Explicit Strategy Instruction in Chinese Character Learning

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Abstract

As a non-alphabetic language, Chinese has a unique writing system, which makes it difficult to master by learners with an English-language background. Due to the significant difference between Chinese and English, few learning strategies effective for learning reading and writing in alphabetic languages such as English, are applicable to learning reading and writing in Chinese. Relatively little research has been conducted on effective strategies for supporting young students in learning to read and write Chinese characters.

This study used the Zone of Proximal Development (ZPD) as the theoretical basis to conceptualise the role of teachers in teaching Chinese as a foreign language (CFL). An Imagery Strategy was developed based on ZPD and learning theories for an ultimate goal of increasing students' retention of Chinese characters. The Imagery Strategy consisted of teacher-led instructions, scaffolding and teaching materials. A total 67 Year 6 students (N=67) participated in the study. The effects of the strategy were tested by comparing the treatment condition of students using Imagery Strategy with a control condition in which students used their own preferred strategy for both production and recognition of the Chinese characters. Chinese characters' recall tests were used to compare learning outcomes across three phases: pre-test, intervention, and post-test in a weekly interval in six weeks. Each phase included three time points to evaluate students' learning outcomes: on the day of learning (Time 1), a week after learning (Time 2) and two weeks after learning (Time 3). A series of 2 (Condition: Treatment vs. Control) × 3 (Time: Time 1, Time 2, Time 3) mixed-model ANOVAs were conducted on the production and recognition of Chinese characters.

The results showed no difference between the groups at pre-test. In the intervention and post-test phases, students who received the strategy instruction performed better in both production and recognition than students using their own strategies for all tests. The pattern of retention of characters over time in recognition varied between two groups in post-test where students with a strategy

instruction under teacher's scaffolding demonstrated more advantages in retention of characters over time.

The findings of the current study confirmed the effect of Imagery Strategy in learning Chinese characters in both recognition and production, even among young learners. The study also highlighted the crucial role of teachers in explicit instruction, scaffolding and material design to support Chinese character learning.

Declaration

I certify that this thesis:

1. does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university

2. and the research within will not be submitted for any other future degree or diploma without the permission of Flinders University; and

3. to the best of my knowledge and belief, does not contain any material previously published or written by another person except where due reference is made in the text.

Signed.....Xiaoxue Liu.....

Date.....April 2025.....

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Chapter One Introduction

Teaching Chinese as a foreign Language

The rise of China's economy and political influence has seen a greater number of people around world learning Chinese, reaching twenty million by the end of 2020 (Zou, 2021). However, underneath the passion for learning Chinese, the process is hard for learners, especially learners from alphabetic language backgrounds (Hu, 2010).

Chinese language is unique in various ways, and it is considered one of the hardest languages in the world to master for learners with an English background (Chan et al., 2022). Compared with European languages, the time and effort required from learners is enormous (Chan et al., 2022). Moreover, the knowledge and strategies that learners of Chinese normally adopt in their first languages (especially alphabetic languages) are inefficient to be applied to Chinese (Orton & Scrimgeour, 2019). Without tackling these issues, the learning process will be prolonged and difficult, leading to a high likelihood of dropping out of languages because of lack of strategies and motivation (Orton, 2016; 2017; Orton & Scrimgeour, 2019, Chan et al., 2022).

Chinese has been taught in schools for four decades, along with Japanese, Italian, French, Indonesian and German (Orton, 2016; 2017). However, the large number of students taking up learning of Chinese decreases significantly during the course of schooling years. In 2015, the drop-out rate in Chinese increased by 20% since 2007, and went up to 94% in total before completing Year 12 (Orton, 2016; 2017). Although there is no recent number of the drop-out rate, the overall Chinese enrolment in Year 12 is still decreasing in 2020 (ACARA, n.d.).

According to Orton (2016; 2017), the key reason for this drop-out rate is the slow progress in learning Chinese in the school environment. The complexity of the graphic form

of characters is a hurdle for reading and writing (Orton & Scrimgeour, 2019; Shen, 2004). Despite more complexity in mastering Chinese language, the class time scheduled for all languages is the same. Hence, the literacy level of Chinese language learners is far lower than that of alphabetic languages. While learners of alphabetic languages are able to read newspapers when graduating from high school, most Chinese language learners are still at the level that equals to Year 1 native Chinese speakers. The slow progress is a frustrating experience even for most capable second language learners (Orton, 2016; 2017; Orton & Scrimgeour, 2019).

Teachers mainly use repetition and rote memorisation to teach Chinese characters. With restricted lesson time, this method does not meet learning requirements (Orton & Scrimgeour, 2019).There are two reasons for this. The first one is that a large number of teachers of Chinese languages are from mainland China. Being first language speakers, teachers may lack awareness of different learning paths of first and second Chinese language learners (Orton, 2016; 2017; Orton & Scrimgeour, 2019). Most teachers either refer to instructions of English as second language or instructions of Chinese as first language (Orton & Scrimgeour, 2019). The other reason is the lack of resources and support from research on Chinese as foreign or second language. Most research in the field took place in Unites States with university students as participants (Orton, 2016; 2017). According to Chan and his colleagues (2022), among all studies of Chinese as second or foreign language from 1990 to 2021, 72% of studies are at university level, with only 8% focused on secondary level and 6% for primary level. Given students' cognitive developmental stages, it is uncertain whether findings from most CFL research apply to school-aged learners (Chan et al., 2022; Orton, 2016, 2017).

Hence, there are no direct, valid, or relevant pedagogies to support Chinese teachers in Australian schools. As a result, many teachers rely on the methods they experienced when

learning Chinese as first-language learners in China, or on approaches used for learning English as a second language. Students often have no access to the knowledge of effective strategies in reading and writing pertaining to specific Chinese language features other than rote memory (Orton & Scrimgeour, 2019). The lack of learning strategies not only hinders the process of learning but also has a negative impact on students' motivation (Macaro, 2006).

It is suggested that at the end of secondary school, students have to master around 500 characters (Orton, 2016). However, the reality makes this process challenging. Take South Australia as an example. Languages are not mandatory after Year 8. This means that if students pick up a language from reception, by the end of Year 8, they have completed around 512 class hours of learning, close to proposed 600 class hours to master an alphabetic language in a proficient level, but far behind 2200 class time to master Chinese (Chan et al., 2022). In the meantime, another fact is that among all these compulsory language learning hours from Reception to Year 8, 73% of learning time is at primary school. However, there is no clear requirement for primary students to learn how to read and write in characters systematically (Orton & Scrimgeour, 2019). Moreover, there is no clear requirement for the number of basic characters to be mastered at primary level. If character learning starts at an early stage, there is a greater chance that students will have an ability to increase their vocabulary for development of language proficiency throughout their future learning (Lam, 2011). There is an urge for students at the primary learning stage to be deeply researched (Chan et al., 2022).

With most research taking place in universities, there are few studies examining character learning in primary schools with learners from English language backgrounds at a beginning level. Furthermore, most studies have examined the reception of character learning

in recognition (Form → Meaning) but the production of learning in writing characters (Meaning → Form) was rarely investigated.

Zone of Proximal Development (ZPD) and scaffolding

Previous studies in CFL mainly examined instructions that combined cognitive psychology and specific Chinese linguistic features, relying mainly on rote memorization to assess individual performance (Gu & Johnson, 1996). Scaffolding from teachers or capable peers that stretch students' potentials in the Zone of Proximal Development (ZPD) have not been fully examined in the character learning field. Therefore, the ZPD was used in the current study to provide a theoretical basis for the teacher's instruction in foreign language class, with the goal of enhancing students' performance.

ZPD and scaffolding are studied as a theory for foreign language research and have been implemented in second language learning classrooms, especially English as second language teaching and learning (Mirzaei & Eslami, 2015; Nazerian, Abbasian & Mohseni, 2021). For example, Mirzaei and Eslami (2015) explored the application of Vygotsky's ZPD in English as a second language classes, highlighting how ZPD-activated language and collaborative learning can enhance second language writing skills. However, most literature on Chinese character learning comes from linguistic or cognitive psychology perspectives. These studies often view character learning as an individual, internal process. They do not consider it as part of an ecological system where learners engage in advanced cognitive processes and make sense of learning through opportunities created in social contexts.

The concept of ZPD provides a foundational framework for understanding how learning occurs through guided support and interaction in language classes. The examination of Chinese as a Foreign Language (CFL) in Australian schools will provide contexts to align ZPD principles with unique challenges and opportunities in CFL teaching and learning.

Hence, this research aimed to enhance learners' ability to recognize and produce Chinese characters by incorporating explicit strategy instruction alongside the social interaction of scaffolding within ZPD. The hypothesis was that strategy instruction under scaffolding from the teacher will improve Chinese character learning in both production and recognition. To further contextualise the current study, the following chapter will examine the relevant theoretical frameworks.

Chapter Two Theoretical Underpinnings

Zone of Proximal Development (ZPD)

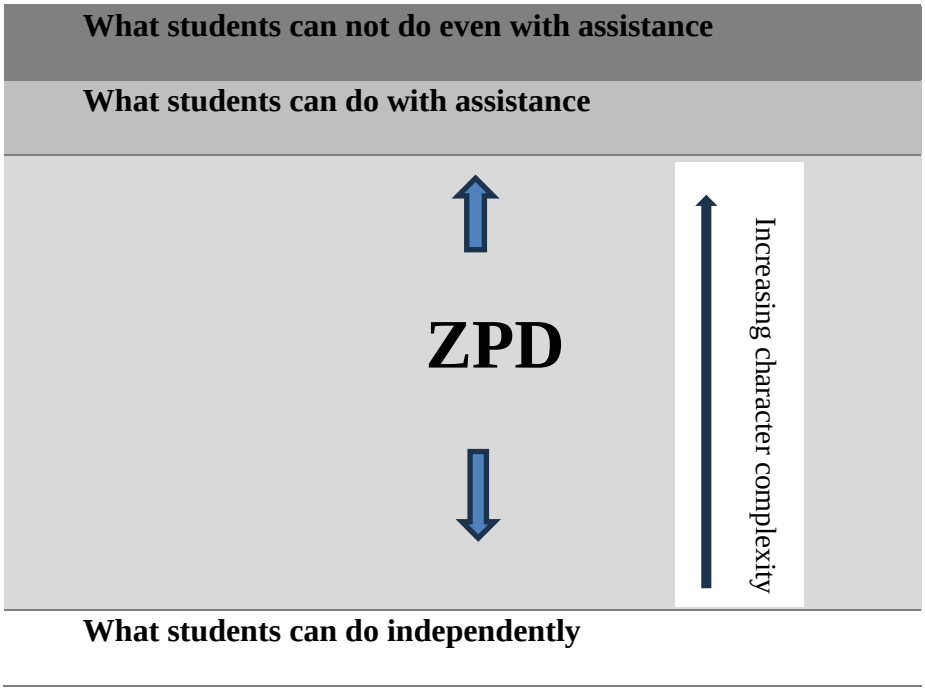
The notion of ZPD is rooted in Vygotsky's Socio-cultural theory, referring to "the distance between the actual developmental level as determined by the student's independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). At the start of the 21st century, Vygotsky's sociocultural theory (SCT) gave rise to a research approach that views second language acquisition primarily as a socially and contextually driven process. SCT explores how social and cultural contexts shape the development of human psychological processes, considering both historical and developmental influences (Xi, 2020). Vygotsky's perspective on the mind emphasises the key role of social interactions and culturally created tools in shaping distinctive thinking processes of human beings (Lantolf, 2004).

