structure of CCWSI is further tested and verified, and the relationships between variables of CCW learning process are also inspected. The detailed research design, the procedures, and the data analysis provided a description and overview for the second phase of the study. In the following chapter, the data analysis results of the main study were presented.

Chapter 4 Data Analysis Results

This chapter presents data analysis results and is organized by 4 parts. First, the internal structure of CCWSI is tested to ensure the reliability and validity of measures. The deleted items from the original instrument are also analyzed. Second, the reliability and validity of CCW motivation scales, which are modified from the R-SPQ-2F motive items, are also checked. Third, the dictation scores as our indicator for CCW learning outcome are summarized. In the last part, the interrelationship among variables (the ten hypotheses H1 to H10) and the mediation function of CCW strategies are inspected. The chapter is concluded with an overall summary of the data analysis.

4.1 Internal structure of CCWSI

4.1.1 EFA analysis for CCWSI

From EFA in the pilot phase of the study, there is a two-factor structure in CCWSI, the indirect strategies and the knowledge-based strategies, which mirrored the cognitive process of writing and the linguistic features of Chinese characters. In the main phase of the study, the same analysis EFA was conducted again to ensure a hidden construct frame in the dataset. 50% of the sample size (half of the 339 participants from four Vietnam Universities), which are randomly selected by SPSS for this EFA study, is considered sufficient according to the five-participant-per-variable rule for samples size more than 100 (Streiner, 1994).

First, the correlation matrix of 31 items is reviewed. Responses to these 31 items are subjected to EFA with Varimax rotation, and the factor number is determined according to the result in phase one and the screen plot analysis (Figure 4.1). The factor number of two is picked. Kaiser-Meyer-Olkin result was 0.88 and Bartlett's test of sphericity was significant ($x^2(3219) = 465,\ p < .001$). Regarding item selection, again, factor loading of 0.30 and higher are considered as meaningful. Item Q9 had factor loading below 0.3 on both

dimensions (Table 4.1). Following the criteria, the item (Q9) is deleted after the EFA analysis. Total 30 items, Factor 1 has 16 items (mean factor loading = 0.52, *SD*=0.15), including strategies items 8, 11, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, and 33. The number of factor 2 items are 14 items (mean factor loading=0.53, *SD*=0.13), including strategies items 1, 2, 4, 5, 6, 7, 10, 12, 14, 15, 16, 17, 18, and 30. The Cronbach alpha coefficients are also calculated for 30 items and each factor: the values are 0.90 as a whole, 0.85 and 0.84 for factor 1 and 2. The items have sufficiently high internal consistency.

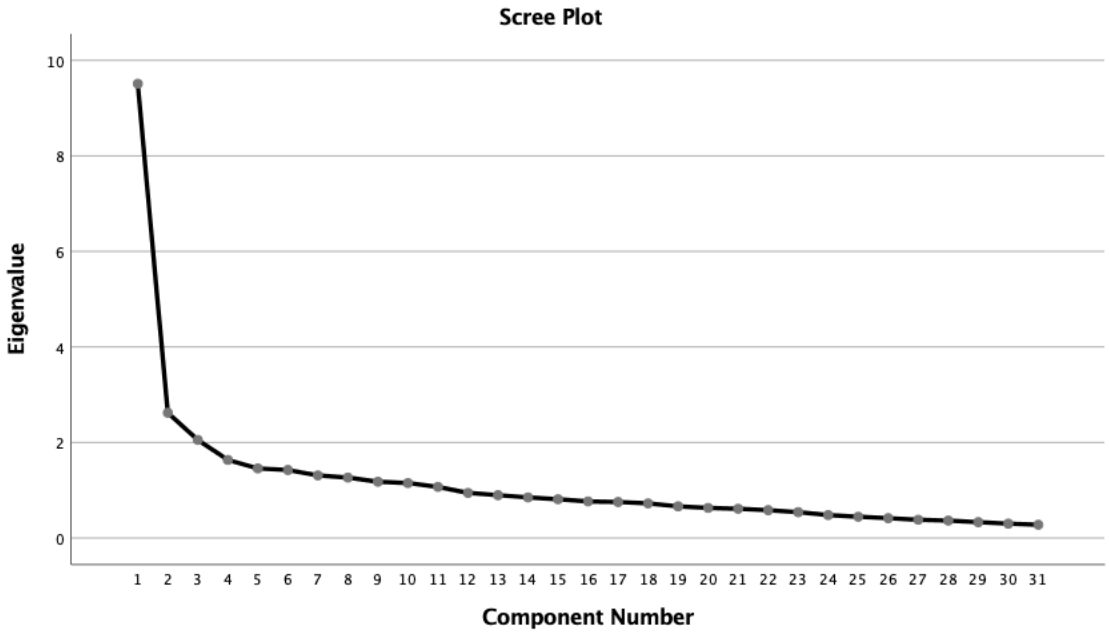

Figure 4.1: The scree plot result of the phase two dataset

EFA results in the phase two indicate two main factors. The factor 1 has 16 items and the factor 2 has 14 items. That is aligned with the analysis in the pilot phase, although there is minor differences in factor loading for few items (Q2, Q8, Q9, Q27, Q30). After the EFA, the CFA is used to explore and confirm the underlying two-factor structure of the CCWSI.

	Factor 1	Factor 2
Q1	0.14	**0.502**
Q2	0.275	**0.335**
Q4	0.139	**0.62**
Q5	0.147	**0.626**
Q6	0.332	**0.465**
Q7	0.104	**0.409**
Q8	**0.325**	-0.032
Q9	0.103	0.115
Q10	0.214	**0.665**
Q11	**0.354**	0.336
Q12	0.261	**0.55**
Q14	0.144	**0.421**
Q15	0.045	**0.703**
Q16	0.115	**0.589**
Q17	0.242	**0.642**
Q18	0.101	**0.667**
Q19	**0.548**	0.433
Q20	**0.71**	0.056
Q21	**0.756**	0.135
Q22	**0.543**	0.295
Q23	**0.639**	0.21
Q24	**0.688**	0.061
Q25	**0.699**	0.076
Q26	**0.441**	0.346
Q27	**0.326**	0.296
Q28	**0.502**	0.332
Q29	**0.327**	0.286
Q30	0.021	**0.293**
Q31	**0.504**	0.261
Q32	**0.396**	0.218
Q33	**0.538**	0.154
Items	16	14
Proportion of variance	0.17	0.17
Cronbach's Alpha	0.86	0.84

Table 4.1: Rotated Component Matrix

4.1.2 CFA analysis for CCWSI

4.1.2.1 Two-factor structure of CCWSI

Internal construct validity of the CCWSI is tested by CFA using IBM SPSS Amos 26. The overall size of the sample (339 participants) is used in CFA. Total 30 items from EFA

are further studied in CFA. The item Q9 is excluded from further CFA study because of the low factor loading.

Traditionally, researchers used the chi-square statistic to evaluate the fit of CFA models. A significant chi-square value indicates the considerable difference between the model implied and the observed sample covariance matrices, so that it tells the model rejection (Barrett, 2007). However, researchers prefer to use descriptive goodness-of-fit indices to evaluate latent models because of the sensitivity to sample size (Marsh, Hau, & Grayson, 2005; Yang, Arens, & Watkins, 2016). Thus, the commonly accepted good-of-fit indexes, including the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR), are broadly applied in various research. The CFA model evaluation in the present study is also based on these good-of-fit indexes. According to Kline (2011), CFI and TLI are required to be at least 0.9 to indicate a good model fit, RMSEA and SRMR values are required to be smaller than 0.08 to demonstrate a good model fit.

The result of the 30 items with two-factor structure is showed in Figure 4.2, which indicates that indexes of the model fit summary are unacceptable:x^2(df = 404) = 966.16, $p < 0.001$, CFI=0.81, TLI=0.80, RSMEA = 0.06, SRMR=0.07. Addition to the indexes, the factor loading of F1 items ranges from 0.23 to 0.74, and the factor loading of F2 items ranges from 0.24 to 0.68. Regarding to the item selection, some scholars think that the factor loading for convergent validity should be ≥ 0.5 (Hair, Black, Babin, &Anderson, 2009), others think the critical value is ≥ 0.4 (Gagne & Hancock, 2006). For the presented study, we take the middle point and drop items with factor loading from 0.45. CFA is conducted again to examine the fitness of the model (Figure 4.3). The results indicate an adequate fit: x^2(df = 169) = 425.50, $p < 0.001$, CFI=0.90, TLI=0.87, RSMEA = 0.07, SRMR=0.06. The factor loading for 10 items of factor one are from 0.49 to 0.76, whereas that 10 items in factor two are between

0.44 to 0.70. In the final result, CCWSI has a two-factors structure, and each factor contains 10 items: factor 1 includes those CCW indirect strategies (Q19、Q20、Q21、Q22, Q23, Q24, Q25, Q26, Q28, Q31); factor 2 includes those Chinese character knowledge-based strategies (Q1, Q4, Q5, Q6, Q10, Q12, Q15, Q16, Q17, Q18). The final items of two factors are in Table 4.2.

Factor 1: Indirect Strategies	
Q19	学习汉字书写时，我有清晰的目标。 I have clear goals for learning to write Chinese characters.
Q20	我制定了书写汉字的学习计划（例如每天练习书写 10 个汉字）。 I have a plan for writing Chinese characters (e.g. writing 10 characters per day).
Q21	我检验书写汉字的学习计划, 反思学习进程。 I check my plan for writing Chinese characters and reflect on my progress.
Q22	我注意自己书写汉字时犯的错误，并努力不再犯错。 I notice my mistakes in writing Chinese characters and try not to make the same mistakes again.
Q23	我常常鼓励自己书写汉字 。 I encourage myself to write Chinese characters.
Q24	在上课前，我预习书写新的汉字。 I study ahead on how to write the new characters before class.
Q25	我对学过的汉字进行自我书写测试，或请其他人帮测试。 I review how to write Chinese characters by testing myself or asking someone to test me.
Q26	我尝试寻找记忆书写汉字的最好办法。 I try to find the best way to remember how to write Chinese characters.
Q28	在日常生活交际中，我尽量书写汉字 (如用汉字书写日记、写信、写电邮、写留言条等等)。 I do what I can to write Chinese characters in my daily life (e.g. I use Chinese to keep a journal or write email, cards, phone messages, and so on).
Q31	我会请教老师、同学和朋友，与他们讨论和交流如何学习书写汉字。 I ask my teachers, classmates, language partners, or friends for help and discuss with them how to write Chinese characters.

Table 4.2: Items for Tow Factors (Factor 1)

Factor 2: Knowledge-based Strategies	
Q1	书写汉字时，我会注意笔画是否正确 （如 “亿”中的“乙”和“气”中的“𠂉” 不同）。 When I write Chinese characters, I look carefully at the strokes (e.g. distinguish “乙” and “𠂉”in “亿” and “气”).
Q4	学习汉字书写时，我会把字形相近的汉字放在一起进行比较 （如 " 木" " 太" " 大 "）。When I write Chinese characters, I compare characters which are similar in form (e.g. "木", "太", and "大").
Q5	学习汉字书写时, 我会注意汉字的部件 (如“能”由“厶”、“月”、“匕”、 “匕”组成)。 When I write Chinese characters, I pay attention to logographemes (e.g. “能” consists of “厶”,“月”,“匕”, and “匕”).
Q6	学习汉字书写时，我会注意汉字的结构 (如：“哲”、“夜”、“挚” 、“势”等字，都是上下结构，而不能写成左右结构)。 When I write Chinese characters, I pay attention to the graphic structure (e.g. characters such as “哲”,“夜”,“挚”, and “势” have an upper and lower structure, but not a left and right structure).
Q10	学习汉字书写时，我注重在生字和已知形近字之间建立联系。 When I write Chinese characters, I pay attention to the shape of characters, and associate new characters with those I already know that have similar shapes.
Q12	学习汉字书写时，我注重汉字读音, 在生字和已知同音字、近音字之间建立联系（如“耶”（ye1）、“爷”(ye2)、“也”(ye3)、“叶”(ye4)等）。 When I write Chinese characters, I pay attention to the pronunciation of characters, and associate new characters with those I already know that have the same or a similar sound (e.g. “耶” (ye1), “爷” (ye2),“也” (ye3), and “叶” (ye4)).
Q15	学习汉字书写时，我注重在生字与具有相同声符的已知汉字之间建立联系 (如“把”“吧”“爸”有相同的声符“巴”)。 When I write Chinese characters, I pay attention to phonetic radicals of characters, and associate new characters with those I already know that have the same phonetic radicals (e.g. “把”, “吧”, and “爸” have the same phonetic radical “巴”.)
Q16	书写汉字时，我会通过组词找回汉字(比如通过“医生” 而找回“医”)。 When I write Chinese characters, I recall specific characters in the context of compounds (e.g. “医生” (doctor) helps me remember “医”).
Q17	书写汉字时，我注重在生字和已知同义、近义字之间建立联系 (如“看”、“望”、“瞧”、“盯” 等都有“看”的意思)。 When I write Chinese characters, I pay attention to the meaning of characters, and associate new characters with those I already know that have the same or similar meanings (e.g. “看”, “望”, “瞧”, and “盯” all mean “look”).
Q18	书写汉字时，我注重在生字和具有相同意符的已知字联系起来（“妈”“姐”“妹”“奶”“姨”“姑”有共同的意符“女”; “你、们、他”有共同的意符“亻”）。 When I write Chinese characters, I pay attention to semantic radicals of characters, and associate new characters with those I already know that share a semantic radical (e.g. “妈”, “姐”, “妹”, “奶”, “姨”, and “姑” all have the semantic radical “女”; “你”, “们”, and “他” have the semantic radical “亻”).

Table 4.2: Items for Tow Factors (Factor 2)

In other words, Q8, Q11, Q27, Q29, Q32, Q33 in factor 1 and Q2, Q7, Q14, Q30 in factor 2 have been deleted. Adding Q9, which has been deleted in EFA, total 11 items are excluded in CCWSI. Each of these items will be discussed in the next section (section 4.13).

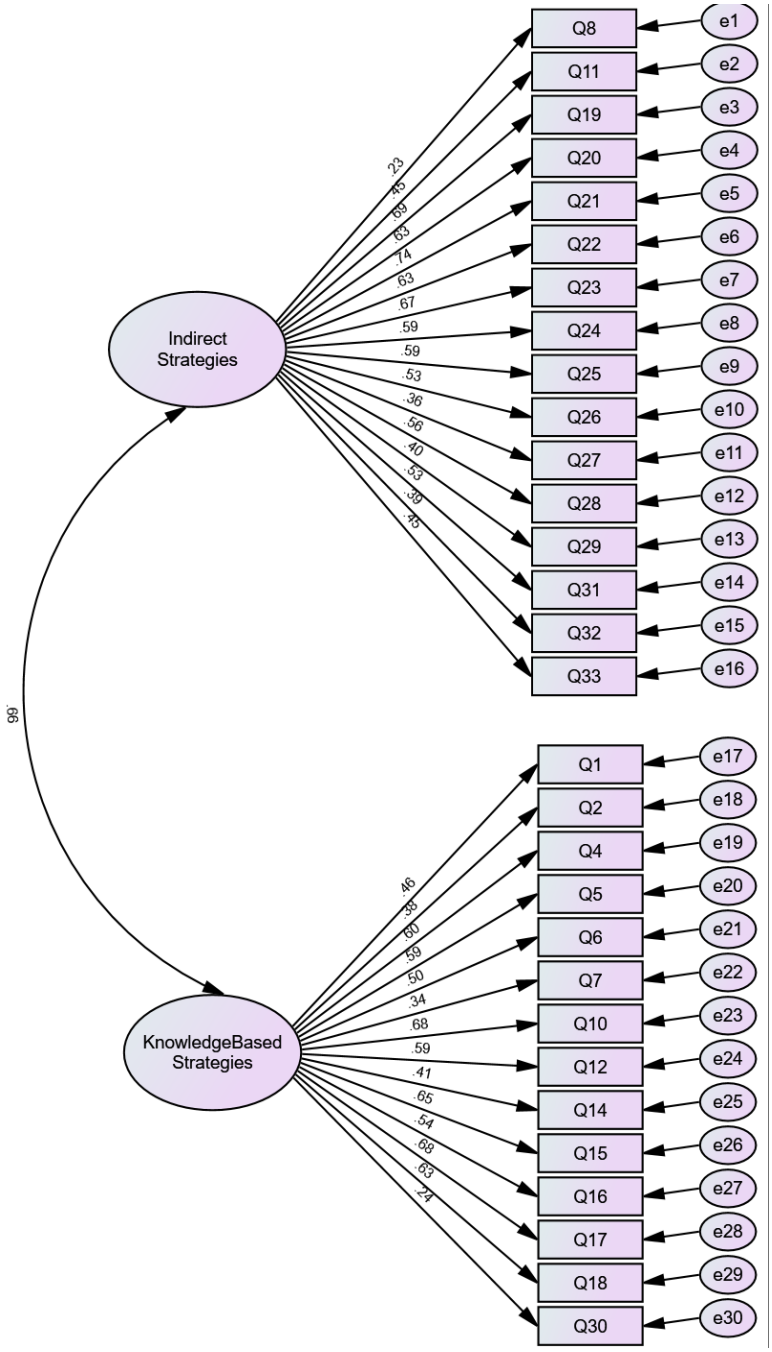

Figure 4.2. Two-factor CFA model for 30 items

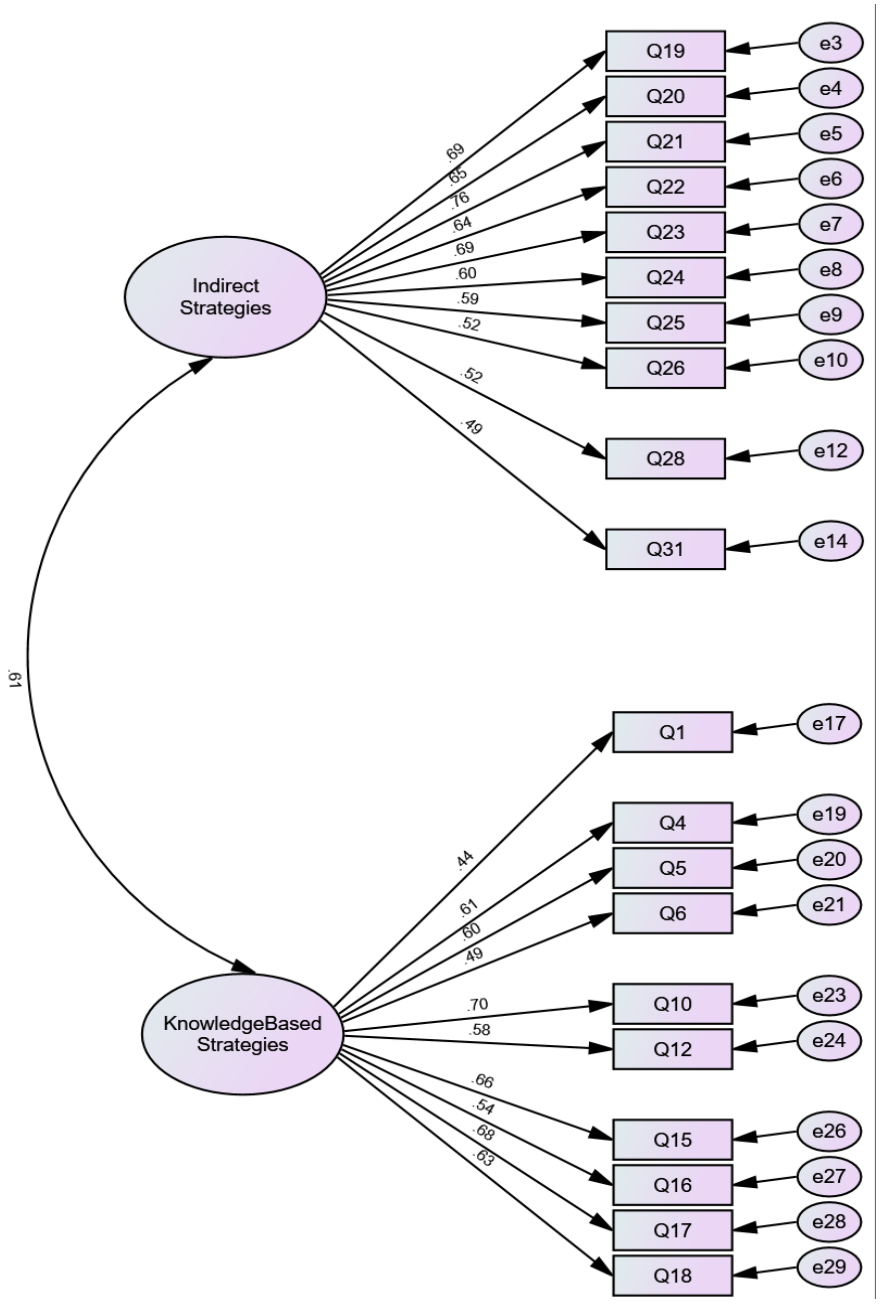

Figure 4.3. Two-factor CFA model for 20 items (after deleted factor load < 0.5 items)

In order to further inspect the applicability of the two-factor structure of CCWSI, a competing model was constructed (Figure 4.4), which groups all 20 items in one factor. Its' indexes of the model fit summary were: $x^2(\text{df} = 170) = 738.17$, $p < 0.001$, CFI= 0.74, TLI=0.71, RSMEA = 0.10, SRMR=0.09. It verifies that two-factor structure provided better fit indexes.

