Intervention for Children with Dyslexia in Chinese: A Comparison of Two Instructional Approaches

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Abstract

This study evaluated the effectiveness of two supplemental intervention programs for children with Dyslexia in Chinese. Twenty-two children (mean age: eight years and four months) who were formally diagnosed with dyslexia were assigned to one of the two theoretically different reading interventions. Children in the Code-Emphasis program received explicit and systematic instructions in character recognition with meta-linguistic analysis (ortho- morphological and ortho-phonological awareness), fluency and reading comprehension. Children in the Meaning-Emphasis program received explicit and systematic instructions on vocabulary building, fluency and comprehension. Both groups received 25 two-hour sessions (i.e., 50 hours in total) of intervention led by the researcher and teaching assistants for five consecutive weeks in the summer when the children did not attend regular classes. Pre- and post- intervention performances were measured in terms of (1) Reading Achievement Measures: Character Dictation (Spelling), Character Reading Fluency Test, Passage Reading Fluency Test and Reading Comprehension Test, and (2) Meta-Linguistic Measures: Test of Logographic Principles and Test of Orthographic Structure (Copying Accuracy Test and Copying Fluency Test). In the course of the intervention, students' progress was monitored eight times by measuring the students' character and passage reading fluency. Results indicate that (a) Meaning-Emphasis students demonstrated greater gains over the comparison group at the end of the 50-hour intervention on measure of Passage Reading Fluency Test after adjusting pre-intervention differences; (b) Code-Emphasis students showed an advantage over the comparison group on Copying Fluency Test after adjusting pre-intervention differences; (c) for the pre-post within group intervention effect, there were large treatment effects for four tests (Character Reading Fluency, Passage Reading Fluency, Dictation and Reading Comprehension Test) in the Code-Emphasis group, whereas Meaning-Emphasis group, there were two tests (Character

Reading Fluency and Passage Reading Fluency) with large within group treatment effect and two tests (Dictation and the Test of Logographic Principle) reflected medium treatment effect, and for the comparison group, only the test of reading comprehension reached large effect; and (d) coorelational and regression analyses showed that meta-linguistic awareness of the features of Chinese orthography is highly related to literacy achievement. Implications for future research and practice of supplementary Chinese literacy interventions in Hong Kong for children with dyslexia are discussed.

摘要

本研究旨在探討兩個不同的小組教學模式對支援讀寫障礙兒童學習中文方面的成效。 研究共招募了二十一位被評估爲有讀寫障礙的兒童（平均年齡爲八歲四個月），參加者被編入其中一個輔導小組，兩組的課程設計以不同的教學理念爲藍本。「強調字碼」小組輔導課程 (Code-Emphasis Program) 的學生接受教學目標明確的系統化語文訓練，課程內容包括主要教授「形義意識」及「形音意識」與字形關係、閱讀流暢和閱讀理解訓練。「強調詞義」小組輔導課程 (Meaning-Emphasis Program) 的學生亦是接受教學目標明確的系統化語文訓練，內容包括主要教授詞彙及詞義、閱讀流暢和閱讀理解訓練。

兩組學生分別在暑假期間接受一連五週的小組輔導課程，上課時數共五十小時（每節兩小時，共 25 節），每節課均由研究員擔當導師。研究員分別在課程展開前和課程完成後爲學生進行測試，以評估他們的學習表現。評估項目包括：（1）語文能力測試：單字默寫測試、單字閱讀流暢度測試、篇章閱讀流暢度測試及閱讀理解測試；（2）語言意識測試：形義音知識測試及字形結構測試 (抄寫準確測試及限時抄寫流暢測試)。在整個輔導課程期間，研究員爲學生進行共八次的進度評估，並以學生閱讀篇章的流暢度作爲進度指標。

研究結果顯示：（一）在完成50小時的小組輔導課程後，「強調字碼」小組輔導的學生在限時抄寫流暢測試方面的進步比沒有接受輔導的學生顯著；（二）以「強調詞義」小組輔導的學生在篇章閱讀流暢度測試上的表現比沒有接受輔導的學生優勝；（三）接受「強調字碼」小組輔導的學生的前後測平均數比較顯示，他們在默寫測試、單字閱讀、篇章閱讀流暢度測試及閱讀理解測試均獲得高效應值(effect size)。接受以「強調詞義」小組輔導的學生的前後測平均數比較顯示，他們在單字閱讀及篇章閱讀流暢

度測試均獲得高效應值(effect size)；(四) 從相關系數和迴歸分析發現，四項語文能力測試與語言意識測試 (形義音知識測試及限時抄寫流暢測試)有較高相關系數，而形義音知識測試的表現亦是預測各項語文能力的重要元素。本文亦就是次研究結果，探討在港推行的中文輔導課程在支援讀寫障礙兒童方面的發展及研究方向。

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CHAPTER 1
INTRODUCTION

1.1 Background

Reading is an essential skill of academic success and knowledge acquisition. Skillful readers are able to recognize words effortlessly, quickly and automatically in meaningful context or in isolation (Adams, 1990). Struggling readers are children who fail to recognize words efficiently and thus fall behind academically. Low reading proficiency may relate to a child's demographic background such as an economically disadvantaged family or minority students who receive reading instruction in their native language. Students who are identified as dyslexic persistently struggle with reading. It is suggested that dyslexia is a type of specific learning disability of neurological origin (Lyon, Shaywitz, & Shaywitz, 2003).

Appropriate and effective reading instruction is important in helping children with dyslexia and is receiving much attention internationally. In alphabetic language systems like English, the core deficit of dyslexia is found to be related to phonological awareness; that is the ability to analysis, understand and manipulate the structure of spoken words (Koda & Zehler, 2008). It is also a prerequisite of efficient word decoding and spelling (Lyon et al., 2003). Consequently, intervention for dyslexia in English-speaking countries like the United States devotes much attention to the teaching of phonemic awareness and phonics in helping children with dyslexia (National Reading Panel, 2000). Recently, the Reading First grants under The No Child Left Behind Act at 2001 (No Child Left Behind Act, 2001) suggest that vocabulary, fluency and comprehension are given equal importance to phonemic awareness and phonics in literacy development. The importance

of these five components (phonemic awareness, phonics, vocabulary, fluency and comprehension) was the conclusive findings of the National Reading Panel's comprehensive review (2000) on effective reading instruction. Teachers in the US are encouraged to teach the five essential components by using "research-based approaches" (Reading First Impact Report: Interim Report, 2008, p.10). Two approaches of reading instruction dominate common classroom practices (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001).They are the code-emphasis approach and the meaning-emphasis approach. The code-emphasis approach focuses on explicit instruction of the alphabetic principle and grapheme-phoneme mapping. The meaning-emphasis approach is derived from the whole language approach that reading development is the result of grasping the meaning of reading text and writing and it stresses the child's abilities to infer knowledge (Rayner et al., 2001; Pressley, 2006).

In contrast to the tremendous amount of research on dyslexia in western countries, research on dyslexia in Chinese societies (Hong Kong, Mainland China and Taiwan) has a relatively short history. In the late 1970's, it was believed that there was a low incidence rate of dyslexia in Chinese communities (cited in Ho, Chan, Lee, Tsang, & Luan, 2004). However, in the early 1980's, Stevenson and his colleagues reported that the prevalence rate of dyslexia in Chinese was comparable to that of western countries (Stevenson, Stigler, Lucker, Hsu, & Kitamura, 1982). In the 1990's, much attention focused on the uniqueness of the Chinese language and its writing system and how the orthography may be related to the manifestation of dyslexia in Chinese. Similar to the findings in English-speaking countries, phonological deficits and naming speed are also found in dyslexic Chinese (e.g., Chan, Ho, Tsang, Lee, & Chung, 2006; Goswami, 2002; Ho & Bryant, 1997a,b; Hu & Catts, 1998; McBride-Chang & Kail, 2002; Siok & Fletcher, 2001). However, due to the

low consistency between orthography and phonology in Chinese, deficits in multiple cognitive abilities such as visual-orthographic skills (Ho et al., 2004), morphological awareness (e.g. Shu, McBride-Chang, Wu, & Liu, 2006), and rapid naming speed (e.g. Bowers & Wolf, 1993; Ho & Lai, 1999; McBride-Chang & Manis, 1996; Wolf & Bowers, 1999) have also been observed in Chinese dyslexic children. It seems that, due to the complex relationship among phonology, morphology, and orthography of the Chinese language, various deficits may be involved in the manifestation of dyslexia in Chinese children.

Recently the Hong Kong Test of Specific Learning Difficulties in Reading and Writing was published to identify Chinese students with dyslexia (HKT-SpLD; Ho, Chan, Tsang, & Lee, 2000). The test includes two domains of measure (literacy domain and cognitive domain) to identify children with dyslexia (Ho et al., 2000). The literacy domain includes Chinese word reading, one-minute reading and Chinese word dictation; the cognitive domain includes naming speed, phonological awareness, phonological memory and orthographic knowledge (Ho et al., 2000). The widespread use of the test has rapidly increased the number of children identified as dyslexic in the last ten years (Chan, Ho, Tsang, Lee, & Chung, 2007; Education Bureau, 2009). Therefore, reading intervention for identified and at-risk children is in great demand.