According to Vygotsky, there are two levels of human psychological functions, low-level psychological functions from biological evolution and high-level psychological functions that originate from social activity (Wang, 2022). Vygotsky argued that high-level psychological functions formed in social cultural and historical interactions (Johnson, 2003, p. 108). According to Vygotsky, higher psychological functions develop from external influences at the interpersonal level (such as social, historical, and institutional factors) and are internalized by individuals at 'intrapersonal level' through participation in social activities. This internalisation process progresses through three stages of object-regulation: controlled by external environment; other-regulation, which is relying on adults and capable peers; and finally, self-regulation, where learners take control of high mental process. (Johnson, 2003, pp. 108-109). Hence, the level of higher mental functions an individual can

achieve depends on the sociocultural contexts they are exposed to during the process of internalization.

To explain the transition from intrapersonal to interpersonal level of mental function, Vygotsky developed the notion of ZPD. Vygotsky identified two levels of development actual and potential development (see Figure 2.1 adapted from Lui 2012). The actual development refers to the ability of an individual to solve a problem independently and the potential development means the mental functions that an individual could achieve with the intervention from others. The former mental functions are fixed due to its independence nature while the latter is developing and more dynamic (Johnson, 2003, p110).

Figure 2.1
ZPD of Language Learning



Focusing on potential development, Vygotsky criticised the practice of assessing students based on their current level of development, ignoring the potential development of learners, which he referred as ‘buds’ that will mature with nurture in ZPD (Wang, 2022). Vygotsky argued that a crucial element of learning is its role in creating the Zone of Proximal Development. In this context, learning triggers a range of internal developmental processes

that occur solely when a child interacts with their surroundings and collaborates with capable adults and peers. Once these mental functions are internalized, they contribute to the child's independent developmental achievements.

Vygotsky's theory suggests that effective social interaction enables learners to progress from other-regulation to self-regulation, ultimately allowing them to perform tasks independently. Learning begins through interactions with others, where assistance from more knowledgeable individuals facilitates the learner's development (Johnson, 2003). This concept aligns with the idea of scaffolding, as proposed by Wood et al. (1976), who describe how an expert supports a novice through guided interaction. Drawing from an architectural metaphor, scaffolding involves temporary support structures that assist a learner until they are capable of functioning independently. In education, this means that learners receive initial support from a teacher or knowledgeable peer, which is gradually withdrawn as they gain the skills and confidence to complete tasks on their own.

The assistance that leaners obtain from more capable ones in social interactions in ZPD is called scaffolding, which is a strategy that facilitates the potential abilities to perform activities or tasks independently (Alghamdy, 2023). Scaffolding is intrinsically linked to the Zone of Proximal Development, with exploration of the ZPD being fundamental to the scaffolding process. Nassaji and Swain (2010) stress that targeted assistance within a learner's ZPD is far more effective than random help, highlighting the importance of understanding and utilizing the ZPD for optimal support.

Studies have shown that both teachers and peers can effectively implement scaffolding to support cognitive development. For instance, Donato (1994) demonstrates how peer scaffolding not only fosters individual language growth but also allows learners to enhance their own second language knowledge while contributing to the linguistic development of their peers. However, for scaffolding to be effective, certain conditions must be met.

Research by Donovan and Smolkin (2002), Verenikina (2003), and Antón (1999) identify two key factors: first, scaffolding should not be confused with direct instruction, as teacher-dominated interactions can hinder, rather than help, learners' development. Second, classrooms must adopt a learner-centred approach, where students actively engage in scaffolding and share responsibility for the learning process.

Similarly, Swan (2005) reinforces that social interaction, or "collective behaviour," forms the foundation of the learning process. Through collaborative activities, learners use language as a shared tool to mediate problem-solving, which fosters individual mental functioning and self-regulation. The ZPD is activated through dialogue, helping learners recognize their current developmental level while striving toward their potential with the support of more skilled peers (Lantolf & Thorne, 2006). This dynamic creates an optimal environment for collaborative dialogue, further emphasizing the interdependence between scaffolding and the ZPD in supporting cognitive growth. Furthermore, Swan (2006, 2010) also proposed that when language production is seen as a dynamic process rather than just an outcome, learners are prompted to recognize gaps in their knowledge. This process activates key cognitive mechanisms essential for second language (L2) acquisition. By encouraging learners to engage with language consciously, it triggers socio-cognitive growth and promotes deeper language learning.

Chinese language features

Chinese is a tonal language with different meaning with identical syllables, Chinese pinyin, using different tones (Shen, 2018), for example, 妈(mother) 麻(linen) 马(horse) 骂(scold). This feature of Chinese language makes lexical access to meaning more complicated for learners, especially learners from English background with no tones impacting meanings (Shen, 2018). The complexity of Chinese language is more than just tones. The writing

system makes it even harder. Chinese writing (simplified and traditional) is logographic or morphemic as there is no direct correspondence between sound and character (Perfetti et al., 2007), which means it is mapped on to its morphemes, rather than phonemes (sounds) (Shen, 2004). Unlike alphabetic languages, which consists of alphabetic letters with segmental structures in linear arrangement, the Chinese scripts are made of symbols (characters) consisting of strokes in certain sequences within a square form (Orton &Scrimgeour, 2019; Tong et al., 2016; Want et al., 2003). Based on orthographic depth hypothesis (Katz & Frost, 1993; Share, 2008), the depth of a language in its orthography is based on its transparency in spelling-sound correlation.

Due to this difference in orthography, there are many constraints to processing Chinese characters for learners with alphabetic languages backgrounds (Perfetti et al., 2007; Tong et al., 2014; Wang et al., 2018; Zhou & McBride, 2015). Originating from pictograph, Chinese characters carry meaning rather than sound in each morpheme. Stroke, radical and character are three layers of Chinese orthographic structures (Shen,2004; 2005). Stokes are the basic building materials for radicals and radicals are basic meaningful components for characters (Shen, 2005). There are five basic strokes (horizontal stroke, vertical stroke, slant stroke, point stroke, and angled stroke) with 44 additional variations (Chang et al., 2014). The numbers of strokes for each character, which is also called character density, can vary from one to thirty (Shen, 2004). Strokes with specific sequences make up single characters that are basic meaning components, which can form more complex characters that are called compound characters. In single characters, there is only one basic meaning component while in compound characters there can be two or more meaningful components. These single characters are also called radicals in compound characters.

Radicals are divided into two categories: semantic radicals that indicate meaning, and phonetic radicals that indicate sound. There are three categories of characters that make up

most of the modern Chinese characters: pictographs, ideographs, and phonetic–semantic compounds. The pictographs are the representation of objects, ideographs are made of two or more pictographs. The phonetic–semantic compounds consist of two or more single characters with one side indicating sound and the other indicating meaning (Shen, 2013). In compound characters, 80%-90% are sematic-phonetic compounds with one side indicating meaning the other indicating sound (Orton &Scrimgeour, 2019; Shen, 2004, 2005). However, due to the change through time, modern Chinese has lost most of its phonetic cues (Orton &Scrimgeour, 2019). In the study of Fan et al. (1984), only 26% of phonetic radicals represent sound accurately. A similar finding was obtained by Shu et al. (2003) through their analysis of over two thousand characters taught in Chinese primary schools: 58% of characters relate total sematic radical in meaning while only 39% are associated with phonetic radicals for sound. Hence, semantic radicals that carry meanings have been seen as a key for processing characters among native and non-native speakers (Shen & Ke, 2007; Tong &Yip, 2014; Wang et al., 2015).

The complexity of Chinese characters not only lies in their components but also in the graphic configuration of components (Orton &Scrimgeour, 2019; Shen, 2005; Wang et al.,2003). The structure of components can be left-right, top-bottom or inside-out and so on. These unique features of Chinese language raise challenges for its learners, especially learners with alphabetic backgrounds, who often process characters in a whole way regardless of its components or structure at beginning level (Jiang & Zhao, 2001). Although processing a character as a whole seems ineffective in processing compound characters, the perception of seeing a character as-a-whole provides a perspective for instructions on single characters, especially characters that are pictogram in nature (Weekes et.al, 1997). These characters can be associated with pictorial representations in a learner's mind and promote recall through visual elaborations (Li &Tong, 2020; Shen, 2004). Even with sematic-phonetic

compound characters, the semantic radicals, which are often single characters themselves, still have a pictographic nature (Li & Tong, 2020). The ability to visualise and elaborate these characters will boost the learning process for learners from alphabetic language backgrounds.

Dual-coding theory (DCT)

Given the challenges of learning written Chinese, understanding how newcoming information is being processed and retained can provide valuable insights into language learning (Shen, 2010). Dual-coding theory (DCT) (Paivio, 1971, 1986a) proposed two systems in memory: a verbal system that codes linguistic information and an imagery system that processes non-linguistic information. New information coded in both systems is more easily recalled and has more chance to be stored in long-term memory. Concrete words with visual representations are easier to remember because new information encoded as images forms stronger memory traces than when encoded verbally. For example, the concrete word 'apple' can be easily pictured as a round shape and red or green colour fruit, while the abstract word 'truth' is hard to match with any mental images. Because of the dual representation of concrete words, more activation occurs in concrete words in both verbal and imagery systems, which leads to faster recognition of concrete words than abstract words (Levy-Drori, & Henik, 2006). Incorporated with bilingual memory, Paivio and Desrochers (1980) proposed a dual coding model of bilingualism, arguing that there is a shared imagery system in first language (L1) and second language (L2) and stressed the mediating role of images in second language learning. The multi-store view of DCT has a significant contribution to language learning, especially on word learning (Shen, 2005).

However, most literature in DCT is focused on alphabetic languages for both L1 and L2, and research on non-alphabetic language learning is scarce. Shen (2010) investigated the effect of verbal instruction only and verbal plus imagery coding instructions in learning

concrete and abstract Chinese words. In the verbal instruction group, words were introduced through the explanation of meaning, sound and usage. In the verbal plus imagery coding instruction group, pictures, pictograms or acting out words were added with the explanation of meaning, sound and usage. Two types of receptive vocabulary tests (circle correct English meaning and write down correct English meaning) were conducted at the end of the lesson and after 24 hours. Although no significant difference was observed in the meaning retention of concrete words, verbal plus imagery coding instructions did demonstrate better learning of abstract ones, which was also supported in studies Farley and his colleagues (2012). Chinese concrete words are easy to relate with pictures and achieve form-meaning mapping due to their pictogram nature, which means these characters represent the image of objects, especially in traditional characters in Shen's experiment. Chinese traditional writing, mainly used in Taiwan, has more representational links with meaning, which makes concrete words in traditional writing easy to recall. Hence, the result of simplified Chinese under DCT remains unknown. Furthermore, vocabulary chosen for Shen (2010) is grouped by meaning, which is a distributed approach to introduce Chinese characters. In Shen's approach, all vocabulary is introduced in accordance with the sequence of Chinese textbook for communicative purpose. The graphic form of characters, such as reoccurring radical and layout is not a crucial key for grouping

However, some studies indicated that character -centred grouping, where characters are grouped in same reoccurring radicals, enhanced retention (Chang et al., 2014; Xu et al., 2014). The effect of DCT in characters with character-centred grouping remains unknown. Moreover, Shen (2010) only examined the recognition of Chinese words, there were no production tests (students to write Chinese words) under this intervention. Lastly, Shen's experiment was conducted in a university with students are adults, so the effect among young learners in normal school setting is unclear.