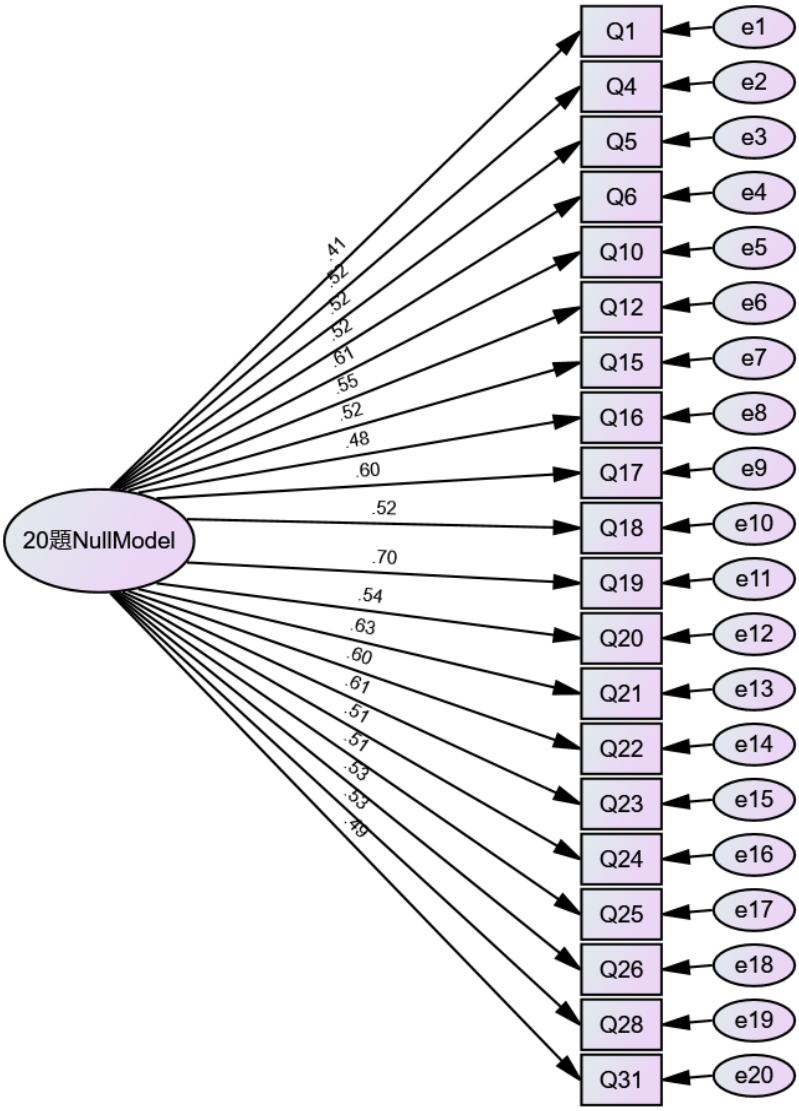

Figure 4.4. One-factor Competing model for 20 items

4.1.2.2 Two subscales in the Knowledge-based strategies

The content of each item is evaluated one by one. That further confirmed the underlining factors of CCW learning strategies. The 20 items two-factor structure is validity for CCWSI. The two factors correspond to the cognitive process of writing and the linguistic features of Chinese characters respectively. These knowledge-based strategies in factor 2 are unique to CCW. By reviewing these 10 knowledge-based strategies, two observable subscales are identified according to the features of Chinese characters: the sound-meaning-based strategies

as well as the form-based strategies. The form-based strategies are only related to the orthographic forms of characters which are only related on the orthographic visual level, but are not taken to mean the constituent radicals constituting the characters and involved the other two linguistic information of Chinese characters (i.e., the sound and the meaning). To be concrete, the stroke forms of legal radicals and legal characters are included in the subscales, but not the functionality of phonological and semantic radicals. In contrast, the sound-meaning-based strategies are those strategies that contained the utilization of phonological and semantic information to establish a connection with character orthographic form. That information is conveyed from character radicals or in a meaningful context.

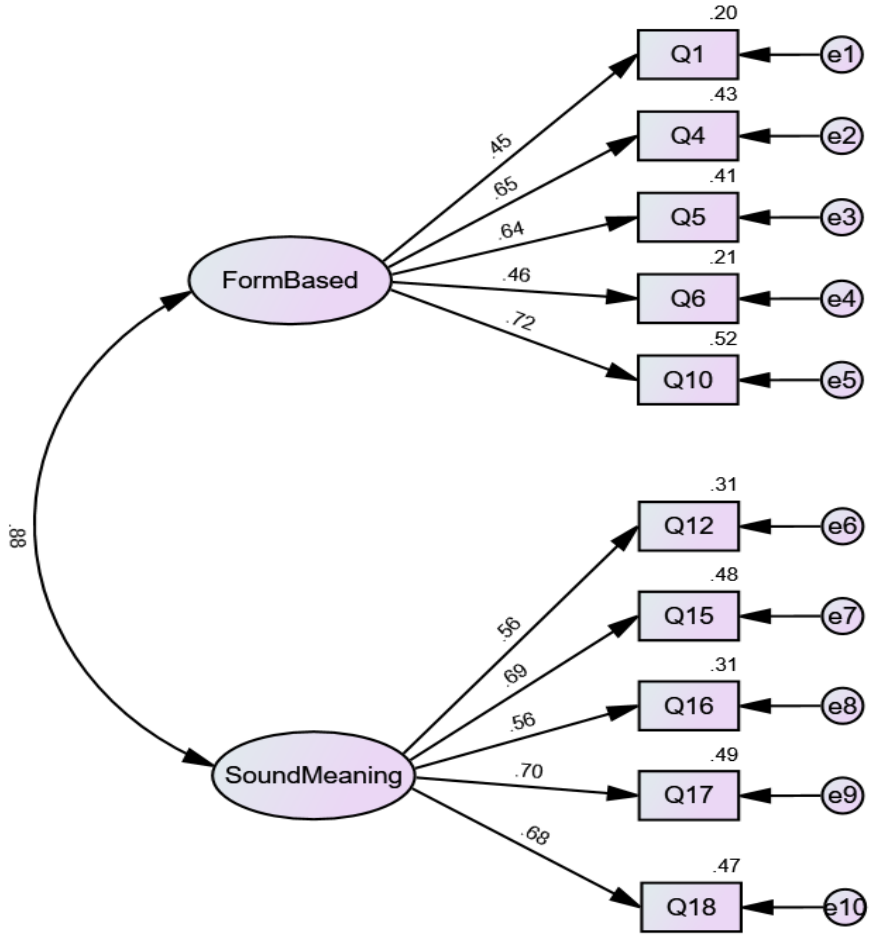

Figure 4.5 Two subscales in the Knowledge-based strategies

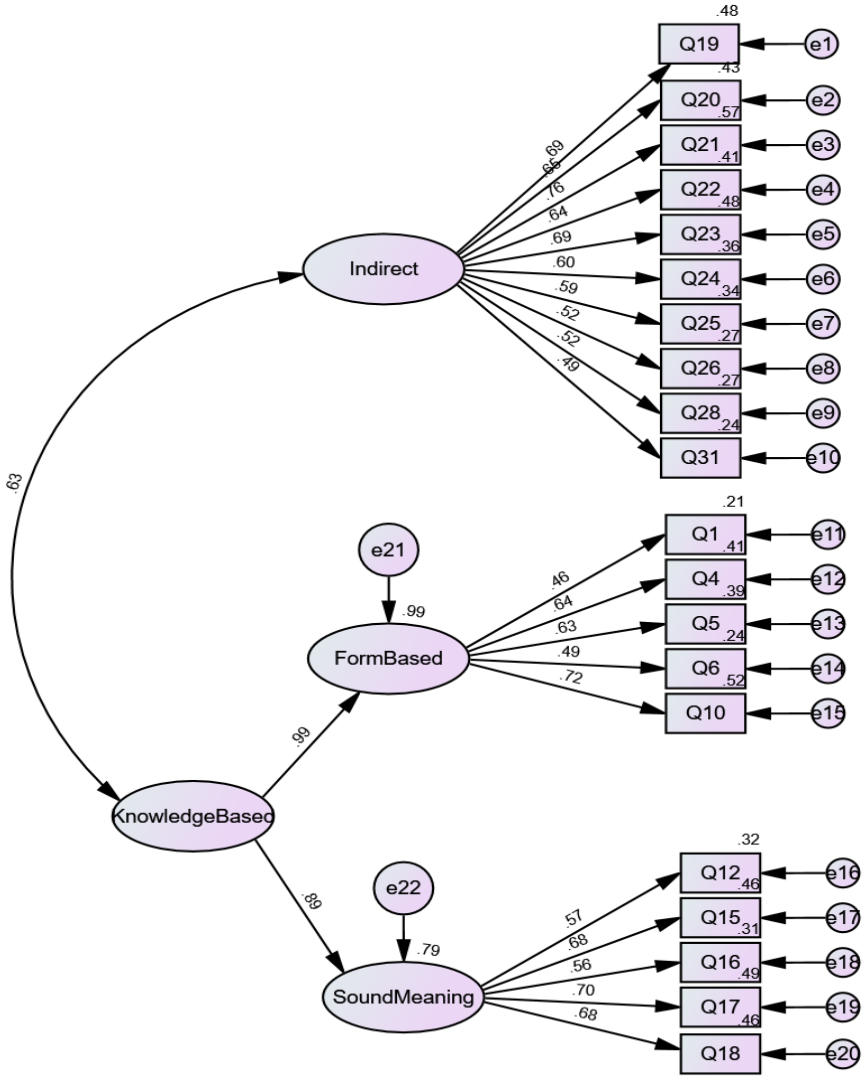

Figure 4.6 Two-factor model for 20 items, with 2 subscales in the Knowledge-based strategies

Specifically, each of the subscales includes 5 items: Q1, Q4, Q5, Q6, and Q10 are under the form-based strategies; and Q12, Q15, Q16, Q17, and Q18 are under to the sound-meaning strategies. The CFA for the two subscales and the two-factor structure with the two subscales are conducted to prove the sufficient validity of these specific scales (Figure 4.5 & Figure 4.6). The indexes of the model fit summary for the two specific scales are satisfied: x^2(df = 34) = 75.90, $p < 0.001$, CFI= 0.96, TLI=0.94, RSMEA = 0.06, SRMR=0.04. Furthermore, the analysis results also indicate an adequate fit of the whole CCWSI which has the two-

factor structure with the two subscales: x^2(df = 170) = 406.51, $p < 0.001$, CFI= 0.90, TLI=0.88, RSMEA = 0.07, SRMR=0.06. The factor loading of the items under sound-meaning scale ranges from 0.56 to 0.70, and the factor loading of the items under form-based scale ranges from 0.45 to 0.72. Overall, the two factors with two subscales under the knowledge-based strategies are the optimum structure of CCWSI in the presented study.

4.1.2.3 Reliability

The examination of the internal structure of the CCWSI is complemented by considering reliability estimates (Table 4.3). Concretely, the Cronbach's alpha values are 0.90 and excellent for the whole CCWSI (20 items), 0.84 for F1, and 0.87 for F2 which indicate a high reliability for CCWSI and the two factors. Also, the Cronbach's alpha values for the two sub-scales of F2 knowledge-based learning strategies were 0.72 and 0.77 which are acceptable. Overall, internal consistency reliability estimates from the CCWSI and its factors as well as sub-scales are statistically high.

Measure	Items	Cronbach's Alpha
CCWSI	20	0.90
Factor 1 (F1) Indirect learning strategies	10	0.84
Factor 2 (F2) Chinese character knowledge-based learning strategies	10	0.87
F2 Sub-scale 1: Form based strategies	5	0.72
F2 Sub-scale 2: Sound and meaning based strategies	5	0.77

Table 4.3: The reliability Coefficient Alphas of Scales and Sub-scales of CCWSI (N=339)

4.1.2.4 Summary

EFA and CFA test the internal structure of CCWSI, and the results support the two factors' structure of strategies. Table 4.4 presents a summary for the results of these CFA

models. Separating the 20 items two-factor model of CCWSI between Chinese character knowledge-based learning strategies and indirect learning strategies provided better fit indexes than the one-factor models. The two subscales under the knowledge-based learning strategies are derived from the features of Chinese characters as supplementary means. The model 4 in table 4.4 shows a prominent feature of CCW and clearly addresses the underlying factors of CCW, and it is adopted in the presented study. Sufficient reliability and validity indicate that CCWSI with the two factors and two subscales in the factor 2 knowledge-based strategies is good to measure learners' CCWS.

Model	Chi-Square Test of Model Fit	*df*	x^2 / df	RMSEA	CFI	TLI	SRMR	Model description
1	966.16	404	2.39	0.07	0.81	0.80	0.07	2-factor model for 30 items
2	425.50	169	2.52	0.07	0.90	0.87	0.06	2-factor model for 20 items
3	738.17	170	4.34	0.10	0.74	0.71	0.09	1-factor model for 20 items
4	406.51	167	2.43	0.07	0.90	0.88	0.06	2-factor model for 20 items，factor 2 the knowledge-based strategies had two subscales：form based strategies as well as sound and meaning based strategies
5	75.90	34	2.23	0.06	0.96	0.94	0.04	two subscales for 10 items of the factor 2 knowledge-based strategies

Table 4.4: The indexes of the model fit summary of CFA models

4.1.3 Deleted items from the main study

In the 2-factors and 20-items CCWSI, total 11 items are excluded from the original 31-items CCWSI in pilot study because of the low factor loading of the EFA and CFA. They are

Q2, Q7, Q8, Q9, Q11, Q14, Q27, Q29, Q30, Q32, Q33 (Table 4.5). In the following paragraphs we explain these items.

Deleted items from EFA	
Q9	我反复书写单个汉字，硬记汉字怎么书写。When I write Chinese characters, I write characters repeatedly and learn them by rote.
Deleted items from CFA: Factor 2 Knowledge-based Strategies	
Q2	书写汉字时，我按照笔顺书写汉字。When I write Chinese characters, I follow the stroke order.
Q7	我会通过手指空写的方法练习书写汉字 (手指空写指学习者用手或笔在空中书写汉字)。 I practice Chinese characters with kinesthetic methods. (A learner uses a finger or a pencil to trace a character in the air, or above the paper).
Q14	书写汉字时，我会边念边写。 When I write Chinese characters, I say the character to myself.
Q29	我用汉字写作业、记笔记（如课堂笔记、学习笔记等）。 I write Chinese characters in my homework and notes (such as in-class notes and study notes).
Q30	书写汉字时，遇到不会写的字，我会查字典或者词典。 When I write Chinese characters, if I encounter a character I don't know how to write, I look it up in a character dictionary or other dictionary.
Deleted from CFA: Factor 1 Indirect Strategies	
Q8	我通过描摹汉字字帖的方法，学习汉字书写。 I copy characters in a character copybook.
Q11	我在课堂上注意观看老师书写汉字。 I pay attention to how teachers write Chinese characters in the classes.
Q27	为了帮助记忆汉字书写，我编造故事（如"楼"是"一栋木头建筑，里面有米饭与美女"）。 I create my own stories to remember how to write characters. (e.g. "楼" (building) is a wooden ("木") building with rice ("米") and beauty ("女") inside.)
Q32	我会通过游戏和多媒体软件来学习汉字书写（如展示笔划、笔顺的汉字游戏）。 I play Chinese character games, including computer games, to learn to write Chinese characters (e.g. games that show the trokes or the stroke order of Chinese characters).
Q33	我练习汉字书法。 I practice calligraphy.

Table 4.5: Items deleted in the main study

The 11 items excluded from the final CCWSI include three most frequently used and three least frequently used items according to the descriptive statistics. Appendix B shows

that Q30, Q9, and Q11with the means from 4.45 to 3.76 (mode 5 and 4) are 3 the most frequently used strategies among participants; Q33, Q8, and Q27 have means from 2.09 to 2.5 (mode 1 and 2) and are the least frequently used strategies.

From the contents, Q7， Q8 and Q9 are similar. They are more or less related to mechanical writing and rote learning. Q7 is kinesthetic methods that a learner uses a finger or a pencil to trace a character in the air, or above the paper, Q8 is copy, and Q9 is repeating. Among our participants, Q9 (mean 3.8) is the most frequently used while Q8 (mean 2.29) is the least frequently used, Q7(mean 2.92) is between them and above the average mean. The possible reason could be the availably of copybook (描摹汉字字帖) for the students in Q8. Although copying and repeating may be a common strategy in Chinese character learning (McGinnis, 1999; Tseng, 2000; Yin, 2003; Zhao and Jiang, 2002; Zhou and Yu, 2004), its effectiveness is low. Zhou and Yu (2004) suggest its effectiveness for novices, but Zhao & Jiang (2002) state that it is not effective. Shen (2004) sounds that rote memorization does not lead to an efficient recall of form, sound and meaning of Chinese characters. Thus, rote learning often is looked negatively. Many researchers sate that the rote learning and academic performance is inversed related and pointed out that learning by rote is ineffective in mastering a complex task in advanced level, but in many eastern countries, the teaching philosophy still include it as one of essential strategies to learning (Ahmed & Ahmed, 2017, Sinhaneti & Kyaw, 2012). Different from the traditional “pen-and-paper” approach in Q8 and Q9, kinesthetic method in Q7 is about writing in the air. The biggest advantage of the strategy is convenience, the disadvantage is that writer cannot see the final product (characters). In other words, they cannot review or check what they write. Not much importance is placed on details. According to the metacognitive theory, it is not effective than other two strategies. Overall consideration, because these items are associated with the rote learning, which has

uncertain effectiveness, and are frequently used among students, may be combined and rewritten as an optional item for the future researching and teaching consideration.

Comparing to mechanical writing and rote learning (Q7， Q8 and Q9), Q14 takes one more step. It is about writing Chinese characters while saying or reading out. Thus, Q14 involves both a character sound and form simultaneously. This strategy is recommended by researchers and teachers (i.e., Song, 2011; Zhang, 2018; etc.). During the process, learners not only output a character, but also input the sound of the character, which promotes the orthography-phonology link of this character. Also, Q14 has a high mean (3.75) and is one of the frequently used strategies among students. Though it is excluded from CCWSI in this study, it should be further considered in the future studies.