1.2 Objectives of the Study

Unlike the Reading First Initiative, there is no consensus on the essential components for Chinese literacy development. Though a considerable amount of research has been conducted to investigate the nature of Chinese dyslexia, intervention studies in Chinese communities are still limited and fragmented in helping children with dyslexia. In

particular, there is a lack of a comprehensive, systematic and intensive intervention program for children with persistent literacy difficulties in Chinese. This study attempts to close the gap of knowledge by reviewing the essential components in Chinese literacy development to formulate intervention strategies for children with dyslexia. In order to accomplish the mission of the study, three objectives of the study were established.

1.2.1 To develop systematic intervention programs for children with dyslexia in Chinese

Development of intervention programs for children with dyslexia is based on a careful literature review on research in both English and Chinese communities. Literature review will start with an examination of the essential components of English acquisition, the difficulties that struggling readers encounter in mastering those components as well as the design and effectiveness of the intervention program which aims to address the development of these components. The second part of the review will focus on the essential components in Chinese literacy with reference to English's paradigm and intervention studies conducted for Chinese children. Literatures reviews or research from both language systems will provide a preliminary theoretical framework for developing intervention programs for Chinese children. Furthermore, a systematic analysis of the corpus of Hong Kong Primary textbooks will be conducted to provide direction for curriculum content of the intervention programs.

1.2.2 To evaluate the effectiveness of the intervention programs

The most important goal of the present study is to evaluate the effectiveness and contributions of the intervention programs in promoting reading performance of

Chinese dyslexic children. Two questions are to be answered: (1) would children in either program demonstrate significant gains in both meta-linguistic awareness and reading achievement measures when compared with the no intervention control condition? (2) Would children with dyslexia demonstrate improvement in reading skills as a result of the carefully designed instructional approach implemented in this study? The effectiveness of the programs will be examined with both meta-linguistic measures and reading achievement measures.

1.2.3 To investigate the relationship between meta-linguistic awareness and reading achievement performance

In Chinese, meta-linguistic awareness is highly related to literacy development (e.g., Koda & Zehler, 2008). It is an integrated ability of analysis and synthesis of phonological, morphological and orthographical information between the spoken language and the written language (e.g., Koda & Zehler, 2008). Correlational and regression analyses will be performed to examine the relationships between meta-linguistic awareness and reading achievement.

1.3 Significance and Contributions of the Study

The present study attempts to contribute to the three following aspects. First of all, the present study reviews the "essential components" of Chinese literacy development that are important for children with dyslexia. By analyzing the intervention studies in English and Chinese, the researcher will generate the core literacy components in Chinese and provide a reference for local educators in designing intervention programs. Secondly, the study will integrate these essential components into the systematic and intensive intervention programs. Recognizing that most research studies in Chinese societies have focused on the

nature of dyslexia in Chinese and relatively few intervention studies have been conducted in the field, this study gives attention to developing intervention programs based on a theoretical framework and an analysis of local textbooks. It is anticipated that the programs will provide samples for local teachers on designing small-group reading program for children with dyslexia in Hong Kong. Finally, the designed intervention programs of the study are also an important contribution of the study. The study will assess the contributions of the programs on the development of meta-linguistic awareness and reading achievement. It will provide a reference on the design of the intervention and how it facilitates the development of Chinese literacy.

Chapter 2

Review of Literature

This literature review covers four parts. First, it offers a brief discussion of issues related to the definition and identification of dyslexia in western countries and in Hong Kong. Second, it reviews the essential components of English acquisition, examines the difficulties of struggling readers in mastering the components and reviews the intervention components for children with learning disabilities. Though there is no consensus on the "essential components" of Chinese, there is some common ground across languages. Therefore, the third part the review focuses on the nature of mapping principles in Chinese and how the principles guide the development of instruction programs for children with dyslexia in Hong Kong. Lastly, this review describes two different approaches of teaching literacy in English which inspired the design of the two programs for Chinese dyslexic students in the present study.

2.1 Definition and Identification of Dyslexia in Western Countries and in Hong Kong

In the last decade, much attention has been paid to the definitions, identification and intervention for children with developmental dyslexia. In the USA, the working definition of dyslexia defined by The National Institute of Child Health and Human Development (NICHD) and adopted by The International Dyslexia Association (IDA) in 2003 is as follows: "Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may

include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge" (Lyon, Shaywitz, & Shaywitz, 2003, p.1-14).

In Hong Kong, the definition of dyslexia as defined by the Hong Kong Society of Child Neurology and Development Pediatrics at 2006 is as follows: "Developmental dyslexia is one of the specific learning disabilities, characterized by difficulties with accurate and fluent word recognition, word reading and writing to dictation or spelling. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and further acquisition of knowledge through print. Unexpected discrepancy exists between learning aptitude and achievement in school in one or more basic subject areas" (HKCNDP, 2006,p.2-3).

The two definitions share three commonalities: (i) dyslexia is a kind of specific learning disabilities;(ii) it leads to difficulties with fluent and accurate word reading and spelling; and (iii) people with dyslexia may experience unexpected and persistent difficulties in learning to read. Moreover, the US definition explicitly relates dyslexia to phonological deficit, which is not given in the Hong Kong definition (Lyon et al., 2003; HKCNDP, 2006).

Though the definitions of dyslexia in the US and in Hong Kong are quite similar, there is little agreement on the identification or detection of dyslexia between the two regions. In 2004, the US federal government's Individuals with Disabilities Education Act (IDEA) introduced a "Response to Intervention" (RTI) model for the identification of dyslexia. The act is an alternative to the IQ-Achievement discrepancy model (IDEA, 2004;

Fuchs & Fuchs, 2001, 2006). According to information provided by the US Department of Education, RTI is "a comprehensive early detection and prevention strategy that identifies struggling students and assists them before they fall behind" (Gersten, Compton, Connor, Dimino, Santoro, Linan-Thompson & Tilly, 2008, p.4). The IDEA (2004) program encourages and supports schools and educators to use a multi-tiered intervention to identify and help students with learning disabilities (IDEA, 2004; Fuchs & Fuchs, 2001, 2006). Early intervention helps to decrease the prevalence of reading disabilities under the RTI model; thus, the model identified students by their responses to reading intervention (Fuchs, Compton, Fuchs, & Bryant, 2006).

In Hong Kong, The Hong Kong Test of Specific Learning Difficulties in Reading and Writing (HKT-SpLD; Ho et al., 2000) is a standardized test used by psychologists to identify Cantonese-speaking children with dyslexia at primary grade. The test provides an operational definition on dyslexia in Chinese. The test composes of two domains; the literacy domain (Chinese word reading, spelling, and speeded word reading) and the cognitive domain (naming speed, phonological awareness, phonological memory and orthographic knowledge) (Ho, Chan, Lee, Tsang, & Luan, 2004). The diagnostic criteria of dyslexia in Hong Kong are as follows: (1) normal intelligence (i.e., with IQ 85 or above); (2) at least one standard deviation below on the literacy composite score and (3) at least one standard deviation below on one of the cognitive composite score (Ho et al., 2004). Chan, Ho, Tsang, Lee, and Chung (2007) administered the HKT-SpLD to 690 children, and found that between 9.7% to 12.6% of Hong Kong Chinese primary school children met criteria of dyslexia. According to the Government's figure, the number of primary school students with SpLD identified in the year of 2008-2009 is 11,280, representing about 3.08% of students in Hong Kong primary schools only (Education Bureau, 2009). A

wide discrepancy is found between the projection of research findings (9.7% -12.6%) and the prevalence rates officially reported (3.08%).

2.2 Reading Acquisition and Reading Difficulties in English

In 2001, The No Child Left Behind Act authorized the Reading First initiative (No Child Left Behind, 2001). The Reading First adopted the report of The National Reading Panel that five components were essential in English literacy; they are, namely, phonemic awareness, phonics (decoding, word study and spelling), vocabulary, reading fluency and text comprehension (National Institute of Child Health and Human Development [NICHD], 2000; The Partnership for Reading, 2003). The Reading First initiative suggested that successful reading instruction should incorporate five components, namely, the index and dimensions of evaluating reading acquisition (NICHD, 2000; Gamse, Bloom, Kemple, & Jacob, 2008). Each component was described below.