Levels of Processing

In addition to bilingual processing, which involves the use of two distinct language systems to encode and retrieve information, the depth of information encoded also has an impact on memory retention (Li & Tong, 2020). According to Bruning et al. (2010), the way people place information in long-term memory impacts how well they can remember it. Craik and Lockhart (1972) proposed the Levels of Processing Model, suggesting that memory for new information depends on the depth of cognitive process involved in encoding incoming information. In the Levels of Processing view of language learning, deeper, more meaningful elaboration with a word or phrase leads to stronger memory retention (Shen, 2004). For example, if a learner encounters the English word *"apple"* and simply repeats the spelling or sound of the word (*"A-P-P-L-E"*), this is considered shallow processing, focusing only on surface features. In contrast, if the learner thinks about the meaning of the word, imagines eating an apple, connects it with their personal experiences, or uses it in a sentence like *"I ate a green apple today, and it is very juicy"* this is deep processing. Such meaningful associations and elaboration facilitate stronger encoding, leading to better recall over time.

Shen (2004) examined three encoding conditions: rote memorisation, student self-generated elaboration and teacher-guided elaboration in learning new Chinese words for non-native learners. Participants were second-year university students who were asked to learn thirty new two-character words in three conditions. In the rote memorisation condition, students were repeatedly asked to name the sound and meaning of words after the instructor presented the sound, meaning and shape of each word without further explanation. In self-generated condition, they were asked to use whatever methods they like and elaborate their understanding in English writing. In teacher-guided elaboration, the instructor explained etymology, radical and usage in contexts to introduce each word.

The result in Shen's (2004) study was in line with the level of processing theory in word retention, which is deeper processing (self-guided and teacher guided elaboration) had a better effect in word retention (Craik & Lockhart, 1972). Shen found that elaborated encoding strategies (teacher-guided and self-guided) outperformed rote memorisation in both immediate and delayed post-tests. Furthermore, the teacher-guided condition was better than the self-guided one in a 20-minute immediate test, but the significance disappeared in a 48-hour delayed test. Shen (2004) attributed the significance of immediate recall to the quality of instruction the teacher created while maintaining it for a longer time.

The study from Shen (2004) concluded that when introducing new words in non-alphabetic languages, semantic -related strategies involving deeper cognitive processing helps non-native learners to remember. Shen also emphasised the role of elaboration as an encoding strategy in vocabulary learning. This was due to the extra cues learners obtain from elaboration, the more elaboration was involved, the better the recall. Shen (2004) not only applied sematic-related encoding methods (etymology and usage in contexts) but also form-related encoding strategy (analysing radical) to intervention, which makes processing deeper and more dimensional for CFL. The results were also in line with Bird's (2011) finding that meaning-based encoding methods alone are less efficient than some form-related strategies in second and foreign language learners.

Learning strategies

While learning strategies have been considered to make learning easier, studies have indicated the significance of learning strategies in making learning deeper, more efficient and lasting (Cohen & Macaro, 2007; Holschuh & Altman, 2008; Winne & Perry, 2000). Language learning strategies have been explored by researchers since the 1990s. O'Malley and Chamot (1990) argued that language learning is not different from learning other

cognitive skills and can be boosted by effective teaching and learning strategies. Rooted deeply in cognitive learning theories, especially information processing as described by Anderson (1983a, 1993), O'Malley and Chamot (1990) valued the 'proceduralisation of knowledge', from declarative knowledge to procedural knowledge, from cognitive, associative to autonomous phases. Through explicit instruction and repeated practice, automation of strategy use can be achieved. Moreover, Oxford (2011) argued that cognitive strategies such as conceptualising and meta-strategies such as an orchestrating strategy involve deep processing and are more effective for retention in a long-term period. Oxford (2011) suggested strategy instructions should be integrated into textbooks and courses to promote language learning so students can be trained to learn and apply appropriate strategies to learning from a larger strategy repertoire.

However, few studies have investigated strategies for learning Chinese. Due to the unique characteristics of the Chinese language writing system, strategies in learning Chinese have to target these exclusive features to accelerate character learning (Orton & Scrimgeour, 2019). Shen (2005) investigated learning strategies applied by American university students taking Chinese as a foreign language. Results were generated through three questionnaires regarding commonly used strategies implemented by students themselves as they were learning characters. Among 30 commonly used strategies, 25 were cognitive related and five were metacognitive strategies that help learners plan, monitor, and evaluate their own learning processes. The result indicated that, among all 25 cognitive strategies, orthographic-knowledge-based strategies (graphemics, semantics and phonetics) were the most useful. These strategies are closely tied to the recall of characters relating to sound, shape and meaning; this mirrors the logographic nature of Chinese script (Shen, 2005). Students from alphabetic language backgrounds use orthographic knowledge to learn characters and try to connect sound, shape and meaning (Shen, 2005). Moreover, the radical knowledge heavily

used in orthographic-knowledge-based strategies relates the new information about a character to a learned context within a semantically congruent radical, enhancing the memory of a newly learned character. The study also suggested that there is asynchronous development of cognitive and metacognitive strategy use. Shen pointed out that the lack of cognitive strategies of non-native speakers was a main issue that hinders metacognitive development in character learning. Hence, class instructions should direct learners to attend to developing their self-awareness of character learning processes. The investigation into learning strategies in CFL is very rare in literature, especially for younger learners.

Explicit instruction

Explicit teaching has an important position in learning. Pedagogically, Rosenshine (1996) pointed out that explicit teaching is "a systematic method of teaching with emphasis on proceeding in small steps, checking for student understanding, and achieving active and successful participation by all students" (p. 34). According to Archer (2010), teaching through explicit instruction is "a structured, systematic, and effective methodology for teaching academic skills" (p. 1). Bruning et al. (2010) also stressed the significance of explicit teaching in literacy. They argued that in an alphabetic language such as English, metalinguistic ability is not acquired without explicit teaching in letter-sound relationship. Rupley et al. (2009) classified two teaching outcomes in teaching reading: skills and cognitive strategies. Skills involve lower-level cognitive processing such as decoding skills in phonetics and structure analysis, while strategies include higher cognitive processing such as predicting and inferring meaning.

Although there are empirical studies on explicit instruction in English as a second or foreign language, less research has been focussed on other foreign language teaching (Wyra & Lawson, 2018). Wyra and Lawson (2018) embedded explicit instruction in strategy

training in the keyword method (KWM) for Spanish word recall. Through training, both groups had a detailed understanding of KWM elements. However, the retrieval group with additional training of instructions for two-way retrieval strategy (Spanish to English and English to Spanish) demonstrated higher understanding of strategy and meta-strategy knowledge. This improvement can be attributed to the additional retrieval instruction they received. Hence, it is obvious that the mediation of explicit teaching improves linguistic gain in alphabetic languages.

In CFL, some scholars have highlighted instructions at a cognitive level. Some instructions emphasised the effect of developing a mental image which is underpinned by the dual coding system in processing (Ho, 1984; McGinnis, 1999; Shen, 2010). Shen (2010) acknowledged that some abstract words are more difficult to generate images for and recommended that diagrams organised in chunking groups may facilitate the learning of abstract words, which supports the radical awareness instructions (Jackson, Everson, & Ke, 2003; Ke, 1998; Shen & Ke, 2007; Taft and Chung, 1999; Wang, Liu & Perfetti , 2004; ; Wong, 2017; Xu, Chang & Perfetti, 2014).

In research by Xu and his colleagues (2014), the grouping strategy instructions based on radicals was found to improve retention of Chinese compound characters at the beginning level, however, the effect decreased at the intermediate level. The researchers concluded that chunking in radical-based groups is more beneficial for beginners. Combining dual-coding theory with levels of processing theory, Li and Tong (2020) furthered explicit instruction by comparing pictographic-verbal approach (a picture of character associate meaning with form, alongside with explanation of meaning and origin) and pictorial-verbal approaches, (a picture of meaning of character only with explanation of meaning), for Chinese word attainment and retention fourth and fifth grade students. Through a systematic learning routine via pictogram and etymologicon, the origin of new words, learners using a pictographic-verbal strategy

performed better than learners using a pictorial-verbal strategy for word retention. Moreover, the motivation from the pictographic-verbal group was much higher for learning Chinese words. Li and Tong (2020) also examined the role of review in using the pictographic-verbal coding approach to promote word retention. Through regular review with pictographic-verbal instruction, students improved their strategy use, which impacted their performance for a long-term period.

The repetitive practices of pictographic-verbal coding approach helped students improve the conceptual understanding of the relationship among radicals, pictograms, and semantics, which successfully transfer learnt words from short-term memory to long-term memory. However, Li and Tong (2020) pointed out that the process and time spent on review practice should be monitored and adjusted to keep students engaged. Although this study was conducted among younger learners, the experiment is taken as an after-school program. Moreover, the vocabulary is still grouped in topics and written in traditional Chinese. The effect of the instructions for young learners in normal school settings on learning simplified Chinese is still unknown.

Effective strategy use not only improves learning outcomes but also promotes motivation (Macaro, 2006). Studies indicated the imbalanced use of cognitive and meta-cognitive strategy use in CFL and the reliance of cognitive strategy in meta-cognitive strategy use (Shen, 2005). Literature implicated further investigation of explicit teaching of cognitive strategies pertaining to specific Chinese language features needed to promote meta-strategy use (Shen, 2005).

Although there are studies investigating effective strategy instructions to learn Chinese characters for beginners, most of them took place in universities and the participants were tertiary students. The investigation into younger learners at beginning level is rare. With the increase in numbers of students enrolling in Chinese in Primary and Secondary schools in

Australia, there is an urgency to examine the validity of strategies among younger learners in normal school settings to inform effective instructions for teachers of Chinese. Furthermore, the investigation of the relationship among the use of effective learning strategies and learning outcomes in CFL is scarce.

From previous studies, the cognitive strategies for CFL learners are essential for their learning as those strategies provide a repertoire for metacognitive strategy use (Shen, 2005), which will contribute to self-regulated learning, allowing learners to plan, monitor and evaluate their learning. Among cognitive strategies, strategies that promote orthographic awareness of unique Chinese script have been shown to be related with recall of meanings (Jackson, Everson, & Ke, 2003; Ke ,1998; Shen & Ke, 2007; Taft and Chung, 1999; Wang, Liu& Perfetti, 2004; Wong, 2017; Xu, Chang & Perfetti, 2014). The pedagogical instructions that emphasize orthographic awareness, especially radical knowledge, through the use of images to facilitate meaning and form have been examined to be effective with recall of Chinese traditional characters. Besides, sematic-related encoding strategies such as elaboration of meaning and position of radicals provide extra cues for recall of traditional Chinese characters (Li & Tong, 2020 She, 2004). However, most studies took place in United States using Chinese traditional characters in meaning-centred contexts, characters grouped based on topics. Some studies suggested (Chang et al., 2014; Xu et al., 2014) that in character-centred grouping, characters are grouped in same reoccurring radicals enhanced retention.