Q2 and Q11 also could be put as a close analogy. The two items tend to focus on strokes. Q2 is about following character stroke order, and Q11 is about paying attention to how teachers write character. The knowledge of strokes belongs to the orthographic part of characters, the content of the two items more likely be fall into factor 2 the knowledge-based strategies and the form-based subscale. However, Q2 (mean: 3.76) is not one of the most frequently used strategies. One possible explanation is that learners already forme a writing habit, and teachers might be lack of appropriate tools to monitor students' writing process and didn't emphasize the stroke order in the classroom. While studies say that stroke order writing promotes memorizing the forms and orthography of Chinese characters (Tsai, et al., 2012), increasing researchers and instructors argue that stroke order doesn't matter as long as character production is correct (An & Shan, 2007). Hsiung and his coworkers (2017) use a computer-based teaching system to examine the learning effect of stroke order in both Chinese character recognition and production exercises, and they find that stroke order had no significant influence toward Chinese character learning, including handwriting. Thus, the traditional emphasis on the correct stroke order seems to lose popularity in CSL teaching and

learning. Whether Q2 stroke order is an effective strategy could be another question for the further study. In general, we think that Q2 stroke order may be more important for the beginners, and we tend to agree that additional analysis of the strokes of each character may strengthen in the effectiveness of character learning then simply stroke order teaching. (Jin, 2006; Tan et al., 2005). Comparing to Q2 stroke order, Q1 is about looking the strokes carefully and is already included in Factor 2. To a certain extent, Q2 aligned with Q1. For Q11 (mean: 3.76), it is one of the most frequently used strategies. Students usually think they should pay attention to teachers in the class. When they read the question Q11, they may tend to agree with it, but they may not intentionally note the stroke order or other orthographic features of a character. Therefore, Q11 may not be an upstanding question to ask. Q2 and Q11 were not kept in CCWSI.

Likewise, Q30, which is about using a dictionary, also may not be a good question to ask. First, according to the mean (4.45), this is the most frequently used strategy among the learners. Anyone who wants to learn a language must use a dictionary. Consequently, participants choose this strategy without hesitate. Second, because of the technology development, electric devices replace the traditional paper dictionary. Learners often use e-dictionaries with voice-input or pinyin-input that don't efficiently promote CCW, even obstruct CCW develop. Q30 may also be considered to delete or rewrite, for example, using Chinese character radicals to find characters in a traditional paper dictionary.

Q29 have a relatively high mean 3.53 and is an applying strategy which is important for CCW. It overlaps with another applying strategy (Q28) in Factor 1. Q29 emphasize to write Chinese characters in homework and notes, Q28 is more general and apply CCW into everyday life. Therefore, Q29 could be included into Q28.

Q32 has a lower average mean 3.19. It is about playing games, including computer games.

As there are not many fun digital games regarding Chinese characters writing (Lin et al, 2008; Hao et al, 2010), and the schools did not apply CCW games in Chinese teaching or recommend any CCW game for the students, the learners did not use game strategies in their CCW learning. This strategy is not practicable.

Based on the results of descriptive data analysis, for both international school students and those Vietnam adults learners, the least frequently used strategy is Q33 (mean 2.09) practice calligraph. To explain why the calligraphy strategy (Q33) is uncommon, that's may be caused by no calligraphy program in those schools. There are only very few opportunities (i.e. culture events) for those learners to experience Chinese calligraph, so that's why the students do not practice calligraphy frequently. Q32 and Q33 are restricted by the teaching condition and were not applicable for those schools.

Another least frequently used strategy is Q27 (mean: 2.5) "creating stories" for better memorization. McGinnis (1999) reported that it is one of the most commonly used strategies while Ke's (1998) study suggests an opposite finding. It might be due to the difference between their participants. McGinnis investigated 29 year-one college CSL students, and Ke's study was participated by 85 heritage learners and 60 CSL learners. Different learners with different cultures and personalities may create stories for a same character from different perspectives, such as sound, shape, meaning or even their personal experiences. In the meantime, comparing to create stories, other orthographic-knowledge-based strategies, such as Q6 (graphic structure) and Q10 (pay attention to the shape), are more helpful and efficient (Ke, 1998; Zhao & Jiang, 2002). This strategy is also greatly affected by teachers. Zhou (1998) provided some samples for creating stories in order to remember Chinese characters, for example: 早(morning) could be explained as a sun (日) above a cross (十字架) which indicates morning(太阳从十字路口升起，表示早晨)". If teachers provide many of the similar examples, learners may more likely

to adopt this strategy. Overall, the strategy of creating stories depends on the individual involved and the generalization might be uncertain. Thus, Q27 should be considered with the learners' background and learning context, such as teaching method.

According to the above analysis from each item's content, 4 items among 11 (Q11, Q30, Q32, and Q33) were reasonably deleted; 1 item (Q29) could be included into one of item in the existing factor (Factor 1: Q28); 3 items (Q7, Q8, and Q9) should be combined and rewrite; other 3 items (Q2, Q14, and Q27) required a further study. All in all, those strategies may still enlighten learners more or less. The inclusions and omissions of the items are tried to provide a reliable and validated CCW strategy inventory. There is a need to gather more studies for further discussion and consideration in the future studies.

4.1.4 CCWSI descriptive statistics

The descriptive statistics for 20 items in the final CCWSI are listed in Table 4.6, (The descriptive statistics for 31 items of the CCWSI are included in Appendix B), and the mean and *SD* for F1, F2, the form-based subscale, and the sound-meaning-based subscale are listed in Table 4.7. The items with the highest mean are F2 items (Q1, Q18 and Q15), and the items with the lowest mean are F1 items (Q20, Q21, and Q25). From the mean of F1 and F2, we find that students tend to use F2 knowledge-based strategies more than F1 indirect strategies (Figure 4.7). Furthermore, lower-level students tend to have a higher mean in both F1 & F2 than higher level students. Although there is no obvious different in using the form-based and the sound-meaning-based strategies across the different year groups, but the mean value of the sound-meaning-based strategies is recognizable higher than the form-based strategies among year 4 learners. The difference of mean value between the form-based and the sound-meaning-based strategies for year 4 group is 0.1. 0.03 and 0.02 for year 2 and year 3 group, respectively.

	N	Missing	Mean	Median	Mode	SD	Sum
Q1	338	1	3.73	4	5	1.15	1262
Q18	338	1	3.69	4	4	0.97	1246
Q15	336	3	3.68	4	4	0.97	1238
Q16	339	0	3.67	4	4	1.05	1244
Q10	338	1	3.64	4	4	1	1230
Q22	336	3	3.62	4	4	0.94	1216
Q4	339	0	3.53	4	4	1.03	1198
Q5	339	0	3.5	4	4	1.14	1187
Q12	337	2	3.48	4	4	1.06	1174
Q19	338	1	3.38	3	3	1.06	1141
Q23	336	3	3.35	3	4	1.07	1125
Q17	339	0	3.28	3	3	1.02	1112
Q6	338	1	3.18	3	3	1.2	1075
Q31	339	0	3.18	3	3	1.09	1078
Q26	338	1	3.12	3	3	1.08	1055
Q28	339	0	3.12	3	3	1.13	1057
Q24	337	2	2.85	3	3	1.13	959
Q25	337	2	2.73	3	3	1.16	920
Q21	337	2	2.71	3	3	1.06	913
Q20	338	1	2.61	3	2	1.09	882

Table 4.6: The descriptive statistics for 20 CCWSI items

	year 2	year 3	year 4	all participants
F1 Indirect strategies Mean	3.15	3.01	3.04	3.07
F1 Indirect strategies *SD*	0.68	0.75	0.72	0.72
F2 Knowledge-based strategies Mean	3.55	3.53	3.52	3.54
F2 Knowledge-based strategies *SD*	0.63	0.73	0.65	0.67
Subscale 1: Form-based Mean	3.54	3.54	3.47	3.52
Subscale 1: Form-based SD	0.73	30.82	0.68	0.75
Subscale 2: Sound-Meaning-based Mean	3.57	3.52	3.57	3.55
Subscale 2: Sound-Meaning-based SD	0.70	0.78	0.65	0.73

Table 4.7: Mean and *SD* for two factors and two subscales

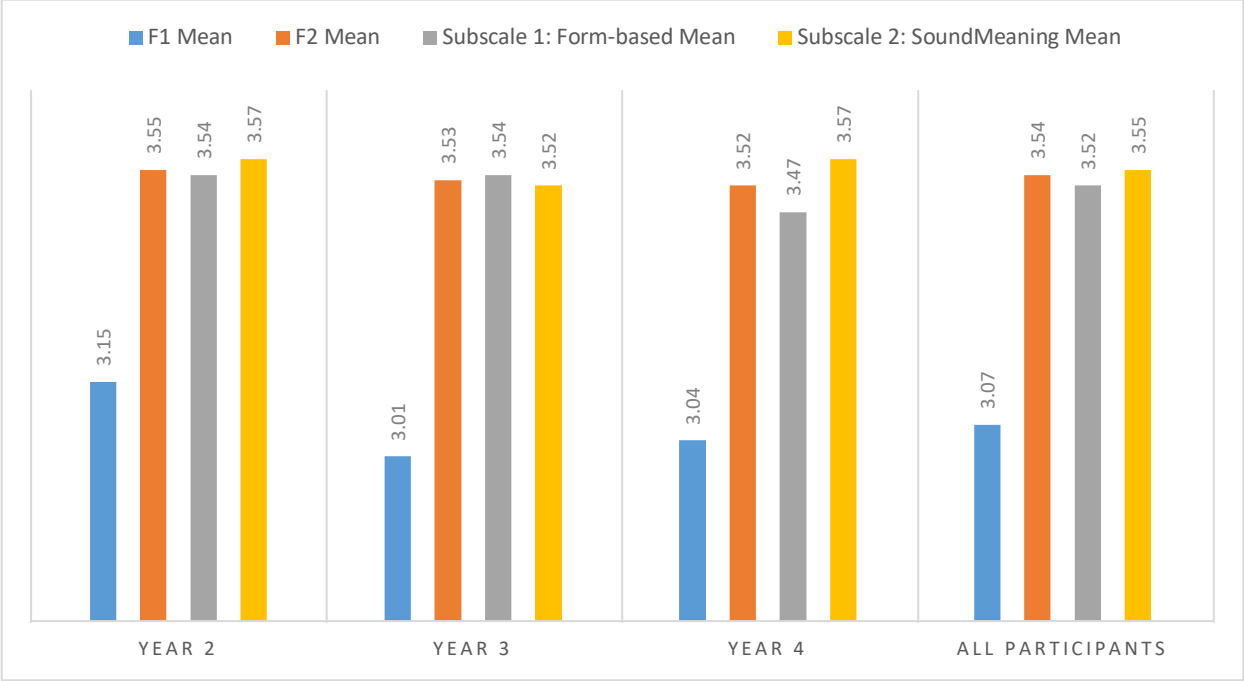

Figure 4.7: Chart for two factors and two subscales mean in different levels

4.1.5 Summary

In order to exam the internal structure of CCWSI, EFA first extracts 2 distinctive factors to measure CCW. Reflecting the cognitive process of writing and the linguistic features of Chinese characters, the two factors are named Factor 1 indirect strategies and Factor 2 knowledge-based strategies. CFA is used to further test the consistency of the pattern structure of two factors. Derived from the features of Chinese characters, the knowledge-based strategies embrace two subscales which are 5 form-based strategies and 5 sound-meaning-based strategies. Thus, the finalized CCWSI has a two-layer structure: two-factor layer with 20 items (10 items for each factor) and two-scale layer under the factor 2 knowledge-based strategies (5 items for each subscale). The total 11 items are excluded from the original 31-items CCWSI during the EFA and CFA. According to the content review, some items are reasonably deleted, though some required a further study. Among these factors of CCWSI, learners preferred F2 knowledge-based strategies to F1 indirect strategies,

and learners in the lower-level groups use more strategies than those in the higher-level group. On the other side, the learners are not in high favor of the form-based strategies, or the sound-meaning-based strategies, but compared to the other two groups, year 4 learners with the highest proficiency level prefer to use more sound-meaning-based strategies and the difference of mean values between the 2 subscales is more observable.

4.2 CCW motivation

4.2.1 CCW motivation CFA

CCW motivation questionnaire adopted two scales (deep and surface) from SAL and Bigg's 3P. There are 10 items in total (5 items per each scale) which are directly modified from Bigg's R-SPQ-2F motive items (Biggs, Kember & Leung, 2001). Thus, CFA is directly conducted to verify the 2-factor structure. The model (Figure 4.8) demonstrates an acceptable model fit: x^2 (df = 34) =. 85.145, $p < .001$, CFI=.93, TLI=0.91, RSMEA = 0.07, SRMR=0.057. Taking consideration of the reliability, Cronbach's Alpha values for surface and deep motives respectively are 0.75 and 0.68 (acceptable for research purposes), and the results supporte the two factors' structure of motivation (deep vs. surface) motivation.

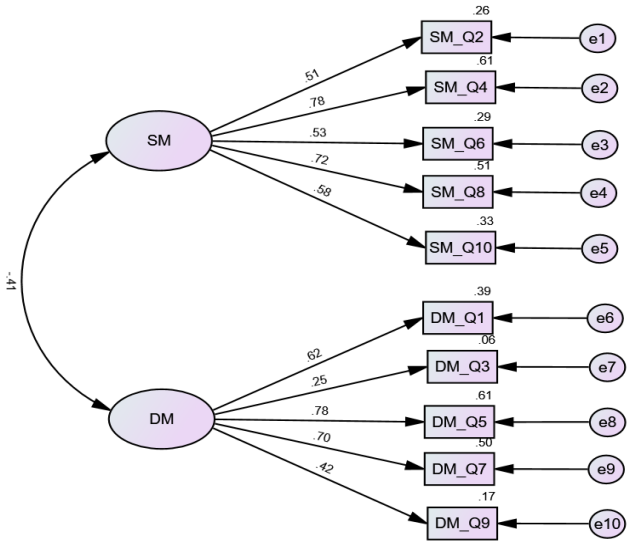

Figure 4.8. Two-factor CFA model for 10 motive items

4.2.2 **Descriptive statistics for CCW motivation**

The descriptive statistics for 10 motivation items are listed in Table 4.8, and the mean and *SD* for surface and deep motives are listed in Table 4.9. The items with the highest mean are DM items (Q3, Q9, Q1, Q7, Q5), and the items with the lowest mean are SM items (Q8, Q10, Q4, Q6, Q2). From the mean of SM and DM, we also find that students tended to be DM more than SM in all level students (Figure 4.9). Although, year 3 has the highest mean in DM, and year 4 has the highest mean in SM, the differences is not significant.

	N	Missing	Mean	Median	Mode	SD	Sum
Q3 (DM)	337	2	3.73	4	4	1.109	1256
Q9 (DM)	339	0	3.27	3	3	1.114	1110
Q1 (DM)	338	1	3.2	3	3	1.01	1081
Q7 (DM)	339	0	2.88	3	3	1.103	977
Q5 (DM)	338	1	2.86	3	3	1.105	968
Q2 (SM)	338	1	2.78	3	3	1.292	938
Q6 (SM)	339	0	2.06	2	1	1.09	697
Q4 (SM)	337	2	1.76	1	1	1.034	593
Q10 (SM)	339	0	1.68	1	1	0.953	571
Q8 (SM)	339	0	1.44	1	1	0.87	489

Table 4.8: The descriptive statistics for 10 CCW motivation items

	Year 2	Year 3	Year 4
SM	9.4884	9.4683	10.4268
DM	15.6589	16.2937	15.8902

Table 4.9: Mean and *SD* for Deep & Surface Motives

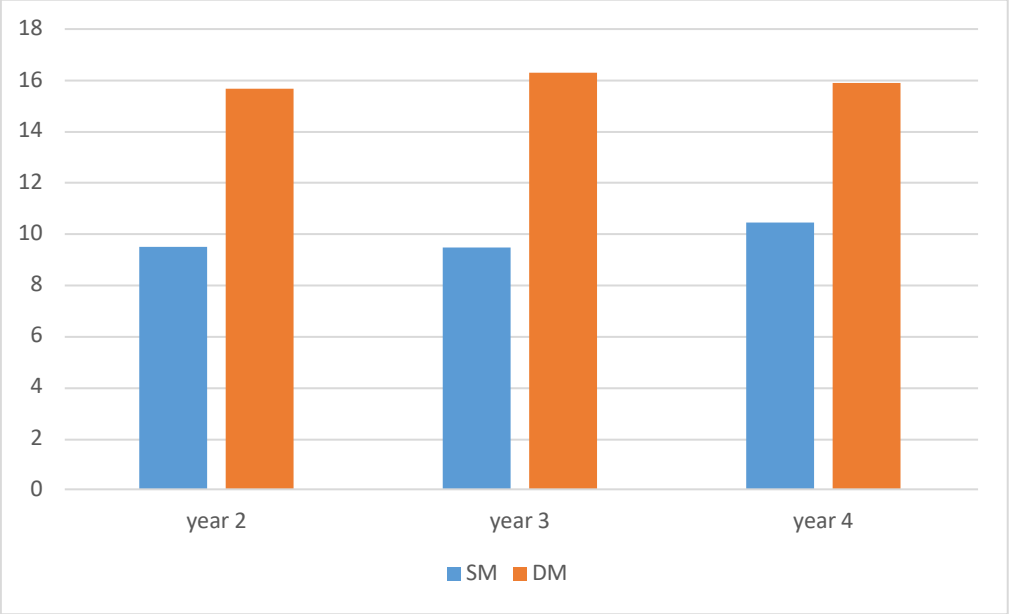

Figure 4.9: Chart for SM & DM Mean in different levels

4.3. CCW performance: the results of the writing-to-dictation task

The learners' CCW performance is assessed by the designed writing-to-dictation task which contained 24 Chinese characters. There are 298 students with valid results for the dictation (Year 2: 130 students; Year 3: 90 students; Year 4: 78 students).

Table 4.10 and Table 4.11 show the summarized dictation results. The total corrects for all participants are 3509 (49.06%). The results are coherent with the general assumption that students from the higher level perform better than the lower-level students. However, even the highest-level students (year 4) have a correct rate 56%. The Chinese characters with high frequent level have higher correct rate (51.07%) than the middle and low frequent characters. But the irregular characters have higher correct rate (58.11%) than regular characters (41.89%).

All participants (N=298)	Total Correct Rate	Blank Rate	Error Rate
Year 2 (N=130)	43.88%	32.76%	23.37%
Year 3 (N=90)	51.90%	24.31%	23.80%
Year 4 (N=78)	56.28%	20.08%	23.65%

Table 4.10: Total correct rate summary of the dictation results

		Regularity	Irregular	Frequency Low	Frequency Mid	Frequency High	Total Corrects
All participants (N=298)	Total Corrects	1470.00	2039.00	715.00	1002.00	1792.00	3509.00
	Mean Score	4.93	6.84	2.40	3.36	6.01	11.78
	Rate	41.89%	58.11%	20.38%	28.56%	51.07%	100.00%
Year 2 (N=130)	Total Corrects	539.00	822.00	238.00	363.00	760.00	1361.00
	Mean Score	4.15	6.32	1.83	2.79	5.85	10.47
Year 3 (N=90)	Total Corrects	474.00	636.00	227.00	335.00	548.00	1110.00
	Mean Score	5.27	7.07	2.52	3.72	6.09	12.33
Year 4 (N=78)	Total Corrects	457.00	581.00	250.00	304.00	484.00	1038.00
	Mean Score	5.86	7.45	3.21	3.90	6.21	13.31

Table 4.11: Summary of the dictation results

From Table 4.12, we find that 3 characters with the highest correct rate are high frequent irregular characters, while the characters with lowest correct rate are low frequent regular characters. The results show that frequency of character had more influence on CCW performance than regularity of characters in the present study.