Phonemic Awareness

"Learning to read is learning how one's writing system encodes one's language" (Perfetti & Dunlap, 2008, p.13). The mapping principle of the English writing system and language is alphabetic, that is, graph (a letter or clusters of letter) to phoneme (Perfetti & Dunlap, 2008). Grasping the mapping principle is fundamental and important to reading success for English readers. Phonemic awareness is one of the critical skills of mastering the alphabetic mapping principle. The definition of phonemic awareness refers to "the ability to focus on and manipulate phonemes in spoken words" (NICHD, 2000, p.2-1). Phonemic awareness is a subtype of phonological awareness. Phonological awareness includes the smallest units of spoken language (phonemes) and larger units such as syllable awareness, rime awareness and onset awareness of spoken words (Anthony &

Francis, 2005). Phonemic awareness is a predictor of reading success for both struggling readers and average readers (e.g., Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; NICHD, 2000). Phonemic awareness instruction teaches students to manipulate (blending and segmenting sounds) phonemes, to be aware of the different patterns of grapheme-phoneme correspondences, and to discriminate "confusable phonemes and words" (Moats, 2009). Effective phonemic awareness instruction significantly improved the reading ability of poor readers or at-risk readers (e.g., Vaughn et al., 2006; Ehri, Dreyer, Flugman, & Gross, 2007). However, among the five interdependent essential components, phonemic awareness is the first step of understanding that words are made up of the smallest unit of sound (phoneme) (Vellutino, Tunmer, Jaccard, & Chen, 2007).

Decoding (Phonics)

According to Beck & Juel (1995), "phonics embraces a variety of instructional strategies for bringing attention to parts of words. The parts can be syllables, phonograms, other letter strings, or single letters. The goal of phonics is to provide students with the mappings between letters and sounds."(Beck & Juel, 1995, p.2) Phonics instruction aims to teach children the mapping relationship between print (letters) and spoken language. Although the relationship between letter and sound is not completely predictable, the teaching of consistency was sufficient for children to "recognize familiar words and decode unfamiliar words." (Gamse et al., 2008, p.30; NICHD, 2000) Systematic phonics instruction significantly improves reading performance (e.g., word attack and recognition) of at-risk readers (e.g., Ehri et al., 2007; Mathes et al., 2005; Denton, Fletcher, Anthony, & Francis, 2006; Foorman et al., 1998; Wolf et al., 2000) and reduces the prevalence rates of learning disabilities (e.g., NICHD, 2000; Torgesen, 2002). Phonics instruction also helps

students encode (spell) accurately by mastering the letter-sound correspondences efficiently (Moats, 2009).

Vocabulary

Excellent readers apply phonemic knowledge and phonics skills to decode and encode words. Accurate and fluent word recognition is the foundation of written vocabulary building. Vocabulary and comprehension are highly correlated because knowledge of word meaning affects the comprehension of text (Curtis, 1987). Nevertheless, children with dyslexia are very likely to have difficulties mastering the alphabetic principles and thus their vocabulary development is hindered (Lyon et al., 2001). Vocabulary refers to words that we use for communication. There are two main types of vocabulary: oral vocabulary (listening and speaking vocabulary) and written vocabulary (reading and writing vocabulary) (Vaughn & Linan-Thompson, 2004). Oral vocabulary instruction for young readers helps to develop their written vocabulary and progress to text comprehension (NICHD, 2000).The quality and quantity of vocabulary knowledge play an important role in text comprehension and knowledge acquisition (e.g., Curtis, 1987; Nagy & Scott, 2000; NICHD, 2000). In 2004, Jitendra, Edwards, Sacks, and Jacobson (2004) reviewed 27 studies on vocabulary instruction for students with learning disabilities. Children with learning disabilities were found to have three areas of difficulty in vocabulary development, (i.e., insufficient time engaged in independent reading, lack of reading strategies to comprehend the word in context and lack of word knowledge) (Jitendra et al., 2004). A variety of effective vocabulary instruction methods for children with learning disabilities were found in the extensive review of the Jitendra et al. (2004) report, including keyword findings strategy, cognitive strategy (e.g., semantic mapping), direct instruction (e.g., systematic presentation of high-frequency word and meaning) and

an activity based or inquiry approach (e.g., building vocabulary through subject-specific activities). Also, vocabulary is not likely to develop if an intervention program does not contain the element of vocabulary building strategy explicitly or implicitly (Gamse et al., 2008, p. 43; Vaughn & Linan-Thompson, 2004).

Fluency

As defined by Vaughn and Linan-Thompson (2004), fluency (oral reading fluency) means "the ability to perform reading skills such as letters, reading words, and reading connected text quickly, smoothly, and automatically" (Vaughn & Linan-Thompson, 2004, p.136). Fluent readers place less focus on word decoding and recognition but more on word meaning and text comprehension (NICHD, 2000). Children with learning disabilities demonstrated difficulties in reading fluency and dysfluency the led to difficulties in comprehension (Chard, Vaughn, & Tyler, 2002). In 1995, the National Assessment of Educational Progress conducted a large scale study of oral reading fluency and stated that "the relationship between reading accuracy and reading comprehension appeared to be dependent" and "slower readers demonstrated lower reading proficiency"(Pinnell et al., 1995, p.3). Fluency instruction becomes the bridge between efficient word reading and reading comprehension (e.g. Gamse et al., 2008; Vaughn & Linan-Thompson, 2004). As suggested by Chard et al., (2002), effective fluency building intervention for children with learning disabilities consists of the following three strategies: (1) learning fluent reading with an explicit model; (2) providing opportunities to read familiar text repeatedly and independently with peer or teacher feedback and (3) developing criteria for increasing passage difficulty according to reading performance. Also, it is important to note that reading fluency is a life-long difficulty that adult dyslexics still face even if their accuracy

of word reading has improved (Shaywitz, 2003). Therefore, fluency instruction is a big challenge to teachers.

Comprehension

Comprehension is the ultimate goal of reading intervention (Vaughn & Linan-Thompson, 2004). Reading comprehension is defined as "a process of constructing meaning from written texts" (Mastropieri & Scruggs, 1997, p.197). Children with learning disabilities are found to have difficulties in comprehending text (Gersten, Fuchs, Williams, & Baker, 2001). Five difficulties are found in reading comprehension: (1) text structure knowledge (e.g., narrative text and expository text); (2) vocabulary knowledge; (3) background knowledge; (4) reading fluency, and (5) task persistence (Gersten et al., 2001). Effective intervention studies were systematically reviewed by Gajria, Jitendra, Sood, & Sacks (2007). The review examined the effectiveness of twenty-nine studies on improving comprehension for students with learning disabilities. They found that "content enhancement" (e.g., use graphic organizer or semantic mapping to retain the content information of the passage) and "cognitive strategy instruction" (e.g., summarization or identification of main ideas) are most commonly used and validated as effective instructional strategies for helping these students in improving reading comprehension (Gajria, Jitendra, Sood, & Sacks, 2007).

The five components mentioned above are the key components of English reading skills and children with learning disabilities are found to have difficulties to master the essences compared with their peers. These five components are interdependent; therefore many designs of the intervention program not only address a single component, but also a

combination of different components especially for supplementary small group intervention (Vellutino, Tunmer, Jaccard, & Chen, 2007).

2.3 Reading Acquisition and Reading Difficulties in Chinese

The five components in English reading acquisition are the fruits of numerous research findings which provide an intervention framework for teachers and researchers to facilitate and assess the development of reading performance of children. However, there is no consensus on the "essential components" in reading Chinese. Therefore, this section will discuss the basic nature of mapping principles in reading Chinese and how the variations of the principles guide the development of instruction program for children with dyslexia in present study.

In English, the mapping principle is alphabetic (grapheme to phoneme). In Chinese, the mapping principle is logographic (e.g., Wang & Yang, 2008; Tan, Spinks, Eden, Perfetti, & Siok 2005), that is, grapheme to morpheme and grapheme to syllable, and therefore Chinese characters are morph-syllabic (Perfetti & Dunlap, 2008, p.20). The mapping principle is "an understanding what information is conveyed through each graphic symbol" (Koda & Zehler, 2008, p.98). Orthographically, Chinese characters are made up of stroke, graphic unit and structure; (a) the stroke, which is the smallest unit of a Chinese character; (b) graphic unit (or bujian), including semantic radicals (部首/意旁), phonetic radicals (聲旁), and dependent graphic unit (a graphic unit that only exist as a part of a character, e.g., 亼); and (c) the structure, orthographic organizations of strokes and graphic units of a character. Among the graphic details of Chinese characters, the semantic radicals and phonetic radicals give more information on the meaning and

pronunciation to readers. The following section will describe how meaning and pronunciation are conveyed through ortho-morphological awareness and ortho-phonological awareness. Also, as is the case with English, phonemic awareness and phonics skills are not the end of reading literacy. Vocabulary acquisition, reading fluency and comprehension are also found to be important components in English reading instruction programs. Therefore, the present study includes Vocabulary, Fluency and Comprehension with the two types of awareness in Chinese as the main items of literature review. It is expected that insights for instructional design will emerge through the systematic literature review.