Nevertheless, explicit instructions serve as an initial point of new learning, enabling teachers to clarify and explain new materials while directing learner's attention to specific forms (Ellis, 2006). According to Ellis, the acquisition of explicit language knowledge is further enhanced when paired with scaffolded activities which provide opportunities for learners to practice and internalize newly taught concepts. This combination ensures that

explicit teaching is not isolated but actively bridges the gap between initial learning and application.

Therefore, explicit instructions and scaffolding are complementary with each other in the learning process, which aligns with SCT in the learning process where learning starts from interpersonal plane to intrapersonal plane. Internalisation is facilitated through explicit instruction and scaffolded activities to support learners in applying new knowledge independently.

Explicit instruction and scaffolding create a dynamic and effective framework for language learning. Explicit teaching establishes the conceptual groundwork, while scaffolding bridges learners' current abilities and potential capabilities within ZPD. This integrated approach emphasizes the teacher's role in providing guidance that gradually diminishes as learners develop autonomy, aligning with the principles of SCT and fostering deeper cognitive engagement.

Development of research questions

There is limited research in the CFL literature examining the effects of character learning that integrates cognitive perspectives with SCT, particularly through scaffolding within the Zone of Proximal Development (ZPD).

Hence, this study investigated the effect of a strategy instruction that combined images with elaboration to recall both meanings and forms for simplified Chinese characters under teacher's scaffolding in ZPD. The strategy adopted in this study is called Imagery Strategy (IS), using images to mirror the form of characters and elaboration to facilitate meaning and form connection. All Chinese characters were grouped in radicals with similar strokes in each word sets. Participants from an Australian primary school in Year 6 were divided into treatment group (TG) and control group (CG) to compare the effect of IS.

The study aimed to fill the gap to investigate the effect of a strategy instruction that relies on the encoding processes of association and elaborations use images (Imagery Strategy (IS) to help primary school students learn Chinese characters with teacher's scaffolding. The study examined the effect of the strategy instruction in learning new Chinese characters through recognition and production of newly learned Chinese characters.

The research question was: Does the intervention of explicit instruction using an Imagery Strategy (IS) with teacher's scaffolding improve vocabulary learning in production (English meaning → Chinese character form) and recognition (Chinese character form → English meaning) of Chinese characters?

The prediction was that treatment group using Imagery Strategy with elaboration under teacher's scaffolding would retain more characters than control group in both production and recognition.

Chapter Three Method

Design

To examine the effect of an intervention using Imagery Strategy, an experimental design was used in this study. Due to the request of the minimum interruption on timetable from the participating school, each intact class were split into two groups. Students in each intact class were ranked according to their Chinese grades in Semester 1 and then randomly assigned to either a control or treatment group in the order of ranking. This arrangement was intended to minimise differences between the two conditions. Both control and treatment groups experienced the same phase of experiment at the same time during their Chinese lesson time. Control and treatment groups were put into separate classrooms with different teachers. Eleven students with Chinese language exposure at home were randomly assigned to control and treatment groups to ensure that the control group (CG) and treatment group (TG) are comparable in terms of student achievement levels in Chinese and socio-economic status. Such an arrangement minimizes group differences as much as possible within the constraints of convenient sampling using intact classes.

There were three phases (Table 3.1), and each phase involved a different word/character set and 3 times of measurement. Phase 1 assessed learning before the intervention. During Phase 1, both TG and CG learned Chinese characters using whatever method they chose. Phase 2 tested the effects of the intervention. In Phase 2, TG underwent the intervention, while CG continued to learn using their preferred method. Phase 3 tested whether giving TG a reminder of the intervention strategy and learning material with images would benefit their learning relative to CG. No teacher involvement in Phase 3. Within each phase, there was only one learning opportunity, but learning was tested three times: immediately after learning the characters, and again at 1 week and 2 weeks to assess retention over time (Table 3.2).

Teacher of CG only read out new characters during teaching session, no further instructions were given.

Table 3.1

The study design

Phase	Procedure	Time	Material	Delivery
Phase 1 Pre-intervention	Both CG and TG are asked to learn 8 Chinese characters using their own/usual way.	20 minutes	8 characters printed on a list with English and Pinyin (Word-Set1)	Printed word list (CG & TG)
	Receptive and productive tests in weeks 1,2,3	3 x 10 minutes	Word-Set 1 test	Paper test administered by the researcher in class. (CG & TG)
Phase 2 Intervention	TG explicit teaching of IS using 16 'practice' characters and discuss strategies with class	20 minutes	16 'practice' characters	TG: In class explicit teaching in PPT.
	CG are presented with the same 16 'practice' characters as TG – teacher read out characters no intervention			CG: printed word list

Phase	Procedure	Time	Material	Delivery
	Receptive and productive tests in week 2,3,4	3 x 10 minutes	Word-Set 2 test	Paper test administered by the researcher in class. (CG & TG
Phase 3 Post intervention	Both CG and TG are asked to learn 16 Chinese characters. TG will be reminded to use IS. CG use their own way.	20 minutes	Word-Set 3	CG: Printed word list TG: Printed word list with images
	CG and TG take receptive and productive tests in week 4, 5, 6 *TG is reminded to apply IS during recall for tests in week4, 5, 6	3 x 10 minutes		Paper test delivered by the researcher in class. (CG & TG)

The original design was using a set of 8 characters in each phase. Due to the lack of guidelines for amount of character learned in primary school in Australian Curriculum (2023), and the lack of literature in learning Chinese characters in Australian primary school, the decision of 8 characters for each phase were based on the experience of the researcher in her teaching context. However, some students reached the ceiling score when Phase 1 was conducted. The decision was made to lift numbers of characters to 16 for the other two phases for a more robust result for data analysis. The cause of the full marks may result from divergent socio-economic backgrounds of students in two different school contexts. The

school the researcher has been working is socio-economically lower than the school that experiment was taken, which leads to disparate capabilities in learning. There should have been a pilot study, however due to the scope of master dissertation and limited time span for the researcher as a full-time teacher, no prior data has been collected before the experiment. This is a factor that should be considered for any further study.

Table 3.2

Test Timeline

	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**
Phase 1	Learning, Word set 1, Word set 1 test 1	Word set 1, Test 2	Word set 1, Test 3			
Phase 2		learning word set 2 word set 2 test 1	word set 2 test 2	word set 2 test 3		
Phase 3				Learning word set 3 Word set 3 test 1	Word set 3 test 2	Word set 3 test 3

Participants

Students from Year 6 classes, studying Chinese as part of their normal curriculum, in a private school in Adelaide were invited to participate in this study. The school is a co-ed Catholic school from Reception to Year 12 located in an eastern suburb in Adelaide. There are three classes with 67 students in Year 6 including 29 girls and 38 boys. Most students

have been learning Chinese from Reception till Year 6 with a few students enrolling in halfway. There is no clear guideline in Australian Curriculum for the quantity of Chinese characters students should learn in primary level in Australia, hence the Chinese lessons in the school are mainly focused on listening and speaking. Reading and writing in Pinyin, the Chinese alphabetic system for pronunciation rather than Chinese characters have been adopted in teaching and learning. Through randomly assigning students in control group and treatment group in their intact class based on their grades, there were 34 students in treatment group and 33 students in control group.

Materials

Three sets of characters were selected for this study (see Appendix A). The criteria of character selection were guided by memory capacity, character type (radical based), word frequency, stroke numbers/density and spatial layout (see Table 3.4). These criteria were used to try to ensure that all sets of words were of similar difficulty. According to Shen (2013), the presentation of learning materials should consider a learner's cognitive process in character learning as well as content in curriculum. Therefore, characters in each set were presented from single (radical) to compound, emphasising the orthographic-based knowledge in the process (see Table 3.3).

Table 3.3

Single and Compound Characters

Single	**Compound**
(character)	(character)
mù 木	lín 林
Meaning in English	Meaning in English
tree	woods

Table 3.4

Examples of characteristics of characters

Character	Type	Frequency	Density	Layout
日	Single character	67	4 strokes	Integral
月	Single character	116	4 strokes	Integral
生	Single character	40	5 strokes	Integral
兔	Compound character	725	7strokes	Top-bottom
昌	Compound character	1174	8 strokes	Top-bottom
明	Compound character	112	8 strokes	Left-right
星	Compound character	515	9 strokes	Top-bottom

Character	Type	Frequency	Density	Layout
晚	Compound character	674	11strokes	Left-right
木	Single character	682	4 strokes	Integral
田	Single character	714	5 strokes	Integral
才	Single character	227	3 strokes	Integral
林	Compound character	355	8 strokes	Left-right
果	Compound character	193	8 strokes	Top-bottom
材	Compound character	1069	7 strokes	Left-right
校	Compound character	632	10strokes	Left-right

Based on the findings in Xu et al. (2014) and Li and Tong (2020) in grouped character learning, radical-based grouping improves retention in compound characters. Hence, compound characters are grouped in radicals. All chosen characters are on high-frequency characters list of modern Chinese by Jun (2005) and compound characters are either in left-right or top-bottom structure. In Xu and Padilla's study (2013), stroke numbers/density is based on the Dictionary of Modern Chinese Characters (2005, p. 155), which has an average of 7.958 strokes of top 1000 the most frequently used characters. In the current study, the stroke numbers/density is from 4-11 with 56 strokes of set 1 characters in total, 102 strokes of set 2 characters and 101 in set 3 characters. Due to the reach of ceiling of set 1 characters in Phase 1 tests, set 2 and 3 had been lifted to 16 characters from 8 in set 1. There are unequal

character stroke numbers in Set 2 and 3, however, it is impossible to select characters of the same stroke numbers in each set to accommodate similarity in term of numbers of single and compound characters.

Two types of vocabulary recall were used in tests: receptive test (see Appendix B) and productive test (see Appendix C). In the receptive recall test students were required to write an English meaning of a Chinese word provided on a test sheet. In the productive recall test, students were required to write Chinese characters corresponding to the English words presented on the test sheet.

Procedure

The researcher provided instructions for treatment groups and the Chinese teacher of students' intact classes supervised with all control groups in all phases of experiment. Control and treatment groups were put into separate classrooms. Pre-test (Phase 1) was conducted for both groups with a set of 8 characters (single and compound) chosen for the experiment. No instructions were provided in this stage, and students were all required to learn these characters by themselves with a character list. Pinyin (phonetic system of characters) and English translation were provided with each character. Both recognition and production tasks were tested in week 1, 2, 3. Students were required to recognise characters by writing their English meanings in recognition test and writing characters with its English meanings in production test.

In Phase 2, the set of 16 characters were learned under different instructions. The control group continued learning using their own strategies with a handout only with characters, pinyin and English meaning. The teacher of control group read out new Chinese characters for the students. The treatment group learned through an Imagery Strategy with association and elaboration taught by the researcher; they associated the image with meaning and

elaborated the image in relation to both meaning and shape. Discussions of strategy use were conducted during this session with the treatment group were provided scaffolding from both researcher and capable students. For example, of 16 characters, 8 characters were provided with image and elaboration associated with meaning and form and the researcher explained in detail to provide assistance for students to implement this strategy. The other 8 were left for students to discuss the implementation of strategies they just learned to apply into new characters. All learning sessions for each group were 20 minutes. Both recognition and production were tested in week 2, 3, 4.