	Frequency	Regularity	Correct Rate
空	High	Irregular	90.30%
店	High	Irregular	89.90%
怕	High	Irregular	80.90%
治	High	Irregular	77.90%
骑	High	Regular	73.20%
球	High	Regular	69.50%
领	High	Regular	63.80%
梯	Mid	Irregular	61.10%
铁	Mid	Irregular	57.70%
桥	High	Regular	56.00%
肤	Mid	Regular	47.70%
终	Mid	Irregular	45.00%
炉	Low	Irregular	44.30%
浪	Mid	Irregular	44.00%
屏	Low	Irregular	43.60%
蚊	Low	Regular	43.30%
棋	Low	Regular	40.60%
郊	Mid	Regular	36.90%
萝	Mid	Regular	28.90%
峡	Low	Irregular	24.80%
鸭	Low	Irregular	24.80%
砖	Low	Regular	15.80%
疲	Mid	Regular	15.10%
舰	Low	Regular	2.70%

Table 4.12: Correct rate for the target characters

4.4 CCW learning approaches

To study the role of CCW strategy in the CCW learning process, the interrelationships between CCW learning approach (including CCW motives and CCW strategies) and the CCW performance are explored. The correlation analysis is conducted and the ten hypotheses in the analytical model of CCW (Figure 3.4) were tested one by one. Table 4.13 presents correlations between the factors, the motivates and the dictation score. Because of the failures

of the equipment, only 298 validated data from dictation are used in the correlation and mediation path analyses.

	DM	SM	F1	F2	F2 Form-based	F2 Sound Meaning-based	Dictation Score
DM	1						
SM	-.340**	1					
F1	.508**	-.265**	1				
F2	.361**	-.262**	.541**	1			
F2 Form-based	.360**	-.280**	.524**		1		
F2 Sound Meaning-based	.330**	-.195**	.483**		.668**	1	
Dictation Score	.164**	-.157**	.149*	.117*	.119*	0.103	1

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Table 4.13: Intercorrelations among variables

4.4.1 **The interrelationships among CCW motivation and CCWS: H1, H2, H3, H4**

Hypothesis 1 (H1) and Hypothesis 2 (H2) state that deep motivation of CCW has a positive relationship with F1 and F2 strategies. Hypothesis 3 (H3) and Hypothesis 4 (H4) state that surface motivation of CCW has a negative relationship with F1 and F2 strategies.

Two CCW motivation scales are highly related to both CCWS factors. Deep motivation showed a strong pattern of positive relations with F1 and F2 strategies. The relationship between deep motives and F1 indirect strategies are higher ($r = .51$, $p < .01$) than deep motives and F2 knowledge-based strategies ($r = .36$, $p < .01$). Oppositely, surface motives show a significant negative relationship with both strategies (with F1: $r = -.27$, $p < .01$; with F2: $r = -.26$, $p < .01$). The patter is the same in the subscales. While deep motives had a positive relationship with the form-based strategies ($r = .36$, $p < .01$) and the sound-meaning-based strategies ($r = .33$, $p < .01$), surface motives have a negative relationship with them ($r = -.28$, $p < .01$; and $r = -.20$, $p < .01$;). The results suggest that learners with deep motivation take more

strategies in learning CCW, and learners with surface motivation take less strategies in learning CCW.

4.4.2 The interrelationships among CCW motivation and CCW performance: H5, H6

Hypothesis 5 (H5) and Hypothesis 6 (H6) state Deep motivation and Surface motivation have oppositely influence on CCW performance. Accordingly, deep motivation positively influences CCW performance ($r = .16$, $p < .01$) and surface motivation of CCW negatively influences CCW performance ($r = -.16$, $p < .01$). The two motive scales have the opposite effect on CCW performance.

4.4.3 The interrelationships among F1 and F2 strategies and CCW performance: H7 and H8

Hypothesis 7 (H7) and Hypothesis 8 (H8) stated that both strategies (F1indirect strategies and F2 knowledge-based strategies) have a positive relationship with CCW performance. In other words, both F1 and F2 strategies promote CCW performance.

The correlation analysis results show that both strategies factors are significantly and positively related with the dictation results. F1 is strongly positively correlated with the dictation scores ($r = .15$, $p < .01$) while F2 is moderately positively correlated with the dictation scores ($r = .12$, $p < .05$). However, high frequent characters and irregular characters have no significant correlation with both factors. Both F1 and F2 have significant correlation with lower frequent and regular character. Among different level learners (Table 4.14), lower-level students (Year 2) more relied on strategies. F1 retains positive relationship with low frequent, middle frequent and regular characters in year 2 and 3. Irregular characters are strongly positively correlated with F1 in year 2. F2 retains significant association with mid frequent

and regular characters in year 2, but only low frequent characters in year 3. No correlation is found for strategies and dictation achievement in Year 4. High frequent characters are not associated with both strategy factors in any study level. In general, CCW strategies have a stronger correlation in lower-level students.

For the two subscale strategies, the intercorrelations with performance are aligned with F2. Both scales have a positive relationship with the total score and the low frequency characters. Although the relationship between the sound-meaning-based strategies and the total score is not significant, the positive patter is followed. Moreover, the sound-meaning-based strategies significantly related with the regular character performance. The strategies are more effective in the lower-level students, especially the form-based strategies.

	F1 Indirect Strategies				F2 Knowledge-based Strategies			
Dictation	All participants	Year 2	Year 3	Year 4	All participants	Year 2	Year 3	Year 4
Total Score	.151**	.261**	.273**	-0.048	.116*	.183*	0.153	0.02
LowFrequency	.166**	.216*	.317**	0.023	.145*	0.095	.243*	0.124
MidFrequency	.137*	.260**	.217*	-0.036	0.102	.192*	0.095	0.028
HighFrequency	0.082	0.17	0.188	-0.118	0.047	0.164	0.057	-0.113
Regular	.150*	.239**	.286**	-0.024	.128*	.233**	0.132	0.033
Irregular	0.084	.244**	0.044	-0.058	0.007	0.106	-0.046	-0.001

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 4.14: Strategies and dictation correlation in different level students

	F2 Form-based Strategies				F2 Sound-meaning-based Strategies			
Dictation	All participants	Year 2	Year 3	Year 4	All participants	Year 2	Year 3	Year 4
Total Score	.117*	.181*	0.144	0.038	0.099	0.147	0.144	0.005
LowFrequency	.142*	0.117	.211*	0.145	.127*	0.066	.240*	0.087
MidFrequency	0.093	.183*	0.069	0.037	0.098	0.159	0.111	0.024
HighFrequency	0.065	0.147	0.106	-0.094	0.024	0.136	0.005	0
Regular	0.113	.193*	0.113	0.056	.124*	.219*	0.135	0.013
Irregular	0.017	0.142	-0.036	-0.002	0.000	0.053	-0.048	0.004

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 4.15: F2 subscales strategies and dictation correlation in different level students

4.4.4 The relationship between F1 and F2 strategies, and the relationship between deep and surface motivation: H9, H10

Hypothesis 9 (H9) states that deep motivation and surface motivation of CCW are negatively related to each other. Hypothesis 10 (H10) states that F1 and F2 strategies are positively related to each other.

Two motivation and two strategies are highly related to each other. While two strategies show a pattern of positive relations ($r = .55$, $p < .01$), two motivations influence each other in a negative way ($r = -.32$, $p < .01$).

According to the results, the ten hypotheses are accepted in the analytical model of CCW (Figure 3.4).

4.4.5 The role of CCWS: mediation analyses

Motivation of L2 drive learners' learning behavior, i.e. learning strategies (Ho, 1998). Researchers generally agreed that high motived learners often use more learning strategies

which promoted learning outcomes. In opposite, low motived learners tend to use less or inefficient learning strategies, thus, the learning related outcomes also are negatively affected. However, would CCWS be a mediating factor that influence the relationship between CCW motivation and CCW achievement? To determine if the mediating role of CCWS in the relationship between CCW motivation and achievement is also inspected, the present study tests a mediation model by using Structural Equation Modelling (SEM) in AMOS.

Figure 4.10 presents the standardized path coefficients among factors: CCW motivation (DM, SM), CCWS (F1, F2), and CCW performance (achievement). The results of the analysis reveal that only 4% of achievement could be explained by two CCW motivation factors (DM, SM), and two CCWS factors (F1, F2). The indirect effect of CCW motivation on the CCW achievement via CCWS is not significant. CCWS is not the mediating factor between the CCW motivation and achievement.

Meanwhile, the result supports the relationship between CCW motives and CCWS. DM is the strong predictor of F1 CCWS (β=.47, $p < .001$). It has a weak positive relationship with F2 CCWS (β=.06) and has no significant effect ($p > .05$). SM has the inverse relationship with F1 and F2 ($p < .05$). Although it does not have a strong effect as DM to F1, the inverse relationship is expected and indicates that learners with SM demonstrated less CCWS in CCW learning.

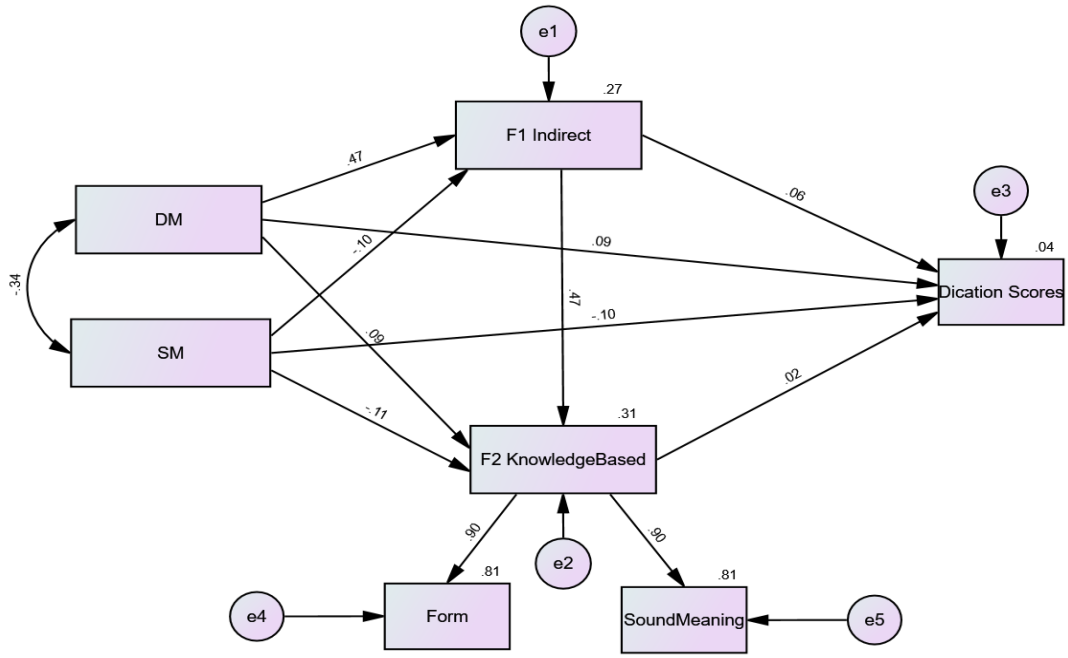

Figure 4.10 path model depicting relationship between CCW motivation (DM, SM), CCWS (F1, F1) and achievement

4.5 Summary

One of the main purposes of the present study is to develop the CCWSI. From a literature review on Chinese character learning strategies, the CCWSI is developed and included 31 items. The pilot phase of the study is conducted among 43 CSL learners in a Hong Kong international school in order to inspect the internal structure of CCWSI. The EFA result shows two factors, the indirect strategies and the knowledge-based strategies. This two-factor structure is further examined and verified by EFA and CFA in the main phase of the study which are undertaken using 339 CSL learners from 4 universities in Vietnam. The final CCWSI includes 20 items under two factors. Each of factors (F1: indirect strategies and F2: knowledge-based strategies) had 10 items. Furthermore, reviewing the knowledge-based strategies, the subscales: the form-based strategies and the sound-meaning-based strategies, are identified and confirmed by CFA. Therefore, CCWSI has been finalized as a two-layer

structure: the upper-level layer is two factors (10 items for each factor), and the two-subscale layer is under the factor 2 knowledge-based strategies (5 items for each subscale).

In addition to develop CCWSI, another main purpose of present study is to understand the relationship between CCW motivation, CCWS and CCW performance. Thus, the Bigg's 3P model which integrates these variables as a dynamic system is adopted and modified in the main study. The instruments, the CCW motivation Questionnaire (which is modified from Biggs' R-SPQ-2F) and the CCWSI (which is developed from the pilot study), are employed to measure two scales of CCW motives (Deep and Surface) and two factors of CCWS (F1 and F2). Moreover, the dictation task is used to measure the performance of CCW. The characters in the dictation task are designed from three aspects: complexity (character strokes were controlled from 8 to11), frequency of characters (low, middle, high), and regularity (regular and nonregular). The frequency and regularity are mainly considered with other variables. The proposed 10 hypothesizes which assume the relationships between those variables are tested and accepted according to the correlation analysis. However, the path analysis with AMOS denies the mediating role of CCWS in the relationship between CCW motivation and achievement. The interpretation and implication of the data analysis results are discussed in the flowing chapter.

Chapter 5. Discussion

The major primary of the present study is to develop a specific instrument to measure CCWS and investigate the role of CCWS in the CCW learning process. In order to attain the purposes, we develop CCWSI based on the previous studies. Meanwhile, the study adopts the 3P model to explore the relationship between CCW motivation, CCWS, and CCW performance. This chapter presents the response to the research questions and the implication of the findings in the first few sections. The first section (5.1) mainly answers the research question about the CCWSI internal structure; the second section (5.2) focuses on what the strategies are used by CSL learners in CCW; followed by the section (5.3) discusses the role of CCW strategies in the CCW learning process for CSL learners; based on the key findings, the last section of the chapter (5.4) suggests practical implications for enhancing CSL learners' CCW learning.

5.1 CCWSI internal structure: two-factor structure

In light to the previous Chinese character learning studies, the present study develops a CCWSI to assess CCW strategies and validate among Vietnamese CSL learners. The factor analysis, including EFA and CFA, is used. The results of factor analyses support the structure with a basic two layers, two main factors, and two subscales (Figure 5.1). The CFA is used to adjust the final items and confirm the internal construct validity of the instrument. The item loadings on their respective factors and subscales are acceptable and fit the model. There is a total of 20 items in the final CCWSI. The simple first-order/layer structure has two factors; and 10 items for each factor. Both factors and the whole instrument have good internal consistencies. The overall reliability (0.90 Cronbach's *a*), two factors' reliability (0.84 and 0.87 Cronbach's *a*), as well as two subscales' reliability (0.72 and 0.77 Cronbach's *a*) are satisfied. Both reliability and validity of two-factor CCWSI are supported by statistical data.

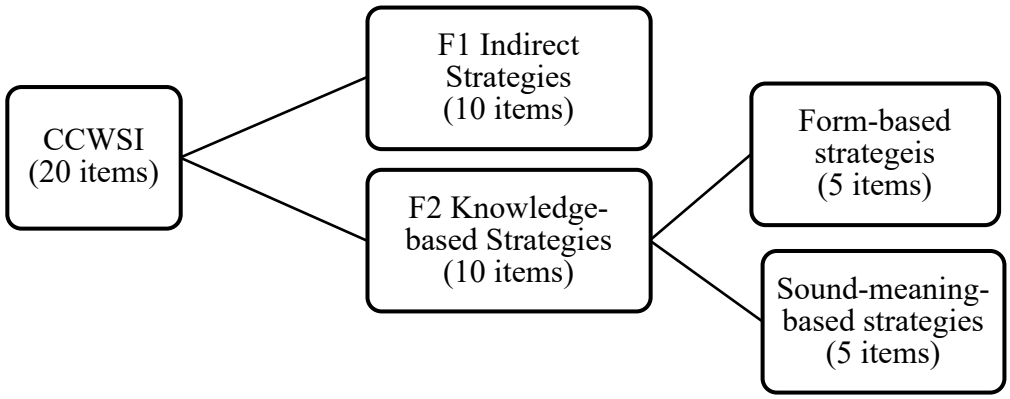

Figure 5.1 The CCWSI internal structure

The two upper layer factors are named the knowledge-based strategies and the indirect strategies according to the content of the items. The indirect strategies (F1) are not directly related to Chinese characters but correspond to the cognitive process of writing. This factor includes metacognitive strategies: Q19(goal), Q20(plan), Q21(reflection), Q22(review mistake), Q24(preview), Q25(self-testing), and Q26(try to find the best way); application strategies: Q28(daily applying); affective or emotion strategies: Q23(self-encouraging); and social strategies: Q31(asking for help and discuss with others). Metacognitive strategies and emotion/ affective strategies are also classified as indirect strategies in Oxford's categories (Oxford, 1990) which "contribute indirectly" to the learning subject, a new language. Oxford (1990) SILL categized 6 groups of strategies into direct and indirect dimensions. The indirect strategies of Oxford also include three strategies: metacognitive strategies, affective strategies, and social strategies. Metacognitive strategies are those skills relating to plan, monitor and evaluate the learning process in order to manage, direct, regulate and guide the learning (Wang, Spencer & Xing, 2009). Affective or emotion strategies are important to self-encourage in learners' study. During the learning, learners must identify feelings and moods in order to manage their anxiety level and think positively. Social strategies are significant because they "help the learner work with others and understand the target culture

as well as the language" (Oxford, 2003). In addition to the above three strategies, our indirect strategies include another strategy, called application strategies in the previous studies, which are related to applying CCW in their daily life and learning, such as using Chinese to write a daily shopping list. Application strategies are under the cognitive strategies in Jiang and Zhao's (2001) study. Obviously, indirect strategies not only contribute to CCW learning but also involve other subject matter.

In the opposite way, the knowledge-based strategies (F2) resemble the three linguistic features of Chinese characters: orthographic knowledge: Q1(character strokes), Q4(character form), Q5(character logographemes), Q6(character graphic structure), and Q10(similar shapes); phonological knowledge: Q12(similar sound), and Q15(phonetic radicals); and semantic knowledge: Q16(context of compounds), Q17(similar meanings), and Q18(semantic radical). These strategies are particularly useful in CCW, but not in other language learning.

The knowledge-based strategies (F2) are further divided into two subscales which is the second level of CCWSI. The first 5 items (Q1, Q4, Q5, Q6, and Q10) are categized as the form-based strategies, and the rest 5 items (Q12, Q15, Q16, Q17, and Q18) are grouped as the sound-meaning-based strategies.

Most orthography studies on reading and writing are based on the alphabetic writing system, and the definition of orthography often reflects the differences within it (Leong et al., 2011). Thus, the orthographic knowledge is defined as "memory for specific visual/spelling patterns that identify individual words, or word parts, on the printed page" (Barker, Torgesen, & Wagner, 1992, pp. 335–336, cited from Leong et al., 2011). It is the ability to detect the acceptability of letters sequences and letter positions in order to facilitate reading acquisition in English (Cassar & Treiman, 1997). Applied to Chinese, the orthographic knowledge is more complicated.

In the traditional view, the Chinese orthographic knowledge generally embraces: the configuration of the Chinese characters (e.g. Yeh & Li, 2002), a repertoire of the orthographic units of different grain sizes (i.e., strokes, logographemes, and radicals) (e.g. Lau, 2019), and the positional consistency of the components (Lui et al., 2010; Taft et al.,1999). Accordingly, the orthographic knowledge in Chinese refers to an understanding of character configurational structure, the positional constraint, as well as the role of intra-character which includes the constituents of phonetic and semantic radicals and their integration (Leong, et al., 2011).