Ortho-morphological awareness

Ortho-morphological awareness is "the understanding of how semantic information is graphically represented in the writing system" (Koda & Zehler, 2008, p.98). Chinese characters are categorized into four main types, namely pictographs, indicatives, ideographs and semantic-phonetic compounds. Semantic-phonetic compounds cover 74% of Chinese characters (around 2,800 characters) in the local primary school textbooks corpus, similar to the findings in mainland China (Chung & Leung, 2007; Shu, Chen, Anderson, Wu, & Xuan, 2003). A compound character consists of two components: a semantic radical which provides clues for the meaning of a character and a phonetic radical which provides clues for the sound of the character. This section will focus on the nature and reliability of semantic radicals in compound characters and how it affects reading development in Chinese. In most situations, high frequency semantic radicals are included in the radical index in Chinese dictionaries. There are 214 radicals in written Chinese according to the KangXi Dictionary and most of them are semantic radicals. (Kangxi Dictation, 2010) A corpus study conducted by Chung and Leung (2008) showed

that among the semantic-phonetic characters (in traditional script) in Hong Kong primary schools, about 40% of the semantic-phonetic compound characters were semantic transparent, meaning that their semantic radicals provided reliable and accurate information on the meaning of the character. Though the semantic radical in a character does not necessarily provide accurate information on its meaning, children's awareness of the semantic radical in a character does play an important role in Chinese reading development. Shu and Anderson (1997) found that children from the age of eight started to apply the semantic radical to learn or predict an unfamiliar newly compound character (Shu & Anderson, 1997). Besides, a semantic radical also serves as a graphic unit that usually appears on the left-handed side of a character. Children at grade two are found to be able to discern the "correct" position of the semantic radical in a character (Shu & Anderson, 1999). In sum, the semantic radical in a character serves several functions. It provides accurate or partial meaning of a character and allows children to transfer the meaning to new character. The semantic radical also serves as a high-frequency graphic unit of a character and its position in a character can be found relatively consistently on the left-hand side if the character is of left-right structure (72%) (Shu et al., 2003).

In addition to the importance of semantic radicals in developing ortho-morphological awareness, the awareness of discriminating homophones with different graphic forms and meaning has been receiving much attention in recent years (Kuo & Anderson, 2008). Since there are plenty homophones in Chinese characters, children's awareness of the different meanings with the same syllable becomes important. Typically, Hong Kong primary school students are exposed to approximately 4,000 traditional script characters and 1,300 different syllables (TDSpLD, 2008) Therefore, an awareness of homophones of different meanings is also one of the important tasks in developing ortho-morphological awareness.

Ortho-phonological awareness

This section will focus on the nature and reliability of phonetic radicals in compound characters and how it affects reading development in Chinese. Ortho-phonological awareness is "an understanding of the way in which phonological information is graphically represented in the writing system" (Koda & Zehler, 1998, p.98). As mentioned above, phonetic radicals provide information on the pronunciation of compound characters. The phonetic radical can be an independent character or a graphic unit. Generally speaking, there are about 1100 phonetic radicals (Shu et al., 2003). Analyses of Hong Kong primary schools textbooks found that an average of 37% of phonetic radicals in a character provided reliable sound for the character (Chung & Leung, 2008). Though the phonetic radical in a character does not necessarily provide accurate information on its sound, children's awareness of the phonetic radical in a character plays an important role in Chinese reading development. Chan and Sigel (2001) asked primary school students in Hong Kong to read pseudo-characters and compound characters; they found that good readers in primary grades performed better than poor readers in applying the clues derived from phonetic radicals to pronounce an unfamiliar character. Similar results were obtained in Beijing, demonstrating that high-ability primary grade students showed better use of regular phonetic radicals (the phonetic radical shared the same sound with the character) to name new and unfamiliar character than low-ability children (Shu, Anderson, & Wu, 2000). Also, good readers in upper grades learn not to solely rely on the phonetic radical to pronounce a character when their characters knowledge increases. (Shu et al., 2003) Like semantic radicals, phonetic radicals also serve as sub-character graphic units. In left-right structured compound characters, phonetic radicals are usually on the right-hand side. Therefore a phonetic radical is not only a cue for pronunciation but also a visual

sub-component of a compound character. Both pieces of information can enhance young readers' awareness of character combination and mapping variation.

Vocabulary

The primary goal of vocabulary learning is to increase reading comprehension (Nagy & Herman, 1987). Both ortho-morphological awareness and ortho-phonological awareness are related to character recognition in Chinese literacy development. In Chinese, vocabulary words are mainly composed of one character (carrying one or more meaning) or of a two-character word. In recent years, many research studies examined the relationship between morphological awareness and vocabulary acquisition in Chinese (e.g., Chen, Hao, Geva, Zhu, & Shu, 2008; Liu, Chung, McBride-Chang, & Tong, 2010). Most studies found the promising role of morphological awareness in word reading and vocabulary knowledge (Chen et al., 2008). However, vocabulary acquisition is more than morphological awareness. Vocabulary acquisition also involves vocabulary size: the quantity of vocabulary required to comprehend or acquire knowledge (Nagy & Herman, 1987). In 2008, Curriculum Development Institute of Hong Kong Education Bureau published "Lexical Lists for Chinese Learning in Hong Kong"(Education Bureau, 2007). This reference suggested 9,706 words for local primary school students. Among the 9,706 words, 79% of the words were two-character and 21% of words were three-character. These 9,706 words were constructed with the 3,171 basic characters. This suggestion gave a reference to local primary schools on the vocabulary size necessary for comprehension. Besides the vocabulary size, vocabulary acquisition is related to the quality of word knowledge. Word knowledge can be acquired through three different approaches (Chall, 1987). First, a total language approach (or learning-experience approach), by which students actively and incidentally searched the meaning of words by exploring the text.

This approach stressed children's leaning-experiences and motivation in finding the meaning. Second, the meaning-emphasis approach (or whole word approach), in which teachers provided explicit instruction to explain the meaning of the word by using the texts and stories. Third, the code-emphasis approach (or alphabetic-phonetic approach), by which teachers used texts and stories to facilitate explicit instruction of the mapping principle (e.g., phonemic awareness and phonics in English).

Fluency

Local research studies indicate that both children and adolescents with dyslexia show difficulties in reading fluency (e.g., one-minute Chinese Word Reading) in comparison to their peers with average reading ability (Chung, Ho, Chan, Tsang, & Lee, 2010). However, there was a lack of comprehensive study in understanding the underlying process or intervention on Chinese reading fluency. In English, fluency relates to the accuracy and speed (and expression) of decoding familiar and unfamiliar words. In contrast, reading fluency in Chinese depends greatly on memorization and phonological retrieval of learned characters. Therefore, some researchers recommended "repetition" or repeated practice as one of the most efficient methods to enhance reading fluency (e.g., Adams, 1990; Kuhn & Schwanenflugel, 2008). In addition, poor readers or students with dyslexia were advised to practice oral reading (read aloud) rather than silent reading because oral reading provided "phonological memory code" for students (NICHD, 2000; Kuhn & Schwanenflugel, 2008). In classroom practice, fluency instruction is rarely practiced or conducted. As mentioned by Vaughn and Thompson (2004), "fluency instruction may be the missing element in reading instruction for most teachers because most of us learned to teach reading with a focus on accuracy and comprehension" (Vaughn & Thompson, 2004, p.51). The same situation applies in Hong Kong, where teachers are not trained to practice fluency

instruction in classroom. An attempt was conducted by Cheng and her colleagues to provide students in primary one with a peer-assisted support reading program (Cheng, Luk, & Pang, 2008). Poor readers learned to model teachers and peers' reading during the class with immediate corrective feedback. Students who received the training were found to have a better performance in a character reading fluency test in comparison to the control non-intervention group (Cheng et al., 2008).

Comprehension

Text comprehension is the goal of reading instruction. In English as in other language systems, lexical word knowledge is one of the important aspects of text comprehension (Leong & Ho, 2008). Dyslexic adolescents in Hong Kong were found to have persistent difficulties in reading comprehension in comparison with matched age and reading level groups (Chung et al., 2010). Related findings were documented in Leong and his colleagues, which showed that 12-year old poor readers performed significantly poorer in open-ended comprehension questions in comparison to the group with age matched readers and they were less efficient in applying background knowledge to understanding the text (Leong, Hau, Tse, & Loh, 2007). The performance or research data of local primary dyslexic students in reading comprehension was not available because the diagnostic battery (the Hong Kong Test of Specific Learning Difficulties in Reading and Writing) did not include the comprehension task.

In sum, the five essential components of reading in English were well documented and important for effective instruction for children with learning disabilities. Extensive research studies have shown how the five components were integrated in an instructional program as interventions for struggling readers. Though the instructional approaches of

bringing the five components in classrooms were controversial, the framework is much clear than in Hong Kong and for the Chinese community. Following this framework, the present study attempted to construct and review the "five components" in Chinese acquisition especially for children with dyslexia (see Table 1). From the components reviewed above, ortho-morphological awareness and Ortho-phonological awareness were related to character or sub-character level (meta-linguistic level) Chinese literacy development. Both components were found to be important in Chinese character recognition because they reflect part of the logographic principle in morpho-syllabic Chinese. Poor readers and dyslexic readers in Chinese were found to be less capable of the awareness and of utilizing the knowledge of these two components when learning to read in Chinese. Beyond basic character level, Chinese two-character vocabulary acquisition was found to be important in Chinese because most compound words were made of two characters. Grasping word knowledge by morpheme construction has become the focus of recent studies on helping children with dyslexia. Unlike sub-character knowledge, vocabulary acquisition can be achieved by different approaches, namely language-experiences, meaning-emphasis and code-emphasis (e.g., Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001; Chall, 1987). Local investigators showed that children and adolescents with dyslexia performed poorly in both reading fluency and reading comprehension. However, there was a lack of conclusive local studies discussing fluency and comprehension instruction for dyslexic readers though they face these problems on a day by day basis.