The post intervention (Phase 3) also used 16 characters. Both CG and TG groups received a handout character list. CG was given character list only with Pinyin and meaning while TG were given character list with Pinyin, meaning, pictures, and elaborations using Imagery Strategy with association in the first 8 characters and only Pinyin and meaning for the other 8 characters. TG were reminded to use strategy to learn 16 characters by themselves. All learning sessions for each group were 20 minutes. Recognition and production were tested in week 4, 5, 6.

Imagery Strategy

The instruction of an Imagery Strategy combining association and elaboration (Imagery Strategy IS) was used to introduce characters for the experimental groups (see Appendix E)

Imagery Strategy with association and elaboration (IS)

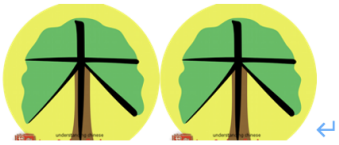
In IS, students were taught to see characters (radicals) as images that are related to their meanings and shape through both pictures and elaboration provided by the researcher (see Figure 3.1). The interpretation of meaning and shape was also added in the encoding process to reinforce understanding and memory. The learning sequence was from simple characters

(radical) to compound characters (Shen, 2013). Discussion of images with association and elaboration in new characters were conducted to enhance internalisation of strategy use to promote cognitive development of learners.

Figure 3.1

Example of Imagery Strategy with association and elaboration (IS)

lín 林 woods



To remember lín 林 means woods, imagine two trees standing together.

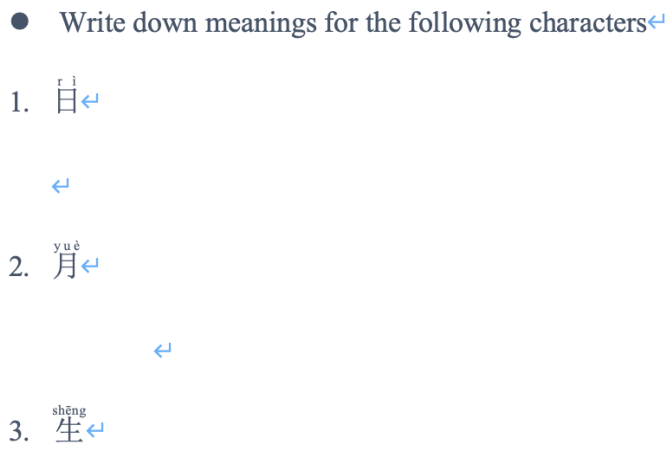
Character-Learning Tests

Character tests

There were two instruments applied to character tests for the purpose of the study: character writing test and character recognition test (see Appendix B, Appendix C, Figure 3.2). To control for the effect of recall, students always took productive tests first, followed with receptive tests. In this way, the receptive tests did not act as another learning opportunity. Students were required to write correct characters according to their English meaning in productive tests and write English meaning for corresponding characters in receptive tests.

Figure 3.2

Receptive Test Example



Character Scoring Scheme

The productive writing test required students to write down characters they have learned. The scoring criteria for production were adopted and modified from the Character Scoring Scheme by Chang et al. (2014). According to Chang and his colleagues, there are four units making up Chinese orthography: stroke, chunk, layout and character. Each unit as an individual scoring schema based on the ratio of correct responses. In this study, characters were groups in radicals with both single and compound characters, therefore, chunk scoring was not suitable for single characters. Hence, only stroke, layout and characters were used to the scoring criteria (Figure 3.3).

Stroke

Stroke is the basic writing pattern to make up a character. To reproduce the correct shape of strokes is the main focus of stroke scoring regardless of graphic relationship with other strokes. The proportion of correct numbers of stroke produced by a learner is the score for stroke, which reflected the participants' representation of these basic writing patterns.

Layout

A layout is a positional rule that forms a hierarchy of spatial information within a square (Chang et al., 2014). Layout structures used by Chang et al. were based on the concept of chunks that include single, half-split, two-quarter circled, three-quarter circled, enclosed, and converging. For this study, radical and components were main concerns, hence, layout referred to pattern of Chinese character structures (Dai et al., 2007) including the most common 10 types: single-radical, left-right, up-down, up-right, left-down, up-left-down, left-up-right, left-down-right, and enclosure. To score a layout, participants needed to respond correctly according to the spatial hierarchy in a square, which is the correct structure of a character. The correct writing of components is not of concern. Hence, the proportion of correct sub-layouts from participants was the layout score.

Character

The character score is the completely correct character produced by the participants. Therefore, the score was either 1 or 0. The total score is the sum of all 3 units.

Figure 3.3

Example scoring

	Correct 'grow' character	**Incorrect 'grow' character (one horizontal stroke less than the correct and the top little line at the bottom)**
		
Strokes	5 strokes Score: 1	4 strokes i.e., one horizontal stroke missing Score: 0.8 (4/5)
Layout	All strokes correctly positioned Score: 1	one stroke incorrectly positioned i.e., the top little line at the bottom Score: 0.6(3/5)
Character	Completely correct character Score: 1	Incorrect character Score: 0 Total score: 1.4

Chapter Four Results

After the experiment, data preparation was conducted to ensure that the data were properly organized for analysis (Creswell, 2012). The results of test were graded by the researcher under the guidance of Character Scoring Scheme by Chang et al. (2014).

All data were checked to ensure they were correctly entered and that no errors have been made. Individual students were given identification numbers from 1-67 and names deleted from file. Due to the inequivalence of characters chosen between Phase 1 and other two phases, as Phase 1 tested only 8 characters, and the 16-character sets in Phases 2 and 3 might not be of identical difficulty, analyses were conducted separately within each phase. In addition, due to unforeseen reasons, such as sickness, absence for medical appointment and school event, there was a total of 28 missing data across all three phases in the 67 participants, with 17 missing data in treatment group and 11 in control group. Given the relatively small sample size, to maximise statistical power, missing data were imputed using SPSS's impute data function. Imputation did not change conclusions: analyses of the imputed data produced similar results to those that only used cases with complete data.

To answer the research question, if intervention improve character leaning in both recognition and production, a series of 2 (Condition: Treatment vs. Control) × 3 (Time: Time 1, Time 2, Time 3) mixed-model ANOVAs were conducted on the production and recognition of Chinese characters. As a reminder, there were three phases in the experiment, Phase1 (pre-test), Phase 2 (intervention) and Phase 3 (post-test). In each phase, students learned a set of Chinese characters, and were tested immediately post learning, and then twice more, at one-week intervals, without further learning opportunities. Different word sets were used for each phase.

Production of characters in each phase

Phase 1 production

In Phase 1 both conditions used their own ways to learn 8 Chinese characters and the purpose of this stage was to compare two groups before any intervention. An immediate test was conducted after the learning session on the same day (Time 1), a first delayed test was conducted one week after the learning session (Time 2) and a second delayed test was conducted two weeks after the learning session (Time 3). The students did not see the word list again after the learning session.

A mixed model ANOVA was conducted to examine the learning results in Phase 1 production for 3 times with word set 1. The descriptive statistics are displayed in Table 4.1. The analysis demonstrated a significant main effect of time, F (2, 130) = 27.58, p < .001, η_p^2 = .30, suggesting that mean scores changed significantly over the three time points regardless of condition. Pairwise comparisons revealed a significant drop in performance from Time 1 to Time 2, p < .01, indicating that both groups found it challenging to retain the newly learned Chinese characters over the first week. The drop continued in Time 3, p = .01, suggesting an ongoing challenge in retention. There was no significant main effect of condition, p =.39, indicating that there was no difference between the two conditions.

Furthermore, there was a nonsignificant interaction between condition and time, F (2, 130) = 1.49, p = .23, ηp^2 = .22, indicating that there was no significant difference between conditions in the pattern of change in production of characters over time. The results showed that the random assignment of participants resulted in no significant difference between the two groups in their ability to produce Chinese characters.

Table 4.1

Mean Percent Correct (and Standard Deviation) for Phase 1 Production, by Condition and Time

	Condition		
Time	Treatment	Control	Total
Time 1	65.94 (34.93)	53.82 (34.44)	61.88 (34.41)
Time 2	46.58 (32.53)	43.36 (29.81)	44.97 (31.17)
Time 3	36.69 (27.72)	35.16 (26.73)	35.93 (27.22)
Total	49.73 (31.72)	44.11 (21.75)	47.60 (30.93)

Phase 2 production

During Phase 2, all students were asked to learn word set 2 with 16 new characters. The control group continued to learn characters using their own way. The treatment groups received an interactive learning session with the teacher. Three tests were taken place in three time points. There was a reminder of strategy use before each test for treatment group from the teacher, and students did not see the word list again after the learning session for both conditions.

The descriptive statistics in Table 4.2. A significant main effect of time was observed, $F(2, 130) = 76.87$, $p < .001$, $\eta_p^2 = .54$. Time had a substantial impact on performance, irrespective of group assignment. Production dropped in Time 2 and the decline lessened in Time 3. Pairwise comparisons revealed a significant drop in performance from Time 1 to Time 2, $p < .01$, $d = 0.52$, indicating that both groups found it challenging to retain the newly learned Chinese characters over the first week. The effect size from Time 1 to Time 2 was $d = 0.94$, which implies that students showed a notable decline after a one-week delay. By Time 3, the performance drop became non-significant compared to Time 2, $p = .90$, with

an effect size of $d = 0.01$, which indicates that while the initial decline in performance was steep, both groups' performance stabilized after the second week.

Of greater relevance, and in contrast to Phase 1, there was a significant main effect of condition, F (1, 65) = 24.83, $p < .001$, $\eta_p^2 = .28$, indicating that the treatment group scored higher than control group overall in Phase 2 intervention.

The interaction between condition and time was nonsignificant, F (2, 130) = 1.28, $p = .28$, $\eta p^2 = .02$, suggesting a similar trend between conditions in the progress of production of characters in Phase 2 over three time points.

Table 4.2

Mean Percent Correct (and Standard Deviation) for Phase 2 Production, by Condition and Time

	Condition		
Time	Treatment	Control	Total
Time 1	82.89 (17.89)	57.75 (25.80)	70.50 (25.35)
Time 2	57.22 (19.58)	38.40 (22.23)	47.96 (22.83)
Time 3	59.60 (20.86)	35.55 (19.53)	47.75 (23.43)
Total	66.57 (19.44)	43.90 (22.52)	55.40 (23.87)

Phase 3 production

In Phase 3, control group students were given word set 3 using their own ways to learn another new 16 Chinese characters. A self-learning session was conducted with treatment group using the same 16 characters, supplemented with a handout featuring illustrative pictures and elaborations that highlighted strategies introduced in Phase 2 at Time 1. Phase 3 was to investigate if treatment students were able to apply the strategies to the new learning content.