Although strokes are the basic units to build Chinese characters, there is an incongruous opinion about how many layers are structured for Chinese characters. Some researchers think that Chinese characters are structured in three layers which consist of strokes (笔画), *bujians*/components（部件）, and a whole character (整字) (Shen, 2005; Shen & Bear, 2000); others argue that Chinese characters are constructed via 4 tiers orthographic structures, including strokes, logographeme, radicals, and a whole character (Law & Leung, 2000; Liang, 2019). In the 4 tiers view, logographeme (*Bujians*) is composed by multiple strokes, which recurs consistently and independently as an integral constituent in a radical or character but do not convey information about the meaning or sound of the host character (Liang, 2019). Radicals are either phonetic or semantic, which give clues to the sound or meaning of the most characters in Chinese, i.e., the semantic-phonetic compound characters (over 80%) (Shu & Anderson, 1997). Thus, they are involved as functional processing units in CCW process (Law, et al., 2005). The general definition of the orthographic knowledge in Chinese, which is conceptualized on the alphabetic writing system, often packed them together as the insight of inter-structure knowledge of Chinese characters (Cheng & Huang, 1995; Ho et al., 2004). In other words, in addition to the visual patterns or the orthographic form, the orthographic knowledge embraces the linguistic properties: the phonological and

semantic function of Chinese characters, which are carried by the constituents of phonetic and semantic radicals (Leong, et. al., 2011). The bind of the orthographic and other two linguistic properties is concerned in the recent decades because of the possible confounding effect from the linguistic functions. Researchers argue that semantic radicals, as an integral part of the CCW compound, could be considered as a part of orthographic knowledge, but they also indicate the semantic category of the morphemes (McBride, 2016). That makes semantic radicals as a unique feature in Chinese, because there is no such clear analogy in alphabetic orthographies (McBride, 2016). On the other sides, though Chinese phonetic radicals may be compared to letter units in alphabetic orthographies (Ziegler and Goswami, 2006), a Chinese character is mapped to a syllable. Compared to the alphabetic language, the mapping between orthography and phonology is not strong in Chinese, and learners cannot entirely rely on phonological information which is conveyed by phonetic radicals to identify a character. Because these phonological cues of Chinese characters are not fully reliable, phonology doesn't play a "privileged role over orthography in constraining semantic activation" (Zhou and Marslen-Wilson, 1999). Collectively, the radical knowledge is a different learning process that separates from the orthographic knowledge, such as orthographic form and the position of radicals (Tong and McBride-Chang, 2010). Based on the difference of Chinese orthography from alphabetic orthographies, some prominent researchers (Cheung et al., 2007; He et al., 2003; McBride 2016; Tong & McBride, 2010& 2014; etc.) suggest separating these two linguistic properties and orthographic form of Chinese character. The only constraints of implementing Chinese writing should be included in the concept of Chinese orthographic processing.

The two subscales echo the above-mentioned view. The form-based strategies are only related to the orthographic form knowledge, such as strokes, and the structure or position constraints of stroke patterns. These strategies process CCW directly from the visual graphic

form. Contrary to the form-based strategies, the sound-meaning-based strategies probe to the linguistic properties of characters (such as sound and meaning). The strategies of this subscale try to build a strong link between a character and its sound and meaning. For example, Q15 and Q18 directly focus on the phonetic and semantic radicals. Moreover, a word in Chinese can be a single character or consist of two or more characters. Q16 "recall specific characters in the context of compounds" uses bisyllable/multi-syllable words to provide supplementary information distinguish homophonic heterographic character. Q12 and Q17 pay attention to homophones and synonyms. The sound-meaning-based strategies aim to connect the sound and meaning of a character to its orthographic form that is referred to the indirect ways of the processing route of CCW (Figure 2.6 in section 2.3.1.1). The two subscales in CCWSI indicate that CCW was strongly implicated in two processing routes. The form-based strategies are related to a direct route in CCW. The learners often gain assess through the visual constraints of implementing CCW first. However, CCW is beyond the visual orthographic level. It also involves the phonological and semantic process. Those sound-meaning strategies involve those indirect routes and are superior to the form-based strategies that could be explained by "transfer-appropriate processing" which is mentioned by Shen (2004) in her study. To give an example, Shen used "说" and "兑". If a learner is given to view the whole character "说" , then asked to find the character in a list, he or she just simply identifies graphic feature and only recalls the perceptual information of the character form from his or her memory to complete the task; but when the learner is only presented by the partial character "兑" and tells that the meaning of the character is "to speak", the learner would require the existing knowledge to recall or restore the target character "说". According to the theory, that mental operations perform better while the encoding process integrates with the recall process. Hence, the two subscales not only demonstrate the

linguistic features of Chinese characters, also indicate the basic processing routes and cognitive process for CCW.

Accordingly, the internal structure of the CCWSI has similarities and differences with other quantitative inventories. The overall internal structure of CCWSI has clear two main factors. Although there is no consensus on the definition and classification of L2 learning strategies, in general, there are two types of strategies: direct and indirect strategies (i.e., Oxford, 1990 & Rubin, 1981), or cognitive and metacognitive strategies (i.e., Jiang Xin and Zhao Guo, 2001 & Shen, 2005). Oxford's LLS is widely recognized and broadly used. The name and concept of Factor 1, indirect strategies, is employed from it. Both Jiang and Zhao's (2001) and Shen's (2005) studies are representatives of Chinese character learning. They classify Chinese character learning strategies into cognitive or metacognitive dimension. The cognitive strategies of Shen's study are related to the utilization of orthographic, phonologic, and semantic knowledges that are similar to our knowledge-based strategies. Jiang and Zhao's study includes not only knowledge strategies but also application and review strategies into cognitive strategies. CCWSI is partly based on those studies, and the CCW strategies are greatly overlapped with the Chinese character learning strategies. Altogether, it's not surprising that CCWSI has a similar internal structure with those inventories.

Nevertheless, the classification of CCWSI directly reflects the characteristics of CCW. The Chinese character learning strategies comprise Chinese character recognition and production. CCW goes one step further and is more difficult than character recognition. From the review of the handwriting process (Chapter 2.3), CCW involves a complex process and need the full knowledge of a character: orthographic, phonologic, and semantic knowledge of a character. This decoding process could be synchronized and also integrated knowledge and multiple skills, such as hand motor skills and eye vision skills (de Haas & Rees, 2010; Ho, Yau & Au, 2003; Shams & Kim, 2010). Therefore, CCWS has two main factors: one is

common strategies for L2 learning, but another one is directly reflected to three linguistic components of Chinese character and concentrates on character product. The second layer subscales also imply the basic processing routes for CCW and further reveal the important features of Chinese characters. As the orthographic property and linguistic property are "mutually reinforcing", the character form and the function of radicals both play an important role in the character encoding and decoding process (Leong, et. al., 2011). Therefore, one subscale is directly related to the orthographic form and includes the direct assembled-rout strategies in CCW; and another one utilizes phonologic and semantic knowledge to assist the output process of Chinese characters.

To conclude, the CCWSI internal structure illustrates the process of CCW that learners integrate the different knowledge, mix various strategies, and use both direct and indirect routes in the production of CCW. Although a part of it is basic strategies that may exist and applicable in any L2 learning situation, the CCWSI reveals the important features of Chinese characters and CCW.

5.2 The strategies used by CSL learners

5.2.1 The two CCW strategy factors used by CSL learners in CCW

According to CCWSI Descriptive Statistics (Table 4.6), learners are more likely to choose the knowledge-based strategies than indirect strategies. Five most frequently used items are the knowledge-based strategies (with a mean from 3.73 to 3.64), in contrast, five least used items are the indirect strategies (with a mean from 2.61 to 3.12). It greatly depends on the writing process and cognitive decoding process of CCW. The process of writing Chinese characters tangles decomposing and deconstructing characters' strokes and components (radicals and logogrphemes), and then regrouping the subcomponents or sub-characters into a

square linguistic unit (Tan, et al., 2005). When learners try to write a character from their memory, learners not only rely on simple memory or single skill, such as motor skills and visual-perception skills, but also need to integrate different kinds of systematic knowledge consisted in the writing system (Ho, Yan & Au, 2003). In spite of the CCW decoding process seems to be on the visual orthographic level, it actually links visual symbols, phonological codes, and semantic codes of Chinese characters. Therefore, partial information can lead to successful recognition, but for accurate production, learners must have the complete knowledge to transform such knowledge into motor activity of hand movement (Ke, 1996). Many researchers have already pointed out that orthographic skills, phonological skills, and morphological awareness are important for learning Chinese writing (Ho, Ng, & Ng, 2003; McBride-Chang & Ho, 2005; Chan, et al., 2006; Shu, et al., 2006; etc.). As we know that learning strategies are teachable. F2 Knowledge-based Strategies are those related to the systematic knowledges of Chinese characters, which are often a major portion of the in-class teaching materials. Consequently, the strategies which are based on Chinese character knowledges are more direct and important for learners.

While learners more tend to use the knowledge-based strategies, indirect strategies have a stronger correlation with the dictation results. The indirect strategy factor is mainly composed by metacognitive strategies. The importance of metacognitive strategies has been proved by numerous studies. The use of metacognitive strategies, which is referred to sequential processes to control cognitive activities in order to achieve a cognitive goal, leads higher learning and better performance (Anderson, 2002; Wang, Spencer and Xing, 2009). It influences CSL achievement (Wang, Spencer and Xing, 2009), so does CCW achievement in the presented study. Indirect strategies also included an application strategy item. Application strategies also have a significantly positive correlation with CCW achievement in Jiang and Zhao's (2002) study. Learners in a higher proficiency level or grade are more likely to apply

Chinese characters in their learning and daily life (Zhou & Yu, 2004; Zhao & Jiang, 2002). As CSL learners in Vietnam, there is not necessary for those learners to apply CCW in their daily life. Social strategy and affective strategy are possibly related to individual differences, such as learners' personalities.

All in all, the learners tend to pay more attention to the linguistic features of Chinese characters, but they need to evaluate their strategies and reflect on their learning processes more. Those strategies that promote and contribute indirectly to CCW could also be crucial for one's learning.

5.2.2 **The trends across learners with the different proficiency levels**

From the descriptive analysis and correlation analysis, the current study finds that the lower-level students take more strategies than the higher-level students. That is different from the majority of L2 studies, which usually suggest that higher proficient learners use strategies more often than lower proficient learners (Greem & Oxford, 1995; Shen, 2005; Wharton, 2000; etc.).

There are two studies, Phillips' (1991) and Hong-Nam & Leavell's (2006), finding a curvilinear relationship between strategies and the language proficiency levels. In other words, students at the intermediate level take more strategies than beginning and advanced level students. The explanation is that L2 beginning-level students may have insufficient knowledge to apply learning strategies. Intermediated level learners have gained sufficient knowledge and competence in L2 while they also have a high level of awareness of using strategies. Once learners reach the advanced level, they do not have to consciously administer strategies. Carl Bereiter (1995) uses the word "automatically" to describe this internalization (Hong-Nam & Leavell, 2006). The explanation of this inconsistency in the present study

could be the complex process of CCW. As mentioned in the previous section, CCW has to integrate character knowledges and incorporate with multiple skills (Ho, Yan, & Au, 2003). Writers need to pay attention to the smallest units, strokes (including the formation of stroke forms and stroke sequencing rules) (Law et al., 1998), and write every character within the boundary of a square grid (Lam et al., 2011). In order to produce legible handwriting outputs, learners are triggered by one or more of those knowledges. The subjects of the present study are Chinese major students in year 2, 3 and 4 who have at least a year of study in Chinese and have already obtained a certain level of writing knowledge. Therefore, year 2 students highly emphasize the CCW strategies in their learning and show the highest level in using CCW strategies, while year 4 students internalize the learning process of CCW and experience automatically applying some CCW strategies.

Meanwhile, there is no significant difference in using the two subscales' strategies across the different year groups. Compared to the form-based strategies, the sound-meaning-based strategies are indirectly-assembled-rout strategies at a deeper processing level and require a certain level of knowledges to be employed effectively (Shen, 2004). As CSL learners, that could be a challenging goal to get. Our learners might not reach the level to show the observable and significant difference between the two subscales' strategies. There are evidence from the dictation results. We find that the irregular characters had a higher correct rate than regular characters across the different level learners. As regular characters provide more phonological information than irregular ones, if learners master the linguistic knowledge of the role of radicals in compound characters, they are expected to utilize the information to help in CCW. Studies report that phonetic radicals help Chinese recognition, and learners have significantly shorter reading latencies in low-frequency regular characters than in low-frequency irregular characters (Hue, 1992; Lau, et al., 2015; Lau, 2019). The higher error rate in regular characters indicate that our participants still tend to rely on the

orthographic form of Chinese character and hadn't comprehensively developed the awareness of sound-meaning correspondence; thus, they couldn't effectively utilize the linguistic function of sound and meaning radicals of Chinese characters in CCW. Furthermore, as the learners in the highest proficient level among the three groups, year 4 learners show a higher mean for the sound-meaning-based strategies and the more recognizable different mean value between the two subscales. The trend more or less implied that learners might increase using of the sound-meaning-based strategies while their proficiency level increase, though further evidence is needed to address this question.

5.3 **The role of CCW strategies in the CCW learning process**

The complex process of language learning can hardly be explained by a simple factor and LLS is affected by other factor in the learning process. According to 3P model, the learning process of CCW includes CCW motivation and CCW strategies for learning. CCW motivation and strategies interact to instigate a corresponding performance. The relationship between them provided new perspectives for understand learners' CCW.

5.3.1 **The relationship with performance**

The correlation analysis of strategies and dictation results prove that both F1 and F2 have a positive relationship with performance. According to the strategy definition, learning strategies should "make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferable to new situations" (Oxford, 1990, p8). Our CCW learning strategies are used to improve CCW proficiency or achievement, to complete CCW, or to make CCW more efficient, more effective, and easier. If a "strategy" negatively influences learners' learning, it couldn't be a strategy. For example, "pinyin replacement" may cause

learners to rely on pinyin more than CCW. That's why it had been excluded from our CCWSI.

At the same time, researchers generally agree that more successful learners usually report greater use of learning strategies. Green and Oxford (1995) did a large-scale study, including 374 ESF learners in at three different course levels at the University of Puerto Rico, and found that other than "bedrock strategies" which were used frequently at all levels, more successful learners also combined strategies that emphasized active, naturalistic practice. In other words, some "basic strategies" were used by learners at all levels, but more successful learners used more and higher-level strategies. That explained F1 and F2 had a positive relationship with each other and with the CCW performance, but among them, F1 (Indirect Strategies) had a stronger relationship with the performance than F2 (Knowledge-based Strategies).

To elaborate further, we find that the majority of items in F1 are metacognitive strategies (7 out of 10 items, including Q19, Q20, Q21, Q22, Q24, Q25, and Q26). Researchers state that a wide range of metacognitive strategies often performs better in examinations and complete tasks more efficiently. In the information-processing theory, metacognitive strategies play an "executive" role (Lv & Chen, 2010). Referring to the learning strategy, metacognitive strategies involve learners' awareness in their systematic thinking and learning process. Therefore, among all learning strategies, metacognitive strategies are also "higher order executive skills" (O'Malley and Chamot, 1990) which help learners to become independent and autonomous. Hence, it also promotes other strategies. The significance of metacognitive strategies has been shown in L2 learning. Ofodu and Adedipe (2011) recommended that learners should be guided into using different metacognitive strategies after they investigated 120 ESL secondary school learners' reading strategies and revealed that students who demonstrated more metacognitive strategies had a

better performance in their reading and comprehension. Lv and Chen (2010) did an experimental study of metacognitive strategies-based writing instruction and found that metacognitive strategy training improved learners writing performance. Similar findings were also in many other studies (i.e. Anderson, 2002; Dabarera et al., 2014; Ohata & Fukao, 2014; Öz, 2016; Şen, 2009; etc.). To put it simply, metacognitive strategies control learners' cognition and learning process (Brown et al., 1983; O'Malley & Chamot 1990; Cohen, 1998). Using more metacognitive strategies helps L2 learners to think about other strategies and what happens during the learning process, consequently, to develop stronger L2 learning skills and more effective learning strategies (Anderson 2002). Under the circumstances, that's easy to understand why F1 had a stronger positive relationship with the dictation performance. It also implied that learners who used more F1 strategies achieved a higher score in the dictation task.

Apart from the above, F1 and F2 strategies have no influence on the high frequent and irregular characters. Lower frequent and regular characters more rely on both strategy factors. The frequency effect is higher than the regularity effect in the CCW. According to the dual-route spelling model, the direct route associates meaning and written forms directly while the indirect route associates with sounds, thus, it also called phonologic route (Good, 1998). Because of lacking the relationship between phonemes and graphemes, students usually more favor "direct access" in Chinese. When sufficient orthographic information is extracted, phonological assess general lags behind the visual analysis. That's also approved in Lau's (2020) study of the dual-route account of writing-to dictation. Lau found that high frequency orthographic entries were allowed to bypass the lexical-semantic route and took the direct lexical non-semantic route. Thus, Chinese characters with higher frequency can be quickly recognized before the phonology information is activated (Li & Chen, 1997). It is plausible, therefore, the form-based strategies showed a significant relationship with the performance. In

the meantime, the regularity effect may only be observed in the low frequent characters. Comparing to non-semantic-phonetic compounds, semantic-phonetic compounds are more sensitive to the use of strategies (Zhao and Jiang, 2002). A regular character sounds the same as its phonetic radical, but regardless of possible tonal discrepancy (Fan, Horng, & Tzeng, 1986). Students may simultaneously active several characters with same or similar sounds during the process of semantic-phonetic compounds. According to the competition theory by MacWhinney (2001 & 2004), errors may be occurred in a case where analogy is strongly in competition. Substitution errors in CCW also can be explained (Shen, 2013). Accordingly, the irregular characters with more obvious orthographies had a higher accuracy rate than those regular ones in the dictation results. In a word, the regularity may cause confusion and raise questions from the consistency between a phonetical radical and the pronunciation of the character. Therefore, the relationship between the sound-meaning-based strategies and the dictation score is also positive, but it is not significant with a limited proficiency level of learners. To conclude, the prior factor in CCW is the frequency of characters.

5.3.2 **The relationship with motivation**

Motivation is an underlying reason why learners use particular CCW strategies, it is also a major area of concern in the CCW learning process. In order to assess approaches to CCW, the relationship between CCW strategies and CCW learning motivation has been investigated. 10 motivation items from Biggs' R-SPQ-2F are modified and employed to measure the CCW motivation level of learners. As we know, there are two scales of motivation, DM and SM. Extrinsic and intrinsic motivation contribute to the SM and DM scale (Biggs, et al., 2001; Draper, 2013). The reliability and CFA model fit indices are good and verify the 2-factor structure (section 5.4).

According to the correlation analysis results, two motivations and two strategies are highly related to each other. While two strategies show a pattern of positive relations ($r = .55$, $p < .01$), DM and SM have a negative effect to each other way ($r = -.34$, $p < .01$), but DM is predominating among the participants (see Table 4.8 & 4.9). It implies that the majority of those Vietnam students desire to learn CCW for the sake of understanding, but if a student has a higher level of SM, he or she has a lower level of DM, and vice versa. The result shows that year 4 students had the highest mean of SM (10.43). As graduates, they consider more about finding a job, and desire to reach a certain level of CCW to help their future career, thus, they focus more on attaining the external goals.

Some researchers believe that surface learning approach has a negative relation with learners' performance, in the opposite, the deep learning approach affects in a higher quality of learning though it may not directly lead a higher grade in a task assessment (Hasnoor, Ahmad, & Nordin, 2013; Mayya, Rao, & Ramnarayana, 2004). Confirmed with the hypotheses, CCW DM has a significant positive relation with the CCW performance ($r = .16$, $p < .01$); in contrast to DM, CCW SM has a significant negative relation with the CCW performance ($r = -.16$, $p < .01$). The CCW strategies also echo an inverted relationship with two motivation scales. As it is known from previous studies, motivation has a significant role in determining the use of L2 learning strategies (Chang and Liu, 2013; Cohen & Dörnyei, 2002; Hung, 2007; Oxford & Shearin, 1994; etc.). Higher motivation directs people to use more LLS (Oxford& Nyikos, 1989; Oxford & Shearin, 1994; ect). Learners with SM often try to avoid failures, but don't want to work too hard. They focus more on "selected details and reproduce accurately". Inversely, learners with DM are driven by self-satisfy curiosity and often to use deep-level strategies to maximize their understanding (Biggs, 1992, p.16). While SM negatively affected both CCW strategies factors, DM is prevalent and has a positive relationship with them. In addition, DM has an expected compatible relationship

with higher level strategies. Among the learners, DM shows a stronger pattern with F1 indirect strategies ($r = .51$, $p < .01$). That is a coherence with the result of which F1 has a stronger relationship with the performance than F2. As most items in F1 are metacognitive strategies, it suggests that metacognitive strategies can convincingly affect the success in CCW. The correlation between motivation and the choice of learning strategies, especially metacognitive strategies, do exist in EFL setting. Chang and Liu (2013) did a study to investigate the relationship between motivation and LLS among Taiwan EFL learners. They find metacognitive strategies have the highest correlation with motivation. Many other studies also provide evidence that highly motivated learners use more LLS in the metacognitive category than lowly motivated learners (Setiyadi, Sukirlan & Rahman, 2016).