Table 1

Framework of Literature Review on the Essential Components of English and Chinese Literacy Development

Writing System	Alphabetic English	Morpho-Syllabic Chinese
Essential Components of Literacy	Phonemic Awareness	Ortho-morphological awareness
	Phonics	Ortho-phonological awareness
	Vocabulary	Vocabulary
	Fluency	Fluency
	Comprehension	Comprehension

2.4 Reading Interventions in English

After visiting the important components of reading acquisition for children with dyslexia between the two language systems, the following review shifts to focus on how the important components are delivered in schools. Two theoretically different approaches in English acquisition are reviewed as follows and lead to the model and inspiration for designing the two programs for Chinese dyslexic students in the present study. Reading Instruction can be categorized by two main approaches, namely, the code-emphasis approach and meaning-emphasis approach (Chall, 1997). These two approaches are based on different theoretical concerns and direction on literacy development. The following section will review the principles and effectiveness of the two approaches in enhancing reading performances of struggling readers in English.

2.4.1 Code-Emphasis Approach

Code-emphasis approach aims to give explicit instruction on the alphabetic principle (Chall,1987). Children can generalize the knowledge of alphabetic code and decoding skills to reading words and texts (Chall, 1997). Explicit instruction on the English mapping

principle and transferring the knowledge into word recognition and reading comprehension is the core of the code-emphasis approach.

Review of Code-emphasis Instruction Studies

Gersten and his colleagues reviewed eleven intervention studies in the report of "Assisting Students Struggling with Reading: Response to Intervention and Multi-Tier Intervention in the Primary Grades" (Gersten et al., 2009, pp.41-44). They gave an example of how to review the effectiveness of intervention studies and investigated the findings of intervention studies based on the performance of five essential components after intervention.

For phonemic awareness, ten out of the eleven studies provided explicit instruction on phonemic awareness (PA). Five of these studies addressed the effect of PA training but only two of them were found to have significant impact on at-risk students (Ehri et al., 2007; Lennon & Slesinski, 1999, cited in Gersten et al., 2009). For decoding, all eleven studies provided training on phonics instruction and measured its effectiveness, while seven of them were found to have significant effect for children with decoding training. (Ehri et al., 2007; Gunn, Biglan, Smolkowski, & Ary, 2000; Jenkins, Peyton, Sanders, & Vadasy, 2004; Lennon & Slesinski, 1999; Mathes et al., 2005; Vadasy, Sanders, Peyton, & Peyton, 2005; Vaughn et al., 2006, cited in Gersten et al., 2009) In vocabulary development, only three out the eleven studies addressed the instruction of vocabulary building and one of them was found to have significant impact on students (Gunn et al., 2000, cited in Gersten et al., 2009). Explicit instruction on reading fluency was found in four studies, with one of them reporting significant results. It is worthy to note that fluency measures (and decoding) were one of the most commonly used tool to test the

effectiveness of instruction even though no fluency instruction was included in the study. For reading comprehension instruction, five studies (Ehri et al., 2007; Gunn et al., 2000; Lennon & Slesinski, 1999; Mathes et al., 2005; Vaughn et al., 2006, cited in Gersten et al., 2009) provided comprehension instruction for children. Seven of the eleven studies used the comprehension test to measure effectiveness though some of them did not include comprehension instruction. It was found that comprehension performance was closely linked to the presence of comprehension instruction.

The review by Gersten and his colleagues (2009) noted three main findings. First, instructional "package" and intensity (i.e., frequency, duration and group size) of intervention varied among instruction. Most of the instruction programs included the instruction of phonemic awareness and word decoding. Because most of the studies focused on early primary grade at-risk students, phonemic awareness and decoding instruction became necessary. Second, spelling and writing instruction were included in some of the studies. Though they were not part of the "essential components," they were actually practiced by students in classroom settings and were included in the program. Lastly, there were varieties of methods to teach the components.

Review of Program Comparison Studies

Nine intervention studies for struggling English readers were selected for discussion because they met the following set of search criteria (Bowyer-Crane et al., 2008; Denton et al., 2006; Foorman et al., 1998; Mathes et al., 2005; Nunes, Bryant, & Olsson, 2003; O'Shaughnessy & Swanson, 2000; Vadasy et al., 2005; Wanzek & Vaughn, 2008; Mathes et al., 2003) First, the participants were mainly primary graders who were identified as at-risk, struggling, or dyslexic. Second, program descriptions, intensity and effectiveness

of intervention were addressed and documented. Third, all selected studies were of small group intensive intervention. Last, all studies were comparison studies (i.e., code-emphasis versus other program(s) or code-emphasis programs of different intensity). Please refer to Table 2 for details.

All nine studies reviewed included explicit instruction of phonemic awareness and phonics skills as the major or one of the treatment conditions. All studies reported that phonemic awareness and phonics training for struggling students created positive and significant impact on the performance of word attack task or/and word decoding for the treatment groups. Furthermore, training in phonemic awareness and phonics was integrated with oral practice (Nunes et al., 2003; O'Shaughnessy & Swanson, 2000), decodable text and story (Mathes et al., 2005; Bowyer-Crane et al., 2008; Foorman et al., 1998; Vadasy et al., 2005; Denton et al., 2006; Mathes et al., 2003) or writing exercise (Nunes et al., 2007; O'Shaughnessy & Swanson, 2000).

Among the nine studies, six studies involved the training of reading comprehension (Mathes et al., 2005; Vadasy et al., 2005; Denton et al., 2006; Wanzak & Vaughn, 2008; Mathes et al., 2003; Bowyer-Crane et al., 2008). However, different strategies were used among the six intervention studies. For example, Denton and her colleagues' Read Naturally Program involved comprehension activities, such as answering written comprehension questions after reading and writing a brief summary of the passage read (Denton et al., 2006). Wanzak and Vaughn (2008) taught students strategies by using literal and inferential thinking to trace answers of the comprehension questions (Wanzak & Vaughn, 2008). Studies with a comprehension component showed that the training of comprehension strategies were most likely to enhance the performance of students with

readings difficulties. Five out of six studies with comprehension training reported significant improvement for the treatment groups. (Mathes et al., 2005; Vadasy et al., 2005; Denton et al., 2006; Wanzak & Vaughn, 2008; Mathes et al., 2003) One study which provided training on phonological awareness training and word analogy training (O'Shaughnessy & Swanson, 2000) was found to have positive impact on students' reading comprehension performance though text comprehension activities were not directly included in the study.

Two out of the nine studies clearly addressed and assessed vocabulary building (Bowyer-Crane et al., 2008; O'Shaughnessy & Swanson, 2000). Similar to the observation of Gersten and his colleagues (2009), relatively few studies included vocabulary training in early primary grade small group intervention. One of the two studies reported significant effect on oral vocabulary and grammatical skills (O'Shaughnessy & Swanson, 2000). Five studies involved fluency training activities (Mathes et al., 2005; Vadasy et al.,2005; Wanzak & Vaughn et al., 2008; Denton et al., 2006; Mathes et al., 2003). Four of them reported significant improvement after fluency training (Mathes et al., 2005; Vadasy et al.,2005; Denton et al., 2006; Mathes et al., 2003). Also, it was observed that most of the studies used either decodable text (or stories), leveled passages or word lists for fluency practice.

Table 2

Performances among the five components of selective Comparison Studies

Intervention Study	Target Participants	Intervention Strategies	Reading Components assessed					Intensity		
			Phonemic Awareness	Decoding / word recognition	Reading Comprehension	Vocabulary	Fluency	Frequency	Duration	Group size
Learning morphological and phonological spelling rules: An intervention study. Nunes et al., (2007)	7-8 year old children	Morphological training group (M+ orally practice only)		* between T& C				30-minute per session	12 weeks	5-8 students
		Morphological training with writing group (M+ spelling practice)		* between T& C						
		Phonological training group (PA, D+ orally practice)		* between T& C						
		Phonological training with writing group (PA, D+ write answer)		* between T& C						
The effects of theoretically different instruction and student characteristics on the skills of struggling readers. Mathes et al., (2005)	1st graders	Responsive intervention (PA, D, C, E, F, W) + Enhanced classroom (instruction sequence based on students' needs)	* between T & C	* between T & C	* between T & C		* between T & C	40-minute per session 5 days per week	8 months	3 students
		Proactive intervention (PA, D, C E, F, Spelling at word level) + Enhanced classroom (instructional components were sequenced)	* between T & C	* between T & C	* between T & C		* between T & C			
Improving early language and literacy skills: differential effects of an oral language versus a phonology with reading intervention.	4-year old children	Phonology with reading program (PA, D+ Book reading)	* between T	* between T				50-minute daily session	20 weeks	30mins small group 20 mins individual
		Oral reading program (V, C)				* vocabulary & grammatical skills				