The descriptive statistics for the production tests in Phase 3 post-test are in Table 4.3. Consistent with Phase 1 and Phase 2, a significant main effect of time was observed, F (2, 130) = 83.06, $p < .001$, $\eta_p^2 = .56$. Performance experienced a similar trend to Phase 2, dropping significantly in Time 2 and stabilised in Time 3. The pairwise comparisons indicated a significant decline in performance from Time 1 to Time 2, $p < .01$, $d = 0.87$. By Time 3, the decrease in performance was no longer significant compared to Time 2, $p = .67$, $d = 0.02$. The similar trajectory of three phases may suggest that even if the intervention was effective in producing more characters, the difficulty of producing characters is still challenging for both conditions without further review. Regardless of condition, compared to Phase 1, both groups seemed to develop their strategy use through repetitive tests to decrease the drop in Time 3 in both Phase 2 and 3.

Similar to Phase 2, a significance main effect of condition was observed, F (1, 65) = 18.12, $p < .001$, $\eta_p^2 = .22$, indicating that, overall, the treatment group outperformed the control group in Phase 3 post-test. There was a large effect of condition with $d = 0.72$, which suggests that students who received interactive strategy instruction had an advantage in producing newly learned characters and were able to effectively apply the strategies to new learning.

No significant interaction of condition and time was found in Phase 3, F (2, 130) =.94, p =.40, $\eta p^2 = .01$. Like Phase 1 and 2, both the intervention and control groups exhibited a consistent pattern, displaying an initial drop in performance one week after the learning session and performance stabilised two weeks after the session.

Table 4.3

Mean Percent Correct (and Standard Deviation) for Phase 3 Production, by Condition and Time

	Condition		
Time	Treatment	Control	Total
Time 1	64.42 (26.96)	39.40 (24.22)	52.10 (28.40)
Time 2	39.53 (23.83)	19.54 (18.01)	29.69 (23.29)
Time 3	40.51 (24.45)	19.71 (19.41)	30.27 (24.31)
Total	42.80(25.08)	26.21 (20.55)	36.35 (25.33)

Recognition of characters in each phase

Phase 1 recognition

Phase 1 was an initial learning stage without any intervention for both groups. Table 4.4 displays the descriptive statistics of recognition tests in Phase 1. A significant main effect of time was found in recognising Chinese characters, F (2, 130) = 17.68, $p < .001$, $\eta_p^2 = .21$. Pairwise comparisons revealed a significant drop in character recognition from Time 1 to Time 2 $p < .01$, $d = 0.50$. However, unlike the production tests in Phase 1, both groups showed stabilization in character recognition by Time 3, with no significant decline compared to Time 2 $p = .16$, $d = - 0.11$, suggesting that the initial drop in recognition was followed by some level of retention or strategy development over time through repetition in tests. It suggests that students were able to develop strategies over time even without intervention for recognition, which also confirmed the finding in production that producing characters correctly is more difficult for students with non-alphabetic backgrounds.

There was no significant main effect of condition $p = .12$, $d = 0.34$, suggesting that both conditions performed similarly in Phase 1 pre-test. There was a nonsignificant interaction

between condition and time, F (2, 130) = 0.02, p = .98, ηp^2 = .00, indicating that there was no significant difference between the conditions in the trajectory of character recognition over the three time points.

Table 4.4

Mean Percent Correct (and Standard Deviation) for Phase 1 Recognition, by Condition and Time

	Condition		
Time	Treatment	Control	Total
Time 1	77.30 (27.54)	87.00 (22.37)	82.15 (24.96)
Time 2	62.71 (32.94)	73.16 (30.37)	67.93 (31.66)
Time 3	59.63 (28.15)	68.81 (32.75)	64.22 (30.45)
Total	66.55 (29.54)	76.32 (28.50)	71.43 (29.02)

Phase 2 Recognition

As a reminder, Phase 2 was the intervention stage where treatment group had an interactive learning session with the teacher and control group learned by themselves.

The analysis from descriptive statistics in Table 4.5 highlights that time played a significant role in character recognition for the sample, F (2, 130) = 59.37, $p < .001$, ηp^2 = .48. Pairwise comparisons further reveal a substantial performance drop from Time 1 to Time 2, $p < .01$, with a large effect size d = 0.81. Yet, by Time 3, performance had stabilized, with no significant difference compared to Time 2, p = .33, and a minimal effect size d = 0.07, pointing to a possible adaptation process where both groups formed some strategies to retain material through repetition in tests. The larger effect sizes in Phase 2 compared to Phase 1 reflect the greater difficulty and complexity of Word Set 2 than Word Set 1.

Of more relevance, a significant main effect of condition, F (1, 65) = 14.89, p < .001, ηp^2 = .19, confirms the benefit of the intervention. The treatment group outperformed the control group on recognition tasks overall, demonstrating that teacher interaction positively impacted retention even though the control group had a small advantage in pre-test d = - 0.33. However, after intervention, the advantage disappeared with d = 0.84. This indicates that students who received strategy instruction under teacher scaffolding were able to retain a significantly larger number of characters in recognition compared to those who relied on their own strategies. Despite this advantage, the nonsignificant interaction between condition and time, F (2, 130) = 1.93, p = .15, ηp^2 = .03, suggests that both groups ultimately followed a similar pattern.

Table 4.5

Mean Percent Correct (and Standard Deviation) for Phase 2 Recognition, by Condition and Time

	Condition		
Time	Treatment	Control	Total
Time 1	83.65 (21.43)	66.29 (28.21)	75.10 (26.30)
Time 2	63.12 (25.46)	42.60 (38.11)	53.01 (28.54)
Time 3	64.13 (23.70)	37.26 (26.68)	50.89 (28.44)
Total	71.30 (23.53)	49.71 (27.67)	59.67 (27.76)

Phase 3 Recognition

Phase 3 was a post-test stage to see if students in the treatment group were able to apply the learnt strategy into new learning. Table 4.6 presents the descriptive statistics of the Phase 3 recognition tests, revealing a significant main effect of time, F (2, 130) = 52.68, p < .001,

ηp^2 = .45. One week after the learning session, students in both groups struggled to retain characters, with pairwise comparisons confirming a significant drop at Time 2, $p < .01$, d = 0.87. However, by Time 3, the decline had stabilized, with no further significant decrease, p = .16, d =-.02.

A significant main effect of condition, F (1, 65) = 16.30, $p < .001$, ηp^2 = .20, highlights the positive impact of the intervention. The treatment group outperformed the control group overall, d = 0.87, demonstrating that strategy instruction effectively enhanced character recognition. This advantage from Phase 2 allowed the intervention group to apply learned strategies to new content in Phase 3, which strengthened their retention.

The ANOVA also revealed a significant interaction between condition and time, F (2, 130) = 5.51, p = .005, ηp^2 = .078, indicating that the retention trajectory over time differed between the two conditions. Table 4.6 gives means and effect sizes. From Figure 4.1, as Phase 3 progressed, the difference between the conditions increased. Figure 4.1 illustrates these distinct patterns, showing that while both groups started at similar recognition levels (p = .06), a significant advantage emerged for the intervention group by Time 2 ($p < .01$), and this gap widened by Time 3 ($p < .01$).

Figure 4.1

Phase 3 Recognition over 3 Times, by Condition

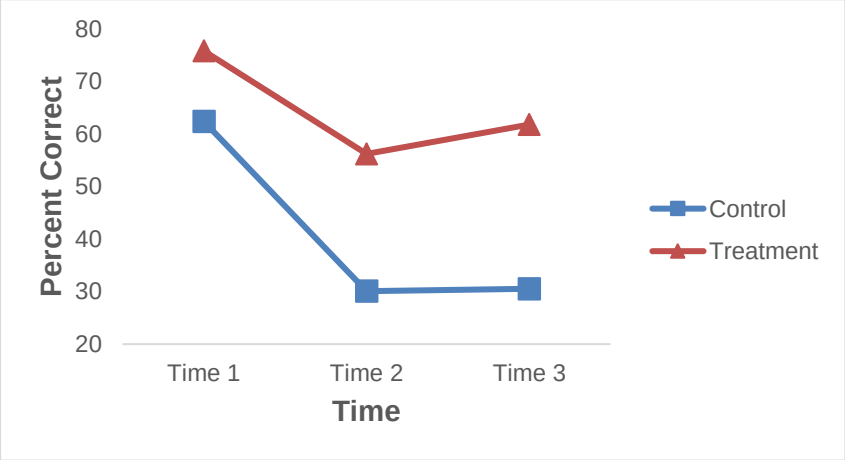


Table 4.6

Mean Percent Correct (and Standard Deviation) for Phase3 Recognition, by Condition and Time

	Condition		
Time	Treatment	Control	Cohen's *d*
Time 1	75.76 (25.68)	62.34 (32.54)	0.46
Time 2	56.17 (28.32)	30.07 (24.16)	1.00
Time 3	61.75 (25.98)	30.50 (25.98)	1.20

The effect sizes in Table 4.6 further support these findings. Immediately after the learning session, the treatment group showed a moderate advantage. This effect size grew substantially at Time 2, reflecting the intervention group's stronger retention a week later, and increased even further at Time 3. The growing effect size indicates the intervention sustained impact on character recognition, as the treatment group consistently retained more than the control group.

The results confirm the hypothesis that teacher- scaffolded strategy instruction lead to improvement in students' recognition and production of Chinese characters.

Chapter Five Discussion

This study examined learners' learning outcomes in the production and recognition of Chinese characters. 67 Year 6 students from a Reception-Yr 12 co-ed Catholic school participated in the study. The explicit instructions were delivered based upon the ZPD framework and its scaffolding strategies. The findings provide insights into how early intervention and targeted scaffolding enhance Chinese language learning and retention, particularly from English-speaking background.

Primary students' ability in learning the meaning mapping in Chinese characters (Chan et al., 2020) include two components, namely production and recognition, because they represent the bi-directional retrieval, examining the strength of the recall in both directions (Wang, 2007). It was found that students showed a similar pattern of loss in production over time regardless of conditions, but the treatment group consistently retained more characters in production during intervention and post-test. For recognition, the treatment group retained more characters after intervention. Furthermore, a difference in character recognition over time was found in post-test. The gap between the treatment group and control group grew larger as time progressed. This suggests that the treatment group was not only able to recognise more characters when taught by teacher, but also able to transfer the knowledge of strategy into newly learnt characters.

In terms of teacher's roles, the better retention of treatment group in both recognition and production could also be attributed to the teacher's role in scaffolding, explicit instruction and designing learning materials. Targeted scaffolding, tailored to English background leaners, combined with both teacher-led and student-led approaches, enabled learners not only retain characters taught by teachers but also able to apply the strategy to their new learning. Through explicit instruction, students' attention was found directed to characteristics of individual characters, supporting them to accumulate orthographic

knowledge to analyse components of characters. Furthermore, the materials arranged in character-centred approach facilitate orthographic knowledge further from scaffolding to independent learning.

The following section starts with discussion of findings in Chinese language perspective, followed by teachers' role and scaffolding.

Learning Chinese Characters

According to Orton and Scrimgeour (2019), the biggest hurdle for learners from English background is the ability to read Chinese scrips and communicate ideas in writing. For beginners, the most reliable source to support their reading and writing is the form of Chinese characters, which normally carry sematic information that helps decode meaning. Hence, form-meaning mapping is crucial for novice Chinese learners to develop their literacy skills, similar to learners of other languages learners (Chan et al.,2020).