Overall, the result reveals that learners are more motivated in terms of intrinsic interests (DM). learners with those DM tend to immerse themselves in using F1 indirect strategies and has a better performance in CCW.

5.3.3 Mediating role

Studies on L2 learning strategies and motivation also have been well documented. Researchers generally accept that learning strategies and success in different learning programs or subjects are related to each other (Duckwall, Arnold, & Hayes, 1991). Although it is widely agreed that motivation and the frequency of using LLS can predicate the learners' L2 achievement (Oxford, Park-Oh, Ito and Sumrall, 1993), motivation may not directly lead to a higher grade in a task assessment (Hasnoor, Ahmad, & Nordin, 2013). There are studies that point out LLS as a mediator in language learning. For example, Setiyadi and her coworkers (2016) did an empirical study and concluded that motivation would predicate learning success through the mediation of the use of metacognitive strategies. Also, learning strategies in specific aspects of language learning have been identified as a mediator factor

that explains the relationship between motivation and knowledge learning, such as collocation learning strategies in Arabic language learning (Asbulah, et.al., 2020).

From the previous discussion, we know that motivation, learning strategies, and CCW performance are intercorrelated, and the relation between them is basically in line with the findings of previous research, but the mediating role of learning strategies in the CCW learning process has not been explored yet. Thus, whether motivation predicates the use of CCW learning strategies and the indirect effects of CCW motivation on the CCW performance have been examined via SEM path analysis. However, the findings in the current study indicate that CCW motivation has no significant indirect effect on CCW performance via CCW learning strategies. The possible explanation might come from two sides.

First, the dictation score has limitations and didn't provide enough information about learners' CCW performance with only 24 Chinese characters. To assess learners' CCW performance, researchers often obtain data from spontaneous writing or free writing, copying tasks, and writing-to-dictation tasks. Each of these has its' own limitation. For example, a copy task focuses on the orthographic form and mainly tells the copying ability of learners, and in free writing, learners may choose to write characters that they know but consciously avoid those unknown or unfamiliar ones. Because the main processing routes of writing to dictation involve the orthographic, phonological, and semantic system of Chinese characters (Han, Song & Bi, 2012), it is the best choice for us under the time and recourse constrains. However, 24 Chinese characters are very limited, and only the writing accuracy (error rate) is concerned. Actually, the writing errors may provide a better window to investigate the knowledge transition of learners, i.e., the graphic errors from stroke aspect or logographeme or radical aspect, and phonetic errors from confusion with homophones. Thus, the writing

errors analysis should be considered in the future research. All in all, the dictation characters are not sufficiently large to give adequate information of learners' CCW performance.

Concurrently, CCW learning strategies are divided into the indirect strategies and the knowledge-based strategies, and CCW largely relies on the F2 knowledge-based strategies, which are more fundamental "bedrock strategies". Those bedrock strategies are unavoidable in Chinese character teaching and learning, all learners must, more or less, involve in these fundamental knowledge-based strategies in their learning. It is a plausible explanation for which our CSL learners are more likely to adopt those basic strategies and use them to a certain extent, regardless of whether they have a high- or low-level motivation. The pathway from DM to the two factors partially implied that basic knowledge-based strategies are not significantly affected by learners' motivation. DM, which often positively promotes learners use of learning strategy (Biggs, 1987; Gijbels et al. 2005; ect.), shows no significant effect on the F2 knowledge-based strategies, though it still has a significance toward the F1 indirect strategies (β=.47, $p < .001$). Consequently, the indirect effects of CCW motivation on the CCW performance is not obvious or remarkable in the CCW learning process. The mediating role of CCW learning strategies in the learning process was not subsequently approved in our analysis. However, there is another factor of strategies, F1 the indirect strategies. Its tendency of motivation toward CCW strategies using, then lead to CCW performance, is observed (DM had a strong effect to F1). Also, SM has an inverse relationship toward both F1 and F2 factors. Thus, whether motivation can predicate CCW performance through the mediation of the use of CCW learning strategies will remain as a future question.

Join the above two parts together: 1. limited Chinese characters in the dictation task have no ample justification for learners' performance; 2. CCW requires some low motivation-involved and basic knowledge-based strategies, the indirect effects of CCW motivation on the CCW performance have not been shown significantly in the path analysis.

However, we cannot simply confirm if CCW motivation has a significant indirect effect on CCW performance via CCW learning strategies, because the tendency, of which learners' motivation predicated CCW learning strategies using and, in turn, learning strategies impacted CCW performance, is indicated in the correlation analysis. Hence, motivation is possible as a potential variable for learning CCW as a mediator or partial mediator; and, to claim whether the mediating role of learning strategies in the CCW learning process needs further research in future.

5.4 Practical implications

The present study extends the L2 learning strategies research to CCW, which has a special feature and requires specific strategies for CSL learners. This study develops a specific instrument CCWSI to measure CCWS and found that CCW learning strategies are mainly based on two factors, the indirect strategies and the knowledge-based strategies. The linguistic features of Chinese characters are further grouped into two subscales, the form-based strategies and the sound-meaning-based strategies, which separate the orthographic form with the linguistic function. The CCWSI and the findings have important implications for promoting Chinese character teaching and learning.

As we know, language learning strategies are teachable (Oxford, 2011; Sahyoni, 2020). Instructor-guided strategies could directly help students to learn efficiently, especially, learners in a low-level proficiency strategy choosing could be more rely on instructor-guided elaboration (Shen, 2005). The CCWSI provides an efficient way for instructors to gain a general and comprehensive picture of learners' CCW learning strategies.

When learners learn how to write Chinese characters, they have to encounter character knowledges. In the traditional teaching approach, rote repetition is the primary strategy and is

often encouraged by Chinese teachers for learning Chinese characters (Wu, Li, & Anderson, 1999).

For intermediate or high-level classes, it seems reasonable to assume that students would have already known this or that, such as phonetic and semantic radicals. However, students may learn not what teachers think they should learn, but what they perceive the task to demand of them. From the process of evaluation, instructors can capture a great idea about learners' performance limitations and deficiencies, as well as disclose their deep needs. The findings provide evidence and guideline for instructors to prepare or adjust their teaching materials and approaches in order to improve the efficiency and effectiveness of in-class teaching. Based on learners' employment of CCW strategies, instructors can target learners' specific needs in CCW.

Specifically, for learners in low-level proficiency, strategy choosing could be more rely on instructor-guided elaboration. Because Chinese is less accessible from its sound-print mapping and many Chinese characters are visually similar (e.g., 十，千，土，and 士), to the novices from alphabetic language background, they often view Chinese character as a "picture" which are easily visually confusable and often cause difficulties for them to dismantle and decode a character. For those learners, instructors may prove their strategies using in knowledge-based category, and the basic orthographic form-based strategies should be emphasized for them. The visual cues of Chinese characters should be pointed out. For example, the following strategies were proposed to enhance CSL learners' CCW by promoting their understanding of the complexity of the graphic configuration of Chinese characters:

1) Q1 and Q5: dismantle a character into smaller units or components, such as strokes and logographemes; make sure learners look at them carefully and can distinguish the similar strokes and stroke patterns (e.g., distinguish "乙" and "乁"in "亿" and "气").

2) Q5 and Q10: introduce simple characters with only one component for students (e.g., “日” and “月”) before teaching compound characters that contain more than one characters (e.g., “明”).
3) Q5 and Q6: dismantle a character and emphasize how the positions of logographemes (e.g., “叶” consists of “口” and “十”; it is a left and right structure; “口” is on the left side, and “十” is on the right side).
4) Q4 and Q10: enlarge learners’ vocabulary by helping them to group characters with similar orthographic forms and associate characters with the same components or same simple characters (e.g., “大” ， “天” ， “太”, “木”, and “林”).

In CCW, although learners output characters’ orthographic form, the linguistic functions also should be emphasized in the teaching. Learners could implicitly learn the stroke forms of legal radicals and characters, but they simultaneously encode the meaning of the functionality of radicals (Wang, et al., 2003). Shen (2004) suggested that rote memorization (shallow processing) was not an efficient way to study Chinese characters, but meaning and sound elaborate rehearsal (deeper processing) lead to a better retention and recall for learners. Therefore, learners should realize that CCW decoding process seems to be on the visual orthographic level, but it doesn’t only simply rely on rote memory or single skills. It simultaneously involves visual symbols, phonological codes, and semantic codes of Chinese characters. For instructors, while paying attention to orthographic form correction in CCW teaching, that is also important for them to repeatedly present the other two linguistic features of Chinese characters (sound, meaning) to facilitate the associative relation between three linguistic features of Chinese characters. For example, the instructors may explain the etymology of characters if applicable and help CSL learners to develop the capability to analyze the radicals. Examples of a same radical group should be consistently given in order

to enlarge learners' characters vocabulary and increase lexical. Some higher-level strategies (i.e., sound-meaning-based strategies) require learners to accumulate a substantial amount of characters before they can be used effectively and efficiently. The instructor-guided elaboration could be more important for learners to develop their own explicit concepts about the linguistic features of Chinese characters and to create a linkage between graphic and linguistic features (Shen, 2004). Instructors can ask questions to guide students to analysis a new character step by step: "how to say the character?"; "pay attention to the pronunciation of the character. Any homophone?"; "what does the character mean?"; "is it a phonetic-semantic compound character. Which radical is phonetic, and which is semantic?"; "please take a look at the character. Recall the characters that we have learned before."; "which component (radicals or logographemes) is exactly the same as in the new character?" (Q12, Q15, Q17, and Q18). As mentioned earlier, some syllables correspond to more than 10 characters and homophones inhibit Chinese character recognition and production. Instructors may provide a two-syllable word, or examples use in different contexts to help learners to identify specific characters (Q16), such as "衣，衣服的衣" and "医，医生的医". This strategy provides deeper processing and results in longer-term memory. In a word, instructors should help learners to remain anchors of the previously learned knowledges and create a bond with new ones. With guided elaboration encoding processes, learners can retrieve additional information which associates prior knowledge with the new characters. However, in order to maintain a long-term retention, further review is required shortly after the learning. That corporate with metacognitive strategies in another main factor of CCW learning strategies, the indirect strategies.

As knowledge of Chinese characters is the main part of Chinese character teaching in the classrooms, the indirect strategies were less favored by learners and might be overlooked in daily teaching, though they show a strong connection with performance. As most items in F1

are metacognitive strategies, it implied that metacognitive strategies can convincingly affect the success in CCW. Because the development of metacognitive strategies directly contributes to the learning outcomes (Shen, 2005), teachers may periodically review and encourage students to do study plans (such as preview, review, and reflection). For example, teachers may facilitate a fixed periodically learning reflection meeting with an individual or a group of learners. At the same time, teachers should provide more social opportunities and encourage students to take more opportunities to write Chinese characters inside or outside the classroom in order to induce the students to become self-empowered learners. For example, if capable, teachers may promote a language partner program and provide opportunities for learners to write letters in Chinese; or they provide a rewarding system for learners where applicable in their teaching situation.

Meanwhile, the significant direct effects of learning strategies on CCW performance, and motivation on learners' learning strategies provide consistent evidence with the previous studies to support the important role of CCW learning strategies in the CCW learning process. Giving this finding, it is also important to integrate learning motivation and strategies. The empirical studies about the correlation between motivation and the choice of learning strategies are done in many L2 settings, such as Taiwan (Chang and Liu, 2013), Thailand and Vietnam (Khamkhien, 2010), and Indonesia (Setiyadi, et al., 2016). The evidence of which different levels of learning motivation impact their strategy use, in turn, have effects on learning success, do exist in L2 settings. Our results show that DM positively affects learning strategies, and SM is in an opposite way. Learners are more motivated in terms of intrinsic interests. Thus, it seems appropriate to infer students' motivation from their interesting. Instructors can employ various ways to increase such motivation in the classroom. First, the most direct way is to aim learners' learning experience, i.e., to well design CCW teaching and make learning not only interesting and fun, thus, increasing

learners' desire to learn. Second, instructors or educators can promote expectancy for success by helping learners to develop specific and realistic goal about CCW in a certain period; review and provide feedback consistently. At the same time, the sufficient support to learners for copying the difficulties of CCW is very important. While well designing a high-quality and level-appropriate teaching material, the learning task as well as in- /out- classroom activities, instructors must offer ongoing assistant for learners to enrich learning confident. There are more, such as developing learners' linguistic and cultural interests of Chinese characters and CCW, promoting learners' awareness of the value of CCW and encouraging more engagement in CCW, and so on. In a word, instructors' interventions should increase learners' intrinsic interests, then, enhance CCW learning strategies.

To sum up, CCWSI and the current findings provide valuable practical implications for the CSL area. One part of CCWSI implies that the linguistic features of Chinese characters and the cognitive process of writing influence students in employing strategies. Basing on the findings of this part, instructors can help learners to enhance their Chinese character knowledge in order to better transform knowledge in to CCW practice. Another part of CCWSI is useful tool for instructors to induce learners to become self-empowered learners. Noteworthy, to enrich and deepen the understanding of the CCW learning process, the present study suggests that practitioners should inspirit learners' intrinsic interests. The intervention of learners' DM produces a much more significant effect on promoting learners' interest or enjoyment toward CCW. By giving the personal learning experience from intrinsic interests, motivation can play an influential role in using CCW learning strategies and enhancing CCW achievement.

5.5 Summary

The present study first develops an inventory (the CCWSI) for identifying how learning strategies in the context of CSL CCW setting is classified; and, how the CCW learning strategies interact with motivation and CCW performance. It is found that 2 main factors of CCW learning strategies existed, F1 indirect strategies and F2 knowledge-based strategies. The factors are classified by whether they contributed directly or indirectly to CCW. F1 strategies are applicable to L2 learning in other languages. F2 knowledge-based strategies reveal the linguistic features of Chinese characters and the characteristics of CCW. The subscales of F2 (the form-based strategies and the sound-meaning-based strategies) indicate that CCW could be routed into the orthographic lexicon as well as the phonological and semantical lexicons. That also implies that the orthographic processing of CCW might separate the orthographic constraints with the linguistic function that are conveyed in lexical radicals. Adopting Bigg' (2001) 3P model, the present study also examines the role of CCW learning strategies in CSL CCW learning process. The correlation analysis demonstrates the significant direct effects of learning strategies on CCW performance, and motivation on learners' learning strategies. The variables of the CCW learning process are interrelated and interacted. Our formulated hypotheses prove that DM promoted CCW learning strategies, especially the indirect strategies, and fostered a better result in CCW performance, though the mediation analysis does not show a significant indirect effect via CCW learning strategies. Except the mediating role of CCW learning strategies in the learning process is still questionable and requires our further investigation, educators should consider that motivation effective on CCW learning strategies. From the pedagogical perspective, instructors' interventions should increase learners' intrinsic motivation, promote their use of effective strategies, and help them to achieve a better performance in CCW.

Chapter 6 Contribution, Limitations, and Future Research

This chapter includes three main parts. First, we present what the present study has contributed to enrich Chinese character learning and teaching as well as CCW research. Second, we clarify the limitations of this study. Last but not least, we discuss a series of extended topics for the future research.

6.1 Strengths and contribution of the present research

CCW learning strategies are influential in Chinese character recognition and production. The present study not only has developed a pioneering inventory, CCWSI, to measure CCW learning strategies, but also investigated the role of CCW learning strategies in CCW learning process by adopting 3P learning model. The present study contributes to enrich CCW research and practical implications in the CSL Chinese character research area by particularly filling in the following gaps.

1. *Extending previous Chinese character learning research by developing and validating an effective inventory (CCWSI)*. There is no validated instrument for effectively measuring CCW learning strategies in previous studies. CCW learning strategies are often included in Chinese character learning strategies. The present study develops CCWSI which is a pioneering inventory to focus on CCW learning strategies among CSL learners and filled the research gap. Comparing with the existing instruments for Chinese character learning strategies, CCWSI not only uses the quantitative method to investigate the internal consistency reliability but also focuses on analysis primarily on the internal construct validity of the instrument. The reliability coefficients for all the scales and subscales are above .70, which indicates a reliable and stable construct. Meanwhile, the models are built and the internal construct validity of the CCWSI was tested by the CFA. The absolute and

comparative fit indices indicate that our instrument has a good internal construct validity among the CSL learners.

2. *Extending previous Chinese character learning research by exploring the underlying factors of CCW learning strategies.* The discovered internal structure of CCWSI has two orders/layers. The first order has two factors that explored the cognitive process of CCW while the second order has two subscales that reveal the orthographic and linguistic properties of Chinese characters. The finding supports that the bind of the orthographic form with other two linguistic properties (the phonological and semantic function) in the traditional orthographic knowledge of Chinese characters should be separate in CCW. That has further substantiated the claim of Tong and McBride (2014) which suggest to only embrace constraints of implementing Chinese writing in the concept of Chinese orthographic processing. This encouraging finding provides possible direction and research potential for the Chinese character recognition and production. Overall, investigations on these underlying factors of CCW learning strategies disclose how the knowledge of Chinese characters associates with the practice of writing Chinese characters, thus, specify the predictors for CCW by CSL learners.
3. *Extending previous Chinese character learning research by investigating the role of CCW learning strategies in the CCW learning process.* By adopting and modifying Biggs' 3P model, the present study synthesizes the most important factors of CCW learning process (motivation, CCW strategies, and performance) and captures a good deal of how the variables are interconnected. The coherent and insightful picture of CCW learning process presents the important and recessive cues for the relationship of the main elements that shaped CCW learning strategies. Starting from the CCW learning process, the present research contributes a good starting point for stimulating

future studies to include more variables (e.g., Presage variables from learner side and teaching context). The inherent integrative CCW 3P framework gives the multilevel and interdependent base to incorporate variables in the complex process of CCW learning.

4. *Contributing to enrich CCW research and CSL educational practice*. First, developing of CCWSI for researchers, instructors/practitioners, and learners offers an easy-to-use tool for them to collect valuable information about learners' CCW learning strategies. For instructors, measuring learners' CCW learning strategies gains a deeper insight into their students' strong and weak points in order to provide them with quick feedbacks and better individual supports. The on-time intervention form instructors could be a positive and direct effect on learners' area of identified deficiency and efficiently affects components within the targeted factors of CCW learning strategies, ultimately improve learners' performance with a long-term retention. For learners, they may not only uncover their individuals' learning behavior, but also reflect and rethink their CCW learning by responding CCWSI items. Knowing their shortages and recruiting more efficient learning strategies help learners to gain a mastery of CCW. For researchers, CCWSI could help them to obtain a large-scale self-report data in an easier way. Furthermore, the present study provides important evidence to demonstrate that deep motivation significantly predicates learner's learning behaviors. By targeting and improving congruence between CCW motivation and CCW strategies, practitioners gain deeper insight into their students' formation of learning strategies, reexamine their Chinese program and curriculum, refine their CSL pedagogy accordingly. Impressively, the present study provides a clear picture to show the complex process of CCW learning. The coherent explanation of learning process enhances learners' ability to Chinese language

learning by improving and promoting the core components of CCW learning process. Researchers may carry out an in-depth investigation of CSL Chinese character recognition and production, based on the current study. Overall, by use of the construct validity inventory and the dynamic concept framework, the present study not only provides more practical implications for CSL learning and teaching, but also contributes to Chinese character research.