Bowyer-Crane et al., (2008)									
The role of instruction in learning to read: Preventing reading failure in at-risk children. Foorman et al., (1998)	1st and 2nd graders	Direct Code: direct instruction in letter-sound correspondences practiced in decodable text. (PA, D, W, E)		* between T			90-minute daily session	1 year	One student or 3-5 students
		Embedded Code: less direct instruction in systematic spelling patterns embedded in connected text (onsets-rimes, Reading, W)							
		Implicit Code (whole language): incidental instruction in the alphabetic code while reading connected text. (Reading, W, E)							
Relative effectiveness of reading practice or word-level instruction in supplemental tutoring: How text matters? Vadasy et al., (2005)	1st graders	Word study with Text Reading Practice (PA, D+ C+ F+Text Practice)	* between T & C	* between T & C	* between T & C	* between T	30-minute session 4 days per week	8 months	1 student
		Word study alone (PA, D + repeated word list)	* between T & C	* between T & C	* between T & C				
A comparison of two reading intervention for children with reading disabilities. O' Shaughnessy & Swanson, (2000)	2nd graders	Phonological Awareness Training (PA, D, E and oral Language)	* between T & C	* between T & C			30-minute daily session 3 days per week	6 weeks (9hours)	5 students
		Word Analogy Training (Whole-word, onset-rime, V, E and written language skills)	* between T & C	* between T & C	* between T				

Response to Varying Amounts of Time in Reading Intervention For Students With Low Response to Intervention Wanzak & Vaughn (2008)	1st graders	Group 1: 30-minutes daily session Group 2: Two 30-minutes daily session Phonics, Word Recognition, Fluency Exercise Passage Reading and Comprehension (D,F,C)		* between T & C	* between T & C		30-minute or Two 30-minute daily session	13 weeks	5 students
An evaluation of intensive intervention for students with persistent reading difficulties Denton et al., (2006)	1st – 3rd graders	Group 1: week1-16 Group 2: week8-24 Both groups: The decoding intervention based on the Phono-Graphix program (PA, D) and The fluency intervention based on the Read Naturally program.(F,C,W)		* (within- group comparison)	* (within- group comparison)	* (within- group comparison)	2-hour Phono-Graphix (week 1-8) 1-hour Read Naturally (week 9-16)	16 weeks	2 students
A comparison of teacher-directed versus peer-assisted instruction to struggling first-grade readers Mathes et al., (2003)	1st graders	Whole class Peer-Assisted Instruction (PAI)	* between T & C	* between T & C			35-minute (PAI) 30-minute (TDI) 3 days per week	16 weeks	PAI: whole class TDI:4-5 students
		Small group teacher-directed instruction (TDI) (Both intervention: PA, D, C, F + Passage Reading + Story Sharing)	* between T & C	* between T & C	* between TDI & C	* between TDI & C			

PA=Phonemic Awareness, D=Decoding, C= Comprehension, E=Encoding, F=Fluency, V=Vocabulary, W=Writing, M=Morphological Understanding
*= statistically significant (P=<.05-.01) ,
* between T= Significant difference was found between Treatment Groups,
* between T & C = Significant difference was found between Treatment group Non-Treatment Control Group

The core concept of the code-emphasis was to provide explicit instruction on the mapping principle of English orthography. However, "explicit instruction" differed in terms of program content and intensity. For instruction components, phonemic awareness and phonics training were the basic essentials in the code-emphasis approach. All studies involved two or more instructional components. In addition to the five essential components, spelling, writing and morphological components were included in some intervention studies. With respect to the effectiveness of the code-emphasis approach, some promising results were reported, especially with significantly better performance on word decoding for struggling readers with small group intensive training. Reading comprehension and fluency performances were most likely to improve if the treatment condition involved both components. Effects on vocabulary building were found to be inconclusive because only one study in the present review was found to have better treatment effects. For the intensity of the code-emphasis approach, the present review focused on frequency (3 to 5 days per week; 30 minutes to two hours per session), duration (12 weeks to 1 year) and group size (1 to 8 students). Specific information of time allocation of different components was not available.

2.4 Meaning-Emphasis Approach

According to Chall (1997, p.258) the meaning-emphasis approach "focuses primarily on reading words and connected text for meaning, right from the start, expecting that the alphabetic principle will be acquired incidentally by inference from the reading for meaning." The meaning-emphasis approach provides explicit instruction on the whole word or sight word level but not on the sub-word level (phoneme, onset or rime) (Moats, 2009). Chall (1997) pointed out that reading research based on the meaning-emphasis approach were mainly qualitative and most of the studies were done in kindergarten and primary one grade (Chall, 1997). Stahl and Miller (1989)'s review

shared similar conclusions with Chall (1997). Stahl and Miller (1989) reviewed five projects and forty-six studies on the effectiveness of the whole-language (the other name of meaning-emphasis in 80's for early readers). They found that the meaning-emphasis approach was more effective in kindergarten than in primary grades. The meaning-emphasis approach produced better effects for average readers than for disadvantaged readers in their review. Jeynes and Littell (2000) reviewed 14 studies on the effectiveness of meaning-emphasis instruction for children of low socio-economic status from kindergarten to grade three. They found that students with low-SES did not benefit from the meaning-emphasis approach. However, it should be pointed that these two reviews made cautions about their findings on two aspects. First, meaning-emphasis and code-emphasis serve different functions in reading development. The former is useful for developing the concept of print while the latter addresses the sub-structure of words (Stahl & Miller, 1989). Second, meaning-emphasis commonly uses qualitative and attitude measures (e.g., reading motivation questionnaire) rather than standardized reading measures. Therefore, it was quite difficult to make simple conclusions about the effectiveness of meaning-emphasis versus code-emphasis (Stahl & Miller, 1989; Jeynes & Littell, 2000). The following section offers further discussion and reviews five studies on the effectiveness of the meaning-emphasis approach.

Five studies were selected for review because they used standardized tests to measure program effectiveness and the target participants were at-risk children (Morrow, 1992; Senechal & Cornell, 1993; Justice & Ezell, 2002; Usova & Usova, 1993; Morrow, Connor, & Smith, 1990). The meaning-emphasis approach appears to have different strategies. For example, shared reading (Senechal & Cornell, 1993; Justice & Ezell, 2002), creative writing (Morrow, 1992), language experience with art and kinesthetic activities (Usova & Usova, 1993), story telling and reading favorite

books (Morrow et al., 1990) were all among the activities included in the intervention programs. Watson (1989) pointed out that the meaning-emphasis program aimed to provide meaningful and authentic reading experience for children through the activities. With respect to program effectiveness, it was found that meaning-emphasis programs showed greater improvement on reading comprehension (Morrow, 1992; Morrow et al., 1990), print awareness (Justice & Ezell, 2002), receptive vocabulary (Senechal & Cornell, 1993), reading (Usova & Usova, 1993), creative writing (Usova & Usova, 1993) and reading motivation (Usova & Usova, 1993). It is important to note that four out of the five studies were conducted in the 90's and that it is difficult to find meaning-emphasis intervention studies based on standardized measures and tailored for children with learning disabilities. However, the studies reviewed offered some important directions for designing a program with a meaning emphasis for children with learning disabilities. Summary of the meaning-emphasis program was shown in Table 3.

Table 3

Performances among the literacy components of selective meaning-emphasis studies For at-risk children

Intervention Study	Target Participants	Intervention Strategies	Results	Intensity		
				Frequency	Duration	Group size
The impact of a literature-based program on literacy achievement, use of literature, and attitudes of children from minority backgrounds. Morrow (1992)	2nd grade minority background	Literature-Based program: Inviting environment Teacher guided activities Independent reading & writing	Students' performance in reading comprehension significantly better than non-intervention group. (C)	7.5 hours per week	7 months	9 students
Vocabulary acquisition through shared reading experiences. Senechal & Cornell (1993)	4 & 5 year old students	Four Strategies: Reading with questioning Reading with recasting (synonym) Reading with word repetition Passive listening	All strategies were effective in receptive vocabulary but not expressive vocabulary. (V)	25-minute session	One session	One student
Use of storybook reading to increase print awareness in at-risk children. Justice & Ezell (2002)	4 & 5 year old students with literacy and language problems	Shared reading with Print Awareness	Shared reading with Print Awareness intervention enhanced Print Awareness for at-risk children when compared with control group.(PA)	5-7 minutes per session (24 sessions)	8 weeks	3-5 students
Integrating art and Language Arts for First Grade at-risk Children. Usova & Uosva (1993)	1st grade students	Whole language, basal reader and language experience with art and kinesthetic activities	Treatment group students showed improvement in standardized reading and writing tests. Children were motivated about reading and writing. (D, W, M)	2.5 hours per session	Not specified	8 students
Effects of a story reading program on the literacy development of at-risk kindergarten children. (Morrow, Connor & Smith, 1990)	Kindergarten	Literature experiences: reading for pleasure, story telling, repeated readings of favorite stories, story retellings.	Treatment group performed better on story telling attempted reading, comprehension tests than control group. (C)No differences on the measure of "reading readiness" between groups.	60-minute per day	7 months	Not specified

C= Comprehension, PA=Print Awareness, V=Vocabulary, D=Decoding & Reading, W=Writing, M=Motivation

2.5 Intervention Studies for Chinese Children with Dyslexia

In comparison to the numerous intervention studies in English, intervention studies in Chinese reading are just beginning. Nine intervention studies (see Table 4) with primary grade children with dyslexia in Chinese are reviewed in this section. (Ho & Ma, 1999; Ho & Cheng, 2003; Hui, 1991; Tsuei, 2006; Chyn & Sheu, 2000; Wang, 2004; Sung, Chang & Huang, 2008; Chen, Su, & Tzeng, 2010; Ho, Lam, & Au, 2001). The review focuses on (1) the choice of intervention components (2) the use of teaching strategies to address the literacy components; (3) program intensity (frequency, duration and group size) and the reported effectiveness of the programs. Please refer to Table 3 for details.