The findings in this study consistently support previous research in Chinese as a foreign language learning that effective strategy instruction enhance character learning (Chang et al., 2014; Li and Tong, 2020; Shen, 2004, 2010; Xu et al., 2014). In this case, the study specifically highlights its effectiveness in both production and recognition Chinese characters for young learners.

Chinese Character Production

In production, students were asked to learn by themselves during pre-test and the results of continuous drop in retention aligns with literature that students find challenging to learn Chinese characters without any instructions from teachers (Orton & Scrimgeour, 2019). As a result, the learning outcome of the treatment group exceeded the control group at all times in intervention phase and post–test phase.

This finding agrees with previous studies that cognitive strategy involving mental imagery improves Chinese character recall (Ho, 1984; McGinnis, 1999; Li & Tong, 2020; Shen, 2010). According to Dual-coding Theory (Paivio, 1971, 1986a), new information coded in both imagery and verbal systems is more easily recalled. This study extended the previous studies by adopting elaboration in both imagery and verbal information. Images of characters provide visual cues (see Appendix A) for students to associate pictures with the form of characters, while verbal elaboration strengthens the route of meaning and form. Together, the two separated but interconnected systems leave a deeper trace in memory for retrieval. However, previous studies have largely focused on *recognition*. This study contributes new evidence by supporting the effectiveness of Dual-Coding Theory in the *production* of Chinese characters. Compared to pre-test, the treatment group retained more characters than control group at all time points during intervention and post-test stages.

In addition, the finding of better production in the treatment group also aligns with the findings of previous studies (Li & Tong, 2020; Shen, 2004) that based on the levels of processing model (Craik & Lockhart, 1972). According to the model, deep processing with sematic related information facilitates better encoding than shallow processing such as rote memorisation. The current research also confirmed Shen's (2004) results, which demonstrated that both teacher-led and self-generated elaboration are more effective for recall than rote repetition. This study extended the effect of elaboration from recognition only to both recognition and production of Chinese characters. Teacher-led and self-generated elaboration were combined during intervention to enhance strategy learning and the superior recall of treatment group in production supports the effectiveness of deep processing in character production.

Furthermore, better retention of character production with intervention found in this study is consistent with previous studies on the significant role of instructions in orthographic

and radical knowledge in character learning (Jackson, Everson, & Ke, 2003; Shen & Ke, 2007; Ke ,1998; Taft & Chung, 1999; Wang, Liu& Perfetti, 2004; Xu et al., 2014; Wong, 2017). Orton and Scrimgeour (2019) argued that the teacher's instruction should direct students' attention to specific Chinese language features to enhance their awareness of orthographic and radical knowledge, which is the key to decode Chinese characters. During teaching session, the teacher explicitly explained the role of radical and its layout principles in a compound character, emphasising the knowledge of Chinese orthograph that is significantly different from English. This knowledge provides a sematic cue to retrieval. Learning how a character is structured and how its radicals are arranged directs students' attention to its form and internal components, which are the most challenging yet essential aspects of writing in Chinese (Orton & Scrimgeour, 2019).

The production scores of both groups stabilised after an initial drop in Time 2 in both intervention and post-test. This finding suggests that repetitive tests can be used to serve as a form of learning. This finding aligns with learning pathways facilitated by testing. Murphy et al. (2023) proposed two routes of learning through testing. One is through self-assessment of students' own knowledge and identify gaps, the other is through strengthening the retrieval route. In repetitive tests, the control group might have developed strategies to remember characters through analysing gaps in knowledge even without intervention. This was because the learning materials were organised in a character-centred way, grouping among radicals from simple to complex characters. With reoccurring components in characters as radicals, some students were able to develop orthographic knowledge by themselves. Studies suggested that character-centred way is more effective for learning characters than meaning-centred method (Chang et al., 2014; Xu et al., 2014), and characters grouped under radicals are better for recall due to the chunking of information in the same unit in memory (Xu & Padilla, 2013). Even without instruction, with repetitive testing, some students seemed able to

notice the recurring components (radical) in characters, hence, started to form their own radical related strategy. This possibility of natural strategy learning with well-arranged learning materials needs further examination in future.

With the ability of self-generate strategies through well organised learning materials and repetitive tests, the action of recalling itself strengthens and adjusts the memory route for representation when leaners successfully retrieve information (Murphy et al., 2023). Even without review for each test, the repetitive practice of retrieval may strengthen or even improv these pathways, which could explain why stabilization did not occur in Time 3 of the pre-test phase but emerged after repeated tests during the intervention and post-test phases.

Despite the stabilisation effect, there was no significant difference between the groups in the trajectory of production over time. This can be attributed to the fact that form is more difficult to recall than meaning (Shen, 2010; Xu & Padilla, 2013). Writing ability such producing characters was developed more slowly than recognition (Lam, 2011) and the complex layers of Chinese characters mentioned above imposed additional challenges for learners to recall form. Writing requires not only orthographic and radical knowledge but also the ability of visual chunking and motor skills (Wright & Wang, 2023). This difficulty is compounded for primary students, who are still developing their fine motor skills.

The lack of the regular reviews and writing practice could explain the similar pattern of Chinese production over time between two groups. Literature suggests these practices are essential for reinforcing the recall of internal arrangement of its components (Orton & Scrimgeour, 2019; Shen, 2010; Xu et al., 2013; Xu & Padilla, 2013). Traditionally, Chinese native speakers started to learn to write 2000 characters before learning to read and the learning of reading and writing was separated (Lam, 2011). The most effective way to learn how to write was identified as repetitively practice in handwriting (Lam, 2011). However, by itself, this approach may not be the best method for learners with English background for

several reasons. First, classroom time is limited, and covering more content often takes precedence over handwriting practice (Orton & Scrimgeour, 2019). Second, repetitive handwriting practice may not align with the preferred learning styles of English-background learners (Orton, 2016). Finally, excessive repetition could reduce motivation (Orton & Scrimgeour, 2019). Nevertheless, incorporating the Imagery Strategy alongside handwriting practice might be worth exploring in future research. Moreover, Shen (2005) identified preview (learning class content before a lesson) and review (learning class content after a lesson) are the second most commonly used strategy after orthographic knowledge-related strategies by learners of English background. Similarly, Li and Tong (2020) found that frequent and extended review sessions guided by teachers significantly improved retention of Chinese word recognition. The effect of repetition review through teacher's instruction for production requests further research.

Chinese Character Recognition

In recognition, in contrast to production, Time 3 stabilisation stage emerged during pre-test not intervention phase, which indicates that the strategy for recognition of characters and the retrieval route of recognition has been formed and strengthened only by two consecutive tests even without intervention. The findings supports the notion that recall of meaning is easier than recall of form, so recognition is easier than production. Students were able to form their own strategies for mapping form on meaning using well-organised learning resources with character-centred approach. This highlights the importance of well-designed materials in facilitating the recognition of characters (Orton & Scrimgeour, 2019).

Despite the early development of retrieval route in recognition, the intervention still played a significant role in retention. Over time, the retention gap grew bigger in post-test. With strategy instruction, the intervention group internalised and refined their learning techniques, progressively building their mastery of Chinese character recognition. Learners

was not only able to retain characters taught by the teacher but successfully transferred the knowledge to new characters. This strategic foundation enabled sustained progress, while the control group's improvement was slower and less pronounced over time. The finding is consistent with literature that orthographic related knowledge and instruction enhance the mapping from form to meaning (Jackson, Everson, & Ke, 2003; Shen & Ke, 2007; Ke ,1998; Taft & Chung, 1999; Wang, Liu& Perfetti, 2004; Xu et al., 2014; Wong, 2017).

Overall, the current study is consistent with literature in Chinese character learning. However, most studies focus on mapping form on meaning or the examination of sound, form and meaning mapping. This study distinguishes between two-way retrieval: mapping form on meaning and mapping meaning on form of Chinese characters (Wyra et al.,2007). With instructions on cognitive strategy of imagery and association, the study supports that the orthographic knowledge can be obtained by learners to strengthen both way retrieval.

Teachers' role and scaffolding

In ZPD (Wood et al. 1976; Vygotsky, 1978), teacher's scaffolding plays a crucial role in assisting learners progress from their current independent level to their potential learning outcomes. This study thus, used ZPD as the theoretical underpinnings for the action of intervention in emphasising the role of the teacher's strategy instruction with scaffolding in learning Chinese characters. The findings in this study support previous research in second or foreign language learning that scaffolding in ZPD framework enhance language acquisition (Liu, 2024; Mirzaei & Eslami, 2015; Nazerian, Abbasian & Mohseni, 2021). Specifically, the study underscores the value of using ZPD to guide intervention strategy, as the main findings indicate that independent learning occurs during pre-test with both groups exhibiting similar retention and pattern of characters. However, during the intervention and post-test phases, the

treatment group recalled more characters in both production and recognition, suggesting that teacher's scaffolding enabled learners to reach their potential learning outcomes.

Our findings show in production, the treatment group consistently retained more characters across all time points, reflecting the direct impact of explicit strategy instruction combined with scaffolding. The advantage was not only limited to immediate recall after learning session but also extended to one-week and two-week intervals, which implied that with teacher's scaffolding, learners were able to restore their knowledge for a longer time. In recognition, the widening gap between the treatment and control groups during the post-test phase highlights the treatment group's ability to apply their knowledge of strategy to newly learned characters. These findings underscore the effectiveness of scaffolding within the ZPD framework (Vygotsky, 1978) in fostering both immediate retention and the long-term application of learning strategies.

The learning outcomes supports the literature of the process of scaffolding in ZPD. As Nassaji and Swain (2010) argued, the assistance from teacher in ZPD should be targeted. By designing intervention to address specific features of Chinese language and learners' perception of learning Chinese characters, the scaffolding targeted the challenges faced by the novice learners. Hence, the strategy instruction was tailored to meet the need of students with an English background. Moreover, scholars (Antón, 1999; Donovan & Smolkin, 2002; Verenikina ,2003) suggested that scaffolding should be learner-centred and teacher should act as a guide rather than being dominant. This principle was reflected in the learning session during the intervention, where the teacher explicitly taught the strategy with examples, followed by a class discussion on applying the strategy to the other half of the new characters. In this process, learners not only learned from interaction with an adult but also through interaction with capable peers in discussions, which is a dynamic learning

environment to foster cognitive growth and deep language learning as Swan (2005) suggested.

There are several implications for the teacher's role in current study. First, teacher's role in scaffolding in ZPD plays an essential part in assisting learners to reach their full potential as Wood et al. (1976) and Vygotsky (1978) proposed. In literature, there is an ongoing debate about whether primary students possess the cognitive ability and sufficient character learning experience to master radical based knowledge (Xu et al., 2014). It is true that the progress of Chinese character learning largely depends on numbers of characters students have encountered to form more effective strategies to analyse radical and components. However, given the limited school time for learning Chinese, relying solely on the natural accumulation to develop strategy is unrealistic. Hence, the teacher's role to assist students to form effective strategy based on their understanding is key to develop literacy skills in school settings. The study demonstrated that teacher's scaffolding in instruction enhanced character learning in both production and recognition at primary level. The gap between students' natural learning and potential learning can be bridged through teacher's scaffolding.