To sum up, the present study extends previous Chinese character learning studies by separating CCW learning strategies from Chinese character learning strategies which embrace both Chinese character recognition and production. In order to measure CCW learning strategies among CSL learners, a pioneering inventory, CCWSI, has been developed. Echoing with previous Chinese character learning studies, the internal structure discloses the cognitive process of CCW and the characteristics of Chinese characters. Importantly, the subscales provide supporting evidence of separating the orthographic form with the Chinese character linguistic functions. That's different from the traditional orthographic knowledge of Chinese characters and promotes the future studies in the field. Moreover, the present research demonstrates the effectiveness of the combined CCW motivation, learning strategies and performance in a comprehensive and dynamic system which was based on 3P model. The findings reveal the congruence of the deep motivation on the use of CCW strategies. The important role of CCW strategies in the CCW learning process has significant implications for future studies and educational practice.

6.2 Limitation

Despite the above-mentioned contribution by the present study, several limitations have to be taken into consideration for more appropriate interpretations and implications of current findings in future studies.

First, although the present study distinctively develops CCWSI, the instrument is aimed for various groups, which may vary in proficient level, age, culture, and so on. As everyone knows, the language learning, including CCW learning, is a complex process that involves many different parties and variables, such as teachers and learners, the learning environment and the teaching context, and so on. The present study is not intended to cover a full picture or all variables in CCW learning, but only a major part of CCW learning process from learners' perspective. The specific differences of learners are not included, and the possible effects of these variables remain untested.

Second, the presented study observes CSL learners of varying proficiency levels, but does not look at variables over an extended period of time. The captured picture of the development between variables may be limited. The intervention effectiveness for CCW learning strategies or motivation have not been tested in this study.

Third, the sample size of the present study is not small in CSL field and meets the requirement for the EFA and CFA analysis, but comparing with other quantitative studies in education filed were tested in a large scale data, i.e. R-SPQ-2F had 229 participants in the testing and refinement process and 495 responses for the final testing (Biggs, Kember & Leung, 2001), the sample size is relatively small. Because of the sample size limitation, in the main phase of the study, 50% of the sample size (half of the 339 participants from four Vietnam Universities) is randomly selected to reexamine EFA and 100% of the sample size is used in CFA to ensure the internal structure of CCWSI. The sample size is sufficient according to the five-participant-per-variable (Streiner, 1994) and 10 participants by item rule for samples size more than 100, but if a stronger data, we would randomly split the data into two sets, then, use 50% for EFA and another 50% for CFA.

Moreover, the present study is conducted by a quantitative method. The items of CCWSI are collected and referred to previous Chinese character learning strategies, and

CCW motivation items are adopted from Bigg's R-SPQ-2F motive items which originally aimed to learners from a variety of subjects, though we had modified them to focus on CCW. Hence, qualitative method to capture participants thoughts or opinions towards CCW are not included.

Last, because of resource limitation, we only use a dictation task to assess the learners' CCW performance. Only the writing accuracy (error rate) of 24 Chinese characters do not provide enough information about learners CCW performance. Error analysis of characters written is not performed. And other assessments of CCW performance, such as spontaneous writing and copying tasks, are not involved. In a word, the assessment of CCW performance is not comprehensive enough. That's one of the possible reasons for which the indirect effects of CCW motivation on the CCW performance have not been shown significantly in the path analysis. It remains uncertain about CCW learning strategies as a medicator factor in CCW learning process.

6.3 Future Research

Based on the findings of the present study, it is meaningful and worthwhile for our future study to investigate the following important areas:

1. *Test the other variables in the CCW 3P framework*. By incorporating variables in the complex process of CCW learning and good practice of enhancement strategies, the future studies will make valuable progress in cultivating positive academic competence of CSL learners at various school levels.
2. *Test the effectiveness of CCW learning strategies.* Learners in different levels may employ different learning strategies. By exploring the effectiveness of CCW learning strategies, researchers can identify a variety of pedagogical implications for

practitioners and learners and the results of research can be applied to real-life practice in CSL education. In the meantime, there are items frequently used among CSL learners, but excluded from CCWSI according to the EFA and CFA results, such as Q2 and Q27. They will require a further confirmation. A mixture of qualitative methods, such as think-aloud method, case study, and interview with learners; also instructors could be introduced and enable to help to revise those item statements.

3. *Extend the form-based and the sound-meaning-based learning strategies to test the orthographic awareness in Chinese character production*. Regarding the recent claim that Chinese orthographic processing should only embrace constraints of implementing Chinese writing, such as "positional constraints of stroke patterns", but not include phonology and semantics, may have a facilitative effect on Chinese character learning (Tong & McBride, 2014). Because the orthographic processing indicates learners Chinese text comprehension (Leong, et al., 2011), it's beneficial for future studies to explore deeper about the relationship between CCW learning strategies and learners' development of orthographic regularity and their orthographic processing. The future studies may be conducted with an analysis of characters. The error pattern analysis will provide us more information to examine learner orthographic processing.
4. *Test CCWSI for traditional Chinese characters.* From 1950s, the simplified Chinese characters have been widely used, while simultaneously, traditional Chinese characters still used in Hong Kong, Taiwan and Macau. In general, since the two Chinese writing systems share structures, the CCW learning strategies from simplified characters should also be generalizable to traditional characters to a large extent. However, traditional and simplified Chinese characters differ most importantly in their visual-orthographic properties, though they also differ at several other levels

(McBride, et al., 2005). Traditional characters contain on average approximately 22.5 % more visual feature information than simplified characters (Gao & Kao, 2002). Learners' visual skills and their orthographic knowledge of characters may have been shaped differently in depth at both behavioral and neurobiological levels (McBride, 2016; Yang and Wang, 2018). That's further affect learners' learning strategies choosing. That could be a particularly interest research topic in the future study.

5. *Develop and validate a CCW motivation inventory*. The current CCW motivation items were modified from Bigg's R-SPQ-2F motive items. More studies are needed to expand CCW motivation research and investigate the indirect effects of CCW motivation in the CCW learning process.
6. *Strengthen implementation of CCWSI and extending sample sizes to a larger number of students*. The current study found the two main factors of CCW learning strategies. The lower-level subscales were identified in the knowledge-based strategies. A larger sample-based studies may help to investigate the subscales under the indirect strategies. Ideally, we hope to examine and re-examine our inventory in large-scale cross-national and cross-age groups in future studies.
7. *Longitudinal research and intervention experimental study.* In the present study, data collection is from 3 level learners at one specific point in time. The further longitudinal research is necessary to observe over a period of semesters in order to test the long-term impact of the reciprocal relationships between these variables under 3P CCW learning model, such as CCW motivation on learning strategies, CCW learning strategies on Chinese character learning outcome, etc. Also, it is worthwhile for future studies to take account of the CCW motivation and learning strategies in developing classroom-based intervention. Hence, the empirical finding about the

effectiveness of learning strategies and motivation, and the development patterns in CSL setting would provide valuable complementary data for practitioners and researchers.

6.4 Conclusion

The present study is built on the interest in CCW learning strategies and emerging the factors of CCW learning process. CCWSI offers a tool for describing and analyzing the particular CCW learning strategies, which CSL learners employ in their CCW learning by taking account of CCW motivations and related to learning outcomes, which are aspects in Biggs' 3P model. It provides us a better understanding of CCW learning approach, and helps to explain why CSL learners adopt specific CCW strategies, and draws a wholistic picture of CCW learning process. Despite some limitations, the present study expands the previous work on Chinese character learning and CCW learning strategies in CSL settings and provides a good starting point for investigating CCW learning strategies. As such, more future studies are encouraged to broaden our current scope to gain a much deeper understanding of the dynamic function of CCW learning strategies in enhancing CCW and fostering Chinese character learning among CSL learners.

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Appendix A: Questionnaire（ Chinese and Vietnamese version）

第一部：基本资料问卷 （请用中文填写）

Phần I: Thông tin cơ bản

1、年龄 Tuổi : _____

2、性别 Giới tính: _____

3、年级 Bạn là sinh viên năm thứ: _____

4、母语 Tiếng mẹ đẻ của bạn: _____

5、是否华裔 Bạn có phải là Hoa kiều không?_____

6、家庭使用的语言 Ngôn ngữ sử dụng trong gia đình bạn：_____

7、你学过的其他外语（例如：英语、法语、西班牙语、日语、韩语等等） Những ngoại ngữ mà bạn đã từng học (VD: tiếng Anh, tiếng Pháp, tiếng Tây Ban Nha, tiếng Nhật, tiếng Hàn…):

_____

8、你学习中文有多久了？ Bạn đã học tiếng Hán bao lâu rồi?

_____

1. 你学中文的目的是什么？ Mục đích học tiếng Hán của bạn là gì?

_____

_____

_____

11、 你觉得自己的中文水平在班级中排名如何？（请在以下答案中选择一个）
Bạn tự đánh giá trình độ tiếng Hán của mình như thế nào so với các bạn cùng lớp (chọn một trong những phương án sau)

A. 在 25% 以下； Dưới 25%

B. 在 25%-50% 之间； Trong khoảng 25% đến 50%

C. 在 50%-75% 之间； Trong khoảng 50% đến 75%

D. 在 75%-90% 之间； Trong khoảng 75% đến 90%

E. 高于 90%；Trên 90%

第二部:书写汉字策略问卷

Phần thứ 2: Phiếu khảo sát phương pháp/chiến lược viết chữ Hán

这问卷内的问题是关于你对汉字书写的策略。

实际上没有一种所谓「正确」的研习方法. 本问卷全在乎它是否切合你个人书写汉字的策略。你对每一条问题诚实作答是很重要的。

请选择最适合的答案。不要花太长时间在一条问题上：你的第一个反应往往是最好的。请回答所有问题。

① 这对我而言，完全不适用或甚少适用。
② 这对我而言，有时适用。
③ 这对我而言，大概一半时候适用。
④ 这对我而言，常常适用。
⑤ 这对我而言，一直适用或差不多一直适用。

Những câu hỏi sau đây khảo sát về phương pháp/ chiến lược viết chữ Hán của bạn

Trên thực tế không có khái niệm "đúng/sai" về phương pháp học tập. Điều chúng tôi quan tâm là nó có thực sự phù hợp với chiến lược viết chữ Hán của cá nhân bạn không.

Bạn hãy chọn đáp án phù hợp nhất. Hãy trả lời bằng đáp án đầu tiên mà bạn nghĩ tới, không dành quá nhiều thời gian cho một câu hỏi khảo sát. Phiền bạn hoàn thành tất cả các câu hỏi của phiếu khảo sát.

① Đối với tôi, điều này hoàn toàn không phù hợp để áp dụng hoặc rất ít áp dụng
② Đối với tôi, điều này phù hợp để áp dụng trong một số trường hợp
③ Điều này này đối với tôi tần suất áp dụng là khoảng 50%
④ Điều này đối với tôi là thường xuyên
⑤ Điều này với tôi là luôn luôn hoặc gần như là luôn luôn.

完全不适用或甚少适用 有时适用 大概一半时候适用 常常适用 一直适用或差不多一直适用

1. 书写汉字时，我会注意笔画是否正确 （如 “亿”中的 “乙”和“气”中的“乁” 不同）。 ①②③④⑤
Khi viết chữ Hán tôi chú ý sự chính xác tuyệt đối của các nét chữ (ví dụ nét 乙 trong chữ 亿 khác với nét 乁 trong chữ 气)

2. 书写汉字时，我按照笔顺书写汉字。 ①②③④⑤
Tôi luôn tuân thủ đúng quy tắc viết chữ Hán

3. *书写汉字时，如果写到一半忘记笔画我就通过猜测来写完。 ①②③④⑤
Khi viết chữ Hán giữa chừng quên nét, tôi sẽ viết nốt nó bằng cách đoán mò

4. 学习汉字书写时，我会把字形相近的汉字放在一起进行比较 （如 〞木〞〞太〞〞大〞）。 ①②③④⑤
Khi học viết chữ Hán, tôi so sánh những chữ có hình dạng gần giống nhau (so sánh các chữ cận hình)

5. 学习汉字书写时，我会注意汉字的部件（如“能”由 “厶”、“月”、“匕”、 “匕”组成)。 ①②③④⑤
Khi học viết chữ Hán, tôi chú ý các bộ phận cấu tạo nên chữ (ví dụ: chữ 能 do 厶, 月, 匕 và 匕 hợp thành)

6. 学习汉字书写时，我会注意汉字的结构（如：“哲”、“夜”、“挚”，“势”等字，都是上下结构，而不能写成左右结构)。 ①②③④⑤
Khi học viết chữ Hán, tôi chú ý đến kết cấu của chữ (ví dụ chữ 哲, chữ 夜, chữ 挚 và chữ 势 đều có kết cấu trên – dưới nên không được viết theo kết cấu trái- phải)

7. 我会通过手指空写的方法练习书写汉字（手指空写指 学习者用手或笔在空中书写汉字)。 ①②③④⑤
Tôi thường luyện viết chữ Hán bằng phương pháp vẽ trong không trung (là cách người học dùng ngón tay hoặc bút viết chữ Hán trong không trung)

8. 我通过描摹汉字字帖的方法，学习汉字书写。 ①②③④⑤
Tôi học viết chữ Hán bằng phương pháp tô lại các chữ trong bảng chữ mẫu.

9. 我反复书写单个汉字，硬记汉字怎么书写。 ①②③④⑤
Tôi viết đi viết lại từng chữ Hán, cố gắng ghi nhớ cách viết của chữ đó.

完全不适用或甚少适用 有时适用 大概一半时候适用 常常适用 一直适用或差不多一直适用

10. 学习汉字书写时，我注重在生字和已知形近字之间建立联系。 …….... ① ② ③ ④ ⑤
Khi học viết chữ Hán, tôi chú trọng tìm ra liên hệ giữa chữ mới với những chữ đã từng học có hình dạng gần giống .

11. 我在课堂上注意观看老师书写汉字。……..... ① ② ③ ④ ⑤
Trong giờ học, tôi chú ý quan sát cách thầy/cô giáo viết chữ Hán.

12. 学习汉字书写时，我注重汉字读音，在生字和已知同音字、近音字之间建立联系（如“耶”（ye1）、“爷”(ye2)、“也”(ye3)、“叶”(ye4)等）。 …….... ① ② ③ ④ ⑤
Khi học viết chữ Hán, tôi chú trọng âm đọc của chữ, tìm ra liên hệ giữa chữ mới với chữ đã từng học có cách đọc giống hoặc gần giống.

13. *书写汉字时，遇到不会写的汉字，我会用拼音来书写。……..... ① ② ③ ④ ⑤
Trong khi viết, nếu gặp những chữ Hán mình không biết viết tôi sẽ sử dụng hình thức phiên âm.

14. 书写汉字时，我会边念写。……..…….... ① ② ③ ④ ⑤
Khi viết chữ Hán, tôi thường vừa đọc vừa viết.

15. 学习汉字书写时，我注重在生字与具有相同声符的已知汉字之间建立联系（如“把”“吧”“爸”有相同的声符“巴”）。 …….... ① ② ③ ④ ⑤
Khi học viết chữ Hán, tôi chú trọng mối liên hệ giữa chữ mới với chữ đã biết có cùng bộ phận biểu thị âm đọc (ví dụ: chữ 把，吧 và 爸 có cùng bộ phận biểu thị âm đọc là 巴)

16. 书写汉字时，我会通过组词找回汉字(比如通过“医生”而找回“医”)。 …….... ① ② ③ ④ ⑤
Khi viết chữ Hán, tôi nhớ ra cách viết của nó nhờ việc coi nó là thành tố cấu tạo từ ghép (ví dụ: viết được chữ 医 thông qua từ 医生)

17. 书写汉字时，我注重在生字和已知同义、近义字之间建立联系（如“看”、“望”、“瞧”、“盯” 等都有“看”的意思)。 …….... ① ② ③ ④ ⑤
Khi viết chữ Hán, tôi chú trọng mối liên hệ giữa chữ Hán mới với các chữ đã biết có cùng nghĩa hoặc gần nghĩa. (Ví dụ: các chữ 看，望，瞧，盯 đều có nghĩa là “nhìn”)

	完全不适用或较少适用	有时适用	大概一半时候适用	常常适用	一直适用或差不多一直适用
18. 书写汉字时，我注重在生字和具有相同意符的已知字联系起来（如“妈”“姐”“妹”“奶”“姨”“姑”有共同的意符“女”；“你、们、他”有共同的意符“亻”）。 Khi viết chữ Hán, tôi chú trọng mối liên hệ giữa chữ Hán mới với chữ đã biết có cùng bộ phận biểu thị ý nghĩa. (ví dụ: các chữ 妈，姐，妹，奶，姨，姑 có chung một bộ phận biểu nghĩa là 女; chữ 你，们 có chung bộ phận biểu nghĩa là 亻)	①	②	③	④	⑤
19. 学习汉字书写时，我有清晰的目标。 Khi học viết chữ Hán tôi có mục tiêu rất rõ ràng.	①	②	③	④	⑤
20. 我制定了书写汉字的学习计划（例如每天练习书写 10 个汉字）。 Tôi đã đặt ra cho mình kế hoạch học viết chữ Hán (ví dụ mỗi ngày luyện viết 10 chữ Hán)	①	②	③	④	⑤
21. 我检验书写汉字的学习计划，反思学习进程。 Tôi kiểm nghiệm, đánh giá rút kinh nghiệm đối với tiến độ và kết quả thực hiện kế hoạch học viết chữ Hán của mình	①	②	③	④	⑤
22. 我注意自己书写汉字时犯的错误，并努力不再犯错。 Tôi chú ý đến các lỗi mình mắc phải khi viết chữ Hán, đồng thời cố gắng để không tái phạm những lỗi đó.	①	②	③	④	⑤
23. 我常常鼓励自己书写字 。 Tôi thường khuyến khích bản thân viết chữ Hán.	①	②	③	④	⑤
24. 在上课前，我预习书写新的汉字。 Trước khi lên lớp, tôi tập viết trước những chữ mới sẽ học trong bài.	①	②	③	④	⑤
25. 我对学过的汉字进行自我书写测试，或请其他人帮我做测试。 Tôi tự kiểm tra hoặc nhờ người khác kiểm tra khả năng viết chữ Hán của mình đối với những chữ đã học.	①	②	③	④	⑤
26. 我尝试寻找记忆书写汉字的最好办法。 Tôi thử nghiệm tìm ra phương pháp tốt nhất để ghi nhớ cách viết chữ Hán.	①	②	③	④	⑤

完全不适用或很少适用 有时适用 大概一半时候适用 常常适用 一直适用或差不多一直适用

27. 为了帮助记忆汉字书写，我编造故事（如“楼”是“一栋木头建筑，里面有米饭与美女”）。 ……..... ① ② ③ ④ ⑤
Để hỗ trợ việc ghi nhớ cách viết chữ Hán, tôi sáng tác ra các câu chuyện (ví dụ: chữ “lầu” là nhà có xà ngang bằng gỗ, bên trong có cơm và người con gái đẹp)

28. 在日常生活交际中，我尽量书写汉字（如用汉字书写日记、写信、写电邮、写留言条等等）。 ..…….. ① ② ③ ④ ⑤
Trong giao tiếp hàng ngày, tôi cố gắng sử dụng chữ Hán (ví dụ: viết nhật ký, viết thư, viết email, viết lời nhắn… bằng tiếng Hán)

29. 我用汉字写作业、记笔记（如课堂笔记、学习笔记等）。…….…… ① ② ③ ④ ⑤
Tôi sử dụng chữ Hán để làm bài tập và ghi chép (ví dụ ghi chép bài giảng trên lớp hoặc viết nội dung học tập…)

30. 书写汉字时，遇到不会写的字，我会查字典或者词典。……..... ① ② ③ ④ ⑤
Khi viết chữ Hán, nếu gặp chữ không biết tôi tra tự điển hoặc từ điển.