Among the nine intervention studies, seven intervention components (Phonetic Radical , Semantic Radical, Characters teaching, Character and Word Writing, Morphological Awareness, Dictation & Comprehension Strategy) were found. They were related to different levels of Chinese literacy development. On the sub-character level, explicit teaching of the knowledge of phonetic radicals (PR) and semantic radicals (SR) were found in intervention studies from grades 2 to 5 (Ho & Ma, 1999; Ho & Cheng, 2004; Chyn & Sheu, 2000; Chen et al., 2010;). On the character and vocabulary level, direct teaching of selected characters (C) and words (CW) with writing or without writing practice were also major ingredients (Ho & Cheng, 2004; Hui, 1991; Tsuei, 2006; Wang, 2004; Sung et al., 2008; Chen et al., 2010; Ho et al., 2001). One of the studies conducted by Tsuei (2006) taught the function of Chinese major morphemes (MA) and its function on word construction during word learning and character or word dictation (D) of was also found in one of the training programs (Tsuei, 2006). Four studies (Tsuei, 2006; Wang, 2004; Sung et al., 2008; Chen et al., 2010) involved passage reading and comprehension (CS) (e.g., summary strategy, story

structure or story grammar) It was noteworthy that Chinese phonetic radical awareness and comprehension strategies were the most common components among the seven components in Chinese programs for dyslexic children.

Teaching strategies varied among the Chinese programs. Shared-book reading for story grammar (Wang, 2004), multi-sensory strategy for character structure learning (Ho et al., 2001), computer-assisted strategy for text comprehension (Sung et al.,), peer-assisted passage reading (Tsuei, 2006) and data-pad method to teach a set of sequenced characters and words. (Hui, 1991) were some of the teaching strategies observed.

With respect to program implementation, some studies did not specify program intensity. Program frequency varied from 40 minutes per session to whole day intervention intensity (Ho & Ma, 1999; Wang, 2004; Chyn & Sheu, 2000). Duration of the program varied from 1 session to 76 sessions. Most of the studies did not specific group size, but single case (Ho & Cheng, 2004), small group (Ho & Ma, 1999) and whole class intervention (Tsuei, 2006) were found among the intervention studies. All intervention studies reported positive results in the post intervention stage for those children with dyslexia in comparison with the non-intervention dyslexic group. However, three studies reported limited effectiveness. One study pointed out that the training effect did not maintain for a long time (Wang, 2004). Another study reported that simple phonetic and semantic radical awareness training was ineffective in promoting dictation ability (Ho & Ma, 1999). Also, a five day multi-sensory training was not effective on improving dictation (Ho et al., 2001).

Table 4

Selective Intervention Studies for Chinese Struggling Readers

Intervention Study	Target Participants	Intervention Strategies	Results	Intensity		
				Frequency	Duration	Group size
Training in phonological strategies improves Chinese dyslexic children's character reading skills. Ho & Ma (1999).	2nd- 5th grade dyslexic students (Hong Kong)	Use of phonological strategies to improve Chinese reading. (PR)	Chinese dyslexic children read regular characters better than irregulars matched on frequency. Significant reading improvements post-intervention No significant improvements in Chinese dictation post-intervention	5 days intensive training	1 week	15 students
Using "Focused Word Recognition Method" to teach a student with reading difficulties in Hong Kong. Ho & Cheng (2004).	5th grade dyslexic student (case study)	To teach the five lists of characters and phonetic radicals. (C, PR)	The student made significant improvement on dictation, reading aloud and cloze activities.	three times per week	4 weeks (3 hour total)	Case study
Using Data Pac for Hong Kong Chinese Children with Reading Difficulties. Hui (1991).	Grade 5-12 dyslexic students & low-achieving (Hong Kong)	Data Pac Package included 20 characters and 430 words. (CW)	Gains in reading, writing and dictation for low achieving readers and students with learning difficulties	One session per week	11 weeks	Not specified
The impact of peer-assisted learning (PALS) strategies on elementary students' Chinese language learning and peer relationships in the inclusive classroom. Tsuei (2006).	3rd graders dyslexic students (Taiwan)	Partner reading. Summarize a passage, Syntax, Morphological construction and New-word dictation. (CW, CS, MA, D)	Students in the experimental group outperformed students in the control group on Chinese language achievement tests and reading comprehension tests. PALS effectively enhanced the Chinese language	4 hours per week	12 weeks (48 hours total)	Whole class

			learning of two students with learning disabilities in the inclusive classroom.			
A study of the effects of teaching phonetic-radical characters on second-grade normal students and students with learning disabilities. Chyn & Sheu (2000)	2nd grade dyslexic students (Taiwan)	Emphasis on teaching phonetic radicals and semantic radicals. (SR, PR)	Students who received phonetic-radical characters teaching were significantly better in the ability of character identification, recognition of phonetic part and radical part, and character combination.	40-minute per week (2 sessions per week)	12 week	Not specified
Effects of story grammar instruction combined with shared-book reading on elementary students with reading disabilities. Wang, C.C. (2004).	2nd grade dyslexic students (Taiwan)	Shared-book reading Story grammar instruction (CS)	Scores of students' basic reading and writing skills were significantly increased after intervention. Most students' scores on story grammar increased after instruction. Maintenance of instructional effects was not stable.	40-minute sessions; 2 sessions per week	6 months	Not specified
Improving children's reading comprehension and use of strategies through computer-based strategy training. Sung et al., (2008).	6th grade low-ability students (Taiwan)	Computer Assisted Strategy Teaching and Learning Environment. (CS)	Computerized Design can effectively enhance students' abilities to apply strategies Participants in experimental group performed better than control group in applying majority of strategies corresponding to text comprehension process	50 minute per session (2 sessions per week)	11 weeks	Not specified
Effect of a remedial Chinese reading program on the Narrative	2nd grade low achieving	Chinese character Phonetic Symbols	Children in treatment group could read and use more	45-minute per	16 weeks	Not specifie

ability of low achieving students. Chen, Su, & Tzeng (2010)	students (Tai Wan)	Comprehension Strategies Narrative Story Structure (PR, C, CS)	characters and demonstrated better understanding of story structure than control group.	session	(76 sessions total)	d
The Effectiveness of Multi-sensory Training in Improving reading and writing skills of Chinese Dyslexic children. Ho, Lam, & Au (2001)	3rd-5th grade dyslexic students (Hong Kong)	Multi-sensory Training (trace characters with fingers), passage reading, word writing, comprehension. (CS, C)	Dyslexic children did better than traditional group on passage reading and answering written comprehension questions. No significant difference was found in post-word reading and dictation performance.	2 hour per session (one session per week)	5 weeks (10 hour total)	17 students

PR=Phonetic Radical, SR=Semantic Radical, C=Character Teaching (with or without writing), CW= Character & Word Teaching, CS=Comprehension Strategy, MA=Morphological Awareness, D=Dictation

2.6 Chapter Summary

This chapter reviewed the importance of five essential components (phonemic awareness, phonics, vocabulary, fluency and comprehension) in English literacy and how the components were integrated into intervention programs with two different instructional approaches (code-emphasis and meaning-emphasis approaches) for children with low reading ability. However, the two approaches addressed the five components differently. The code-emphasis approach started with the alphabetic principle (phonemic awareness and phonics), while the meaning-emphasis approach, in contrast, focused on whole word learning (vocabulary), assuming that students would grasp the alphabetic knowledge naturally (Chall, 1987). Following the "English" framework, five essential components in Chinese Literacy (two related to the understanding of the logographic principle: ortho-morphological awareness, ortho-phonological awareness and three related to literacy achievement: vocabulary, fluency and comprehension) were proposed and reviewed. The Chinese framework was based on some basic research findings in Chinese and a number of studies related to the performance of Chinese dyslexic students. The findings of Chinese intervention studies in this chapter also offered research evidence that the five components were essential for children with dyslexia based on the review of the literature.