Another implication is the effect of the teacher's explicit instruction in strategy. As previous studies suggested, learning strategies are teachable and should be systematically incorporated into class instruction (Nation, 2013; Orton & Scrimgeour, 2019; Shen, 2005). Through explicit teaching (Ellis, 2006), students' attention is directed to the form and specific linguistic features as well as applications of strategies into these features to remember characters. The process not only helps students understand the underlying structure but also enables them to develop metacognition skills by consciously applying appropriate strategies and forming their own unique way of learning. In the study, explicit strategy instruction was paired with class discussion, which empowered students to become autonomous learners by equipping them with tools they can adapt to various language tasks, fostering long-term

learning and proficiency. Therefore, explicit teaching of strategies with discussion is not merely an instructional technique but a critical factor in facilitating deep, sustainable learning.

Another key consideration is the teacher's role in designing teaching materials. In this study, all characters were grouped under radicals. This arrangement releases cognitive load by chunking the characters with same radical under units in memory rather than remember them individually. The other arrangement is that character-centred learning, which is contrary to meaning-centred approach. In meaning-centred approach, characters are chosen from words in textbook based on topics. Although there is an argument about whether characters should be learned in isolation or integrated into lessons focused on communicative skills such as listening and speaking, the reality in Australian schools offers some practical insights. As Orton and Scrimgeour (2019) argued, meaning-centred approach adopted by native speakers learning Chinese in China is practical because of their proficient skills in oral language. By the time the native speakers start to learn how to read and write, they have accumulated vast of range of vocabulary in their speaking and the only thing they need to do is to map meaning and sound to their spoken language. In contrast, for students with limited ability in speaking and listening, this approach imposes extra cognitive burden for students in the process to focus on both communication and literacy. Hence, separating communicative tasks of speaking and listening from literacy tasks of reading and writing is a feasible way to learn Chinese characters for novice learners of Chinese.

This chapter discussed the findings of the impact of an explicit strategy instruction on Year 6 students learning Chinese characters. It examines production and recognition as two components of learning outcomes. In addition, teachers' roles and scaffolding are also examined within ZPD framework. The next chapter will conclude the study, address limitations, and provide suggestions of further investigations.

Chapter Six Conclusion

This study aimed to examine the effect of an explicit strategy instruction on supporting recognition and production of Chinese characters in primary learners, under teacher's scaffolding in framework of ZPD. The findings revealed that the strategy, which integrates imagery and elaboration enhanced retention in both recognition and production under explicit instruction and teacher's scaffolding.

This study makes several contributions to the field of learning Chinese as a foreign language. Firstly, it highlighted that the learning strategy that combined imagery and elaboration of connection of form and meaning facilitate character retention in both recognition and production. The strategy enhances orthographic knowledge in learners to promote better recall in both meaning and form. Secondly, this study fills the gap in the field of Character learning the primary learners. It demonstrated that with explicit instruction and well-designed materials, primary school learners are able to acquire orthographic knowledge to enhance recognition and production of characters. At last, the study highlighted scaffolding and teacher's role in instruction and the design of learning materials. Under explicit instruction of learning strategy and scaffolding, learners are able to reach their potential learning levels.

There are some implications and application considerations from the current study. Firstly, the design and organisation of Chinese teaching materials should account for the orthographic features of characters. There are many textbooks and resources available in Chinese as a foreign language field in Australia. However, most of them are organised in the order of topics from self-introduction to more complicated ones. Based on the benefits of strategy instruction observed in the current study, basic orthographic knowledge should be taught first to prepare students for learning characters at the beginner level, starting from the

concept of strokes, progressing to radicals, layout, and overall character configuration. Even within topic-based textbooks and resources, teaching characters in radical groups is also feasible. Teachers could choose most frequently used radical in each topic to highlight and analyse orthographic features of these characters for students to develop strategies of visualisation and chunking under radicals when process a compound character.

Secondly, scaffolding and meaningful classroom interactions are essential in bridging the gap between a learner's current capability and their potential performance. The explicit instructions on Imagery Strategy are key for scaffolding in this current study as it drew students' attention to specific language features for students to remember both meaning and form. In real class setting, focus should be shifted to the learners after explicit instruction for them to process and internalise knowledge to develop their own strategies for future learning, not only confined to strategies shared by the teacher.

Lastly, the application of the strategy instruction needs the perception, engagement and commitment of teachers. The Imagery Strategy adopted in this current study is developed by the researcher in her own teaching context and research background. However, it requires lots of time to put these instructions into the school curriculum demands considerable time, effort and adaptation. Teachers need to familiarise themselves with the approach, modify lesson plans, and providing ongoing scaffolding to help students internalise strategy effectively. Furthermore, the success of this instructional method depends not only on the willingness of teachers to implement it but also their ability to assess its impact on students learning as well as access to the materials. Regular reflection, adjustments, and feedback loops are essential to refine the strategy and maximise its effectiveness. Additionally, institutional support, including professional development opportunities and collaborative discussion among educators, can further enhance the feasibility and sustainability of strategy instruction. Thus, while the Imagery Strategy offers a promising approach to improving Chinese character

learning, its long-term success relies on continuous teachers' involvement structured implementation and a supportive learning environment.

The study has some limitations. Firstly, the time span for the experiment was restricted to only six weeks, which may not have been sufficient to observe the full impact of the intervention on students' Chinese character retention. Learning Chinese characters, particularly for English background speakers in Australian schools, is a long-term process due to the nature of Chinese writing system and limited lesson time. Secondly, the study conducted on a small scale with only 67 participants from a single year level of the same school. This limited sample size is insufficient to the generalisation of the findings to broader population in different educational contexts. In addition, having equal numbers of Chinese character across all phases are ideal for investigating differences between phases, future studies should ensure balanced set sizes to allow for more reliable comparisons and stronger validity of results. Moreover, conducting two conditions with two teachers may introduce some variation. Future studies should consider having the same teacher deliver both conditions, or incorporating measures to control for teacher-related effects, to strengthen the reliability of the findings. Finally, only Year 6 students were involved in the study and the effect of instruction on learners from other year levels is still unknown.

Building on the current study, some directions for future research are identified. Firstly, future studies should focus on expanding the scope of study to include more research sites, involving a great number of schools, teachers and students. This broad approach would improve generalizability of findings across various educational contexts and age group of learners. More specifically, future studies should explore the suitability of strategy for younger students who start to learn Chinese in Year 1 or 2, when their cognitive abilities are still developing. This would provide insights into how instructions should be adapted to cater for these younger learners. Additionally, it would be valuable to examine whether the

strategy is effective across different age groups or if it is more suitable for a particular developmental stage. Secondly, longitudinal studies are needed to examine the long-term effects of the strategy instruction and scaffolding. Such studies could also determine whether these instructions are effective for learners of different proficiency levels or only beneficial for beginners. Lastly, to obtain insights into experiences and perspectives of both teachers and students, qualitative methods, such as interviews, questionnaires and surveys should be incorporated to the research to form a more comprehensive of the effectiveness of strategy instruction with scaffolding. It would be valuable to explore whether teachers find the strategy easy to learn and implement in classroom setting or if additional training and resources are required to facilitate its application.

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Appendices

Appendix A Character list

Set 1 (pre-intervention)	
rì 日	sun
yuè 月	moon
shēng 生	grow
miǎn 免	remove
chāng 昌	prosperous
míng 明	bright
xīng 星	star
wǎn 晚	late

Set 2 (post-intervention)

mù
木 wood

To remember mù 木 means wood, imagine a tree with a big trunk and 5 branches.

tián
田 field

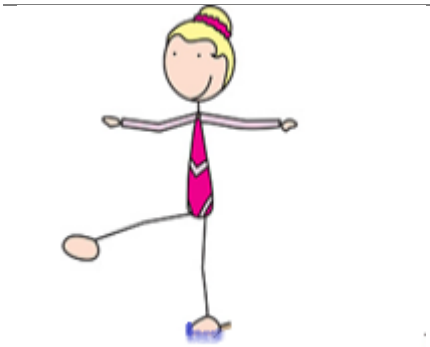
To remember tián 田 means filed, imagine the field used to grow plants

jiāo
交 cross

To remember 交 means cross, imagine two axes crossing with each other and a shield

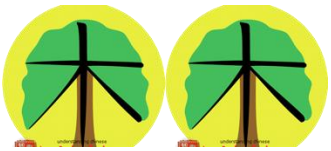
is on top of them.

cái
才 talent



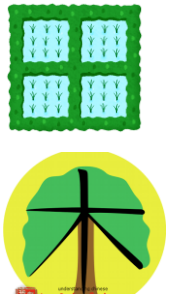
To remember cái 才means talent, imagine a talent of gymnastics is trying to balance in her movement.

lín 林 woods



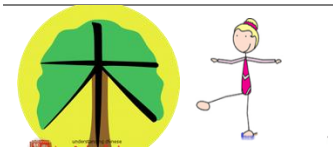
To remember lín 林 means woods, imagine two trees standing together.

guǒ 果 fruit



To remember guǒ 果 means fruit, imagine a fruit farm on top of a tree

cái 材 material



To remember 材 means material, imagine the material of beam used by the talent came from the tree on her left side.

口 (Kǒu)	mouth
叫 (jiào)	call
叶 (yè)	leaf
吉 (Jí)	Lucky

听 (tīng)	listen
吓 (Xià)	frighten
吃 (chī)	eat
喝 (hē)	drink

Appendix B Productive test

Character-Set 1for tests 1-3 in Phase 1

Please write down Chinese characters next to their English meanings provided.

Moon

Remove

Bright

late

Character -Set 2 for tests 1-3 in Phase 3

Please write down Chinese characters next to their English meanings provided.

Frield

Leaf

Fruit

School

Mouth

Talent

Listen

Eat

Appendix C Receptive test

Set 1

- Write down meanings for the following characters

  日

  生

  昌

  星

Set2

- Write down meanings for the following characters

  木

  吓 appe

  交

  林

  吉

  材

  叫

  喝

Appendix D Instructions

Imagery Strategy with association and elaboration (IS)

huǒ
火

To remember 火 means fire, imagine two woods leaning on each other with two flames at each side.

Miè
灭

To remember 灭 means extinguish, imagine to put out a fire, you have to put something on the Top of a fire.

Appendix E Glossary

Compound character	Characters contains two or more meaningful components
Logography	Writing system consists of logograms, which written or pictorial symbols represents whole word and its sound.
Morpheme	The smallest meaningful lexical item
Orthography	A set of conventions for writing a language
Orthographic awareness/knowledge	The understanding of conventions for writing a specific language. In Chinese, it refers to numbers and positions of each component that make characters
Phonetic radicals	Components represents sound of a whole character
Pictogram/ Pictograph	The character resembles the concept it expresses in appearance
Radical	Recurring side components in compound characters
Semantic radicals	Components that suggest broadly the semantic meaning of the character
Sematic-phonetic compounds	Characters have one side indicating meaning the other indicating sound
Simplified Chinese	Chinese characters are standardised by Chinese government in 1952. These characters are mainly used in mainland China and Singapore.
Single character	Characters have one meaningful component
Stroke	The smallest units in character that are constructed with various kinds of lines, dots, and hooks.

Traditional Chinese	Chinese characters commonly used before the foundation of People of Republican of China in 1949