31. 我会请教老师、同学和朋友，与他们讨论和交流如何学习书写汉字。 ……..... ① ② ③ ④ ⑤
Tôi học hỏi từ thầy cô, bạn học, bạn bè, đồng thời cùng họ thảo luận và trao đổi về phương pháp học viết chữ Hán

32. 我会通过游戏和多媒体软件来学习汉字书写（如展示笔划、笔顺的汉字游戏）。 ..…….... ① ② ③ ④ ⑤
Tôi học viết chữ Hán thông qua game và phần mềm đa phương tiện (ví dụ: các game về nét chữ Hán, về thứ tự viết các nét của chữ Hán)

33. 我练习汉字书法。 ……...……..... ① ② ③ ④ ⑤
Tôi luyện viết thư pháp chữ Hán

34. 如果你除了上面的书写策略以外还有其它常用的汉字书写策略，请在下面补充。（请用中文填写）
Ngoài những cách thức trên, bạn hãy bổ sung những phương pháp viết chữ Hán khác mà bạn thường áp dụng (nếu có) (Bạn hãy sử dụng tiếng Việt để điền phiếu khảo sát)

（*咨询专家的意见后删除题项）

Questionnaire（ Chinese and English version）

第一部：基本资料问卷
Part I: General Information Questionnaire

1、年龄 Age _____

2、性别 Sex _____

4、年级 Grade _____

5、母语 Mother Tongue _____

7、家庭使用的语言 Home Language_____

8、第二语言 Second Language _____

9、其他语言 Other Language(s) _____

10、你学习中文有多久了？How long have you been studying Chinese?

_____

11、 你觉得自己的中文水平在班级中排名如何？（请在以下答案中选择一个）
How do you rate your overall proficiency in learning Chinese characters as compared with the proficiency of other students in your class? (Circle one)

A. 在 25% 以下；below 25th percentile

B. 在 25%-50% 之间；between 25th to 50th percentile

C. 在 50%-75% 之间；between 50th to 75th percentile

D. 在 75%-90% 之间；between 75th to 90th percentile

E. 高于 90%；above 90th percentile

第二部分：书写汉字策略问卷

Part II: Chinese Character Writing Strategy Inventory (CCWSI)

This questionnaire has a number of questions about your strategies towards writing Chinese characters. ('Writing' means 'writing by hand'.)

There is no *right* way of studying. This survey depends on what suits your own strategies for writing Chinese characters. It is thus important that you answer each question as honestly as you can.

Please choose the *one* most appropriate response to each question. Do not spend a long time on each item: your first reaction is probably the best one. Please answer each item.

1 – This item is *never* or *only rarely* true of me.
2 –This item is *sometimes* true of me.
3 –This item is true of me about *half the time.*
4 –This item is *frequently* true of me.
5 –This item is *always* or *almost always* true of me.

这问卷内的问题是关于你对汉字书写的策略。

实际上没有一种所谓「正确」研习方法. 本问卷全在乎它是否切合你个人书写汉字的策略。你对每一条问题诚实作答是很重要的。

请选择最适合的答案。不要花太长时间在一条问题上：你的第一个反应往往是最好的。请回答所有问题。

1 - 这对我而言，完全不适用或甚少适用。
2 - 这对我而言，有时适用。
3 - 这对我而言，大概一半时候适用。
4 - 这对我而言，常常适用。
5 - 这对我而言，一直适用或差不多一直适用。

完全不适用或甚少适用 有时适用 大概一半时候适用 常常适用 一直适用或差不多一直适用

1. 书写汉字时，我会注意笔画是否正确 （如 “亿”中的 “乙”和“气”中的“ 乁” 不同）。 …….…..…. ① ② ③ ④ ⑤
When I write Chinese characters, I look carefully at the strokes (e.g. distinguish “乙” and “乁”in “亿” and “气”).

2. 书写汉字时，我按照笔顺书写汉字。…….……...……... ① ② ③ ④ ⑤
When I write Chinese characters, I follow the stroke order.

3. *书写汉字时，如果写到一半忘记笔画我就通过猜测来写完。…….…….…. ① ② ③ ④ ⑤
When I write Chinese characters, if I forget the stroke order halfway through, I will guess.

4. 学习汉字书写时，我会把字形相近的汉字放在一起进行比较 （如 〞 木〞 〞 太〞 〞 大〞）。 ……..…… ① ② ③ ④ ⑤
When I write Chinese characters, I compare characters which are similar in form (e.g. "木", "太", and "大").

5. 学习汉字书写时，我会注意汉字的部件（如“能”由 “厶”、“月”、“匕”、 “匕”组成）。 ……...…..…. ① ② ③ ④ ⑤
When I write Chinese characters, I pay attention to lographemes (e.g. “能” consists of “厶”,“月”,“匕”, and “匕”).

6. 学习汉字书写时，我会注意汉字的结构（如：“哲”、“夜”、“挚”，“势”等字，都是上下结构，而不能写成左右结构）。 ……..…… ① ② ③ ④ ⑤
When I write Chinese characters, I pay attention to the graphic structure (e.g. characters such as “哲”,“夜”,“挚”, and “势” have an upper and lower structure, but not a left and right structure).

7. 我会通过手指空写的方法练习书写汉字（手指空写指学习者用手或笔在空中书写汉字）。 ....…….…… ① ② ③ ④ ⑤
I practice Chinese characters with kinesthetic methods. (A learner uses a finger or a pencil to trace a character in the air, or above the paper).

8. 我通过描摹汉字字帖的方法，学习汉字书写。…….……..…… ① ② ③ ④ ⑤
I copy characters in a character copybook.

9. 我反复书写单个汉字，硬记汉字怎么书写。…….……..…. ① ② ③ ④ ⑤
When I write Chinese characters, I write characters repeatedly and learn them by rote.

完全不适用或较少适用 有时适用 大概一半时候适用 常常适用 一直适用或差不多一直适用

10. 学习汉字书写时，我注重在生字和已知形近字之间建立联系。 …… ① ② ③ ④ ⑤
When I write Chinese characters, I pay attention to the shape of characters, and associate new characters with those I already know that have similar shapes.

11. 我在课堂上注意观看老师书写汉字。…… ① ② ③ ④ ⑤
I pay attention to how teachers write Chinese characters in the classes.

12. 学习汉字书写时，我注重汉字读音，在生字和已知同音字、近音字之间建立联系（如“耶”（ye1）、“爷”(ye2)、“也”(ye3)、“叶”(ye4)等）。 …… ① ② ③ ④ ⑤
When I write Chinese characters, I pay attention to the pronunciation of characters, and associate new characters with those I already know that have the same or a similar sound (e.g. “耶” (ye1), “爷” (ye2),“也” (ye3), and “叶” (ye4)).

13. *书写汉字时，遇到不会写的汉字，我会用拼音来书写。…… ① ② ③ ④ ⑤
When I write Chinese characters, I use pinyin if I don’t know the character.

14. 书写汉字时，我会边念边写。…… ① ② ③ ④ ⑤
When I write Chinese characters, I say the character to myself.

15. 学习汉字书写时，我注重在生字与具有相同声符的已知汉字之间建立联系（如“把”“吧”“爸”有相同的声符“巴”）。 …… ① ② ③ ④ ⑤
When I write Chinese characters, I pay attention to phonetic radicals of characters, and associate new characters with those I already know that have the same phonetic radicals (e.g. “把”, “吧”, and “爸” have the same phonetic radicals “巴”.)

16. 书写汉字时，我会通过组词找回汉字(比如通过“医生”而找回“医”)。 …… ① ② ③ ④ ⑤
When I write Chinese characters, I recall specific characters in the context of compounds (e.g. “医生” (doctor) helps me remember “医”).

17. 书写汉字时，我注重在生字和已知同义、近义字之间建立联系（如“看”、“望”、“瞧”、“盯” 等都有“看”的意思)。 …… ① ② ③ ④ ⑤
When I write Chinese characters, I pay attention to the meaning of characters, and associate new characters with those I already know that have the same or similar meanings (e.g. “看”, “望”,

“瞧”, and “盯” all mean “look”).

完全不适用或甚少适用 有时适用 大概一半时候适用 常常适用 一直适用或差不多一直适用

18. 书写汉字时，我注重在生字和具有相同意符的已知字联系起来（如“妈”“姐”“妹”“奶”“姨”“姑”有共同的意符“女”；“你、们、他”有共同的意符“亻”）。 ①②③④⑤
When I write Chinese characters, I pay attention to semantic radicals of characters, and associate new characters with those I already know that share a semantic radical (e.g. “妈”, “姐”, “妹”, “奶”, “姨”, and “姑” all have the semantic radical “女”; “你”, “们”, and “他” have the semantic radical “亻”).

19. 学习汉字书写时，我有清晰的目标。 ①②③④⑤
I have clear goals for learning to write Chinese characters.

20. 我制定了书写汉字的学习计划（例如每天练习书写 10 个汉字）。 ①②③④⑤
I have a plan for writing Chinese characters (e.g. writing 10 characters per day).

21. 我检验书写汉字的学习计划，反思学习进程。 ①②③④⑤
I check my plan for writing Chinese characters and reflect on my progress.

22. 我注意自己书写汉字时犯的错误，并努力不再犯错。 ①②③④⑤
I notice my mistakes in writing Chinese characters and try not to make the same mistakes again.

23. 我常常鼓励自己书写汉字 。 ①②③④⑤
I encourage myself to write Chinese characters.

24. 在上课前，我预习书写新的汉字。 ①②③④⑤
I study ahead on how to write the new characters before class.

25. 我对学过的汉字进行自我书写测试，或请其他人帮我做测试。 ①②③④⑤
I review how to write Chinese characters by testing myself or asking someone to test me.

26. 我尝试寻找记忆书写汉字的最好办法。 ①②③④⑤
I try to find the best way to remember how to write Chinese characters.

27. 为了帮助记忆汉字书写，我编造故事（如“楼”是“一栋木头建筑，里面有米饭与美女”）。 ①②③④⑤
I create my own stories to remember how to write characters. (e.g. “楼” (building)

is a wooden (“木”) building with rice (“米”) and beauty (“女”) inside.)

完全不适用或甚少适用 有时适用 大概一半时候适用 常常适用 一直适用或差不多一直适用

28. 在日常生活交际中，我尽量书写汉字（如用汉字书写日记、写信、写电邮、写留言条等等）。 ..... ① ② ③ ④ ⑤
I do what I can to write Chinese characters in my daily life (e.g. I use Chinese to keep a journal or write email, cards, phone messages, and so on).

29. 我用汉字写作业、记笔记（如课堂笔记、学习笔记等）。..... ① ② ③ ④ ⑤
I write Chinese characters in my homework and notes (such as in-class notes and study notes).

30. 书写汉字时，遇到不会写的字，我会查字典或者词典。..... ① ② ③ ④ ⑤
When I write Chinese characters, if I encounter a character I don’t know how to write, I look it up in a character dictionary or other dictionary.

31. 我会请教老师、同学和朋友，与他们讨论和交流如何学习书写汉字。 ..... ① ② ③ ④ ⑤
I ask my teachers, classmates, language partners, or friends for help and discuss with them how to write Chinese characters.

32. 我会通过游戏和多媒体软件来学习汉字书写（如展示笔划、笔顺的汉字游戏）。 ..... ① ② ③ ④ ⑤
I play Chinese character games, including computer games, to learn to write Chinese characters (e.g. games that show the strokes or the stroke order of Chinese characters).

33. 我练习汉字书法。 ..... ① ② ③ ④ ⑤
I practice calligraphy.

34. 如果你除了上面的书写策略以外还有其它常用的汉字书写策略，请在下面补充。（请用中文填写）
If you have additional strategies that you commonly use to write Chinese characters aside from the above mentioned, please add here:

*was not included in the final questionnaire.

Appendix B: The descriptive statistics for 31 items of the CCWSI

	N	Missing	Mean	Median	Mode	Sum
*Q30	335	4	4.45	5	5	1495
*Q9	339	0	3.8	4	4	1289
*Q11	339	0	3.76	4	4	1273
*Q14	338	1	3.75	4	4	1266
Q1	338	1	3.73	4	5	1262
Q18	338	1	3.69	4	4	1246
Q15	336	3	3.68	4	4	1238
Q16	339	0	3.67	4	4	1244
Q10	338	1	3.64	4	4	1230
Q22	336	3	3.62	4	4	1216
*Q2	338	1	3.56	4	4	1203
*Q29	339	0	3.53	4	4	1198
Q4	339	0	3.53	4	4	1198
Q5	339	0	3.5	4	4	1187
Q12	337	2	3.48	4	4	1174
Q19	338	1	3.38	3	3	1141
Q23	336	3	3.35	3	4	1125
Q17	339	0	3.28	3	3	1112
*Q32	339	0	3.19	3	3	1080
Q6	338	1	3.18	3	3	1075
Q31	339	0	3.18	3	3	1078
Q26	338	1	3.12	3	3	1055
Q28	339	0	3.12	3	3	1057
*Q7	339	0	2.92	3	3	990
Q24	337	2	2.85	3	3	959
Q25	337	2	2.73	3	3	920
Q21	337	2	2.71	3	3	913
Q20	338	1	2.61	3	2	882
*Q27	338	1	2.5	2	1	846
*Q8	339	0	2.29	2	2	776
*Q33	338	1	2.09	2	1	706
Q1	338	1	3.73	4	5	1262
Q18	338	1	3.69	4	4	1246
Q15	336	3	3.68	4	4	1238
Q16	339	0	3.67	4	4	1244
Q10	338	1	3.64	4	4	1230
Q22	336	3	3.62	4	4	1216

*items were excluded from two factors.

Appendix C: Gender Difference

Among the participants, there were only 5% male students. Female students still dominate in language majors. Despite previously identified gender differences in L2 learning motivation or strategy studies (Green & Oxford, 1995; Csizér and Dörnyei, 2005), little has been done in assessing gender differences in motivation and strategies of Chinese character learning and writing. The present study was attempted to investigate gender as one of variables for CCW motivation and strategies. However, due to the small number of male participants, this discussion was only included as an additional part in Appendix and hope there will be opportunities to explore further in future studies.

According to descriptive statistics (see Figure Gender Difference 1), both male and female groups used more knowledge-based strategies (F2), female students used more direct strategies than male students. Strategies are teachable (Oxford, 1990). Knowledge-based Strategies are those related to the systematic knowledges of Chinese characters which are often major portion of the in-class teaching materials. Students usually more relay on those strategies. Gender difference in term of L2 learning strategies are inconsistent. Although some studies reported that females used more learning strategies in L2 learning (Oxford, 1994; Oxford and Nyikos, 1998; Dreyer and Oxford, 1996; Green and Oxford, 1995; Hong-Nam and Leavell, 2006; Liu, 2004; Salahshour, et al., 2013; etc.), others reported that males used more (Radwan, 2011; Tran,1988; Wharton, 2000; etc.) or no difference was found in the two groups (Ehrman and Oxford, 1990; Griffiths, 2003; Kaylani, 1996; Liang & Ye, 2019; Riazi and Khodadi, 2007; Sung, 2009; etc.). Researchers also don't agree which strategies are used more in male or female students. For example, Hong-Nam and Leavell (2006) found that females tended to use social and metacognitive strategies most, and memory strategies the least; and males use metacognitive and compensation strategies most, and affective strategies least; Goh and Foon's study (1997) showed that females used more compensation

strategies, and affective strategies than male; etc.); and females used more cognitive strategies in Salahshour, et al.'s (2013) study, and direct strategies in Li et al.'s (2011) study.

DM was predominant in both groups, but male students had a higher score in SM. However, the ANOVA (Table Gender Difference 1) showed that was no significant difference between male and female students in term of CCW motivation and CCW strategy using. The relationship between motivation and CCW strategies was shown in Table Gender Difference 2 and 3. DM was significantly correlated with both F1(Indirect Strategy) and F2(Knowledge-based Strategy) in the two groups, but male students are more motivated in terms of intrinsic interests than female students in CCW which is consistent with other studies, for example, Andreou, Andreou, and Vlachos (2004) reported that males had a more deep-oriented approach than females. On other side, SM negatively correlated with female students' CCW strategies (both F1 and F2). That indicated that, for female students, there might be other important or significant factors affecting their CCW strategies (both F1 and F2) aside from deep motivation of CCW. Therefore, instructional interventions to promote male students' CCW strategies and DM are more likely to promote their CCW strategies. The effects might not be equivalently applicable to female students.

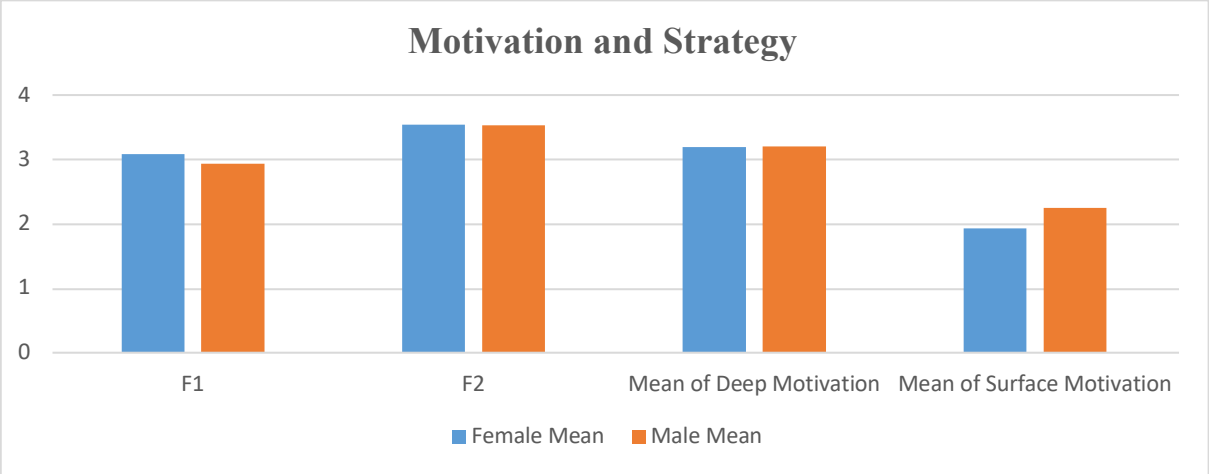

Figure Gender Difference 1: descriptive statistics

		Sum of Squares	df	Mean Square	F	Sig.
F1	Between Groups	0.334	1	0.334	0.653	0.42
	Within Groups	168.39	329	0.512		
	Total	168.724	330			
F2	Between Groups	0	1	0	0	0.99
	Within Groups	149.611	328	0.456		
	Total	149.612	329			
Mean of Deep Motivation	Between Groups	0.002	1	0.002	0.003	0.956
	Within Groups	175.568	335	0.524		
	Total	175.57	336			
Mean of Surface Motivation	Between Groups	1.668	1	1.668	3.003	0.084
	Within Groups	186.072	335	0.555		
	Total	187.74	336			

Table Gender Difference 1:
ANOVA for male and female in terms of motivation and strategy using

		F1	F2	SM	DM
F1	Pearson Correlation	1	.546**	-.193**	.537**
	Sig. (2-tailed)		.000	.000	.000
	N	315	309	314	314
F2	Pearson Correlation	.546**	1	-.229**	.362**
	Sig. (2-tailed)	.000		.000	.000
	N	309	313	312	312

Table Gender Difference 2: correlation analysis for female students

		F1	F2	SM	DM
F1	Pearson Correlation	1	.545*	.007	.725**
	Sig. (2-tailed)		.029	.982	.002
	N	16	16	16	16
F2	Pearson Correlation	.545*	1	-.193	.683**
	Sig. (2-tailed)	.029		.458	.002
	N	16	17	17	17

Table Gender Difference 3: correlation analysis for male students