CHAPTER 3

DEVELOPMENT OF INTERVENION PROGRAMS

3.1 Development of the Two Intervention Approaches

From the literature review, the present study developed two intervention programs for teaching children with dyslexia. Due to different rationales behind the two approaches, the five components were taught either explicitly or implicitly. Please refer to Table 5 for details. For the code-emphasis program, four components (ortho-morphological awareness, ortho-phonological awareness, fluency and comprehension) are addressed starting with the basic logographic principle of Chinese grapheme to syllable and morpheme. For the meaning-emphasis program, three components (vocabulary, fluency and comprehension) were addressed focusing on grasping the meaning of word and assuming that the mapping principle in Chinese would be acquired incidentally. Both programs aimed to enhance the literacy performance of children with dyslexia. This chapter explains the development of the two intervention programs for Chinese children with dyslexia. The chapter is divided into three parts; (1) the development of instructional materials for both programs based on a textbook corpus analysis; (2) the design of intervention content and a typical lesson of the two programs and (3) the intensity of both intervention programs.

Table 5

Suggested Key Components of Two Approaches in Chinese Literacy Program

Essential Components of Chinese Literacy	Code-emphasis approach	Meaning-emphasis approach
Ortho-morphological awareness	Direct instruction on character and sub-character relationship	No direct instruction
Ortho-phonological awareness	Direct instruction on character and sub-character relationship	No direct instruction
Vocabulary	No direct instruction	Direct explanation of the meaning of two-character words
Fluency	Character List - transfer the character knowledge to story-reading	Word List - transfer the word meaning to stories reading
Comprehension	Assigned story-reading with partner	Story-reading with partner

3.2 Development of Intervention Materials

Instructional materials for both reading programs were based on the database developed by the research team of the Teachers' Development for Children with Specific Learning Difficulties (TDSpLD, 2008) project at the Chinese University of Hong Kong according to the procedure shown in Figure 1.

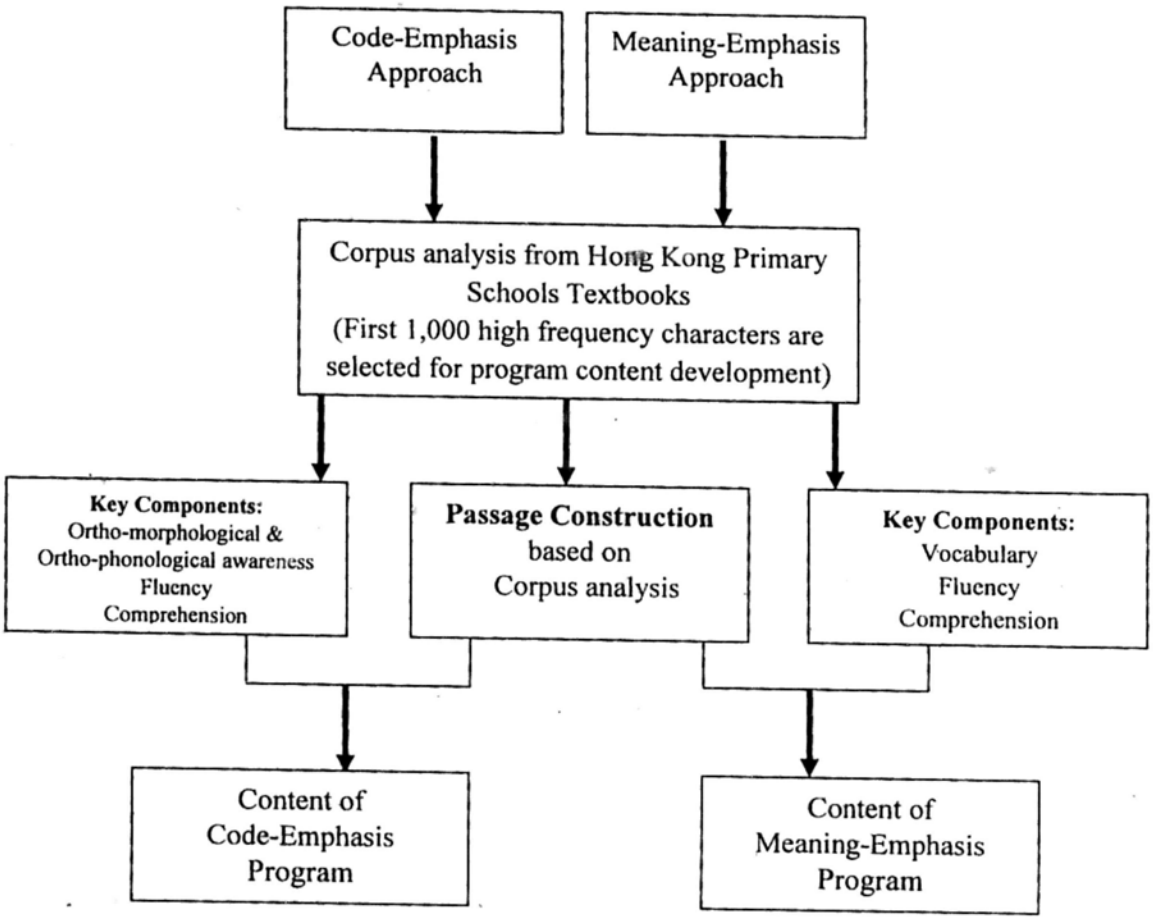

FIGURE 1 Development of Intervention Materials

Corpus Analysis

Chinese language subject textbooks used in Hong Kong primary schools from grades one to six were the primary source of the corpus analysis. Textbooks were taken from the six most popular publishers in Hong Kong, covering 98% of the textbooks used by 364 primary schools in Hong Kong (around 70 % of all primary schools in 2009). Based on this corpus, the total number of Chinese characters found in Hong Kong Chinese language textbooks was 433,027, and the number of unrepeated characters was 3,941 (TDSpLD, 2008).

Character Selection

The corpus analysis also revealed that the first 1,000 characters among the 3,941 characters with the highest frequency of usage represented 89% of the total number (433,027) of characters in the Hong Kong primary corpus (see Table 6). These figures reflect the importance of a child's ability in recognizing and reproducing (writing and spelling) at least the first 1,000 high-frequency characters in an effective way in engendering proficient Chinese reading development. Therefore, these 1,000 characters are used as an important source of instructional materials for both programs.

Table 6

Appearance of High-Frequency Chinese Characters in the Hong Kong Primary School Corpus

	Accumulated frequency (per 433,027 corpus)	Accumulated percentage (per 433,027 corpus)
First 250 high-frequency characters	275276	64%
First 500 high-frequency characters	334158	77%
First 750 high-frequency characters	366014	85%
First 1000 high-frequency characters	386411	89%
First 1500 high-frequency characters	409982	95%
First 2000 high-frequency characters	422181	97%
First 2586 high-frequency characters	429046	99%

Meta-Linguistic Analysis Based on Code-emphasis Components

Meta-Linguistic Analysis of the first 1000 high frequency characters was based on the two core components of the code-emphasis program including ortho-morphological knowledge (i.e., knowledge of semantic radicals) and ortho-phonological knowledge

(i.e., knowledge of phonetic radical). As shown in Table 7, the first 10 high frequency semantic radicals covered 353 characters out of the 1000 high frequency primary characters. As mentioned in Chapter 2, some semantic radicals provide information on both meaning and graphic structure. For example, the semantic radical "口" (mouth) appears in the characters of 吃 (eat)、叫 (scream)、味 (taste). All these characters are related to the meaning of "口" (mouth) and ("口") share the same graphic position. However, some characters like 台 (stage)、商 (business), are unrelated to the meaning of "口" (mouth) but share the same graphic unit in different position. Both transparent (semantic radicals providing reliable clues on character meanings) and opaque (semantic radicals not providing clues on character meanings) aspects of the ortho-morphological relations constitute part of the content in the code-emphasis program. See Appendix A for an example list semantic radicals used in the program.

Table 7

Top 10 Semantic Radicals in first 1000 high frequency characters

Semantic Radicals	Number of characters	Percentage of characters	Characters sharing the same semantic radicals (examples)
人(human)	51	5%	住 (live)、他 (he)、你 (you)
口 (mouth)	50	5%	吃 (eat)、叫 (scream)、味 (taste)
水 (water)	45	5%	海 (sea)、活(live)、法(law)
木 (wood)	33	3%	樹 (trees)、樂 (happy)、果 (fruit)
手 (hand)	31	3%	把 (hold)、打(hit)、拿 (take)
心 (heart)	30	3%	想(think)、意(idea)、愛(love)
言 (speech)	27	3%	說(speak)、話 (talk)、課 (lesson)
糸 (silk)	26	3%	紅 (red)、綠(green)、結(knot)
辶 (walk)	24	2%	過 (pass)、道 (path)、邊(edge)
艸 (grass)	18	2%	花(flower)、葉(leaf)、草(grass)
宀 (house)	18	2%	家(home)、定(stable)、安(peace)
Total	353	36%	

The second component of the code-emphasis program is ortho-phonological awareness. Some examples of high frequency phonetic radicals are shown in Table 8. As mentioned in Chapter 2, some phonetic radicals provide information on both sound and graphic structure. For example, the phonetic radical "分" (sound: fan1) appears in the character 吩 (fan1)、芬(fan1)、氛 (fan1), and these characters share the same

sound of phonetic radical "分" (fan1) in the same graphic position. However, the phonetic radical in characters like 扮(baan1)、岔(caa3) 、盆(pun4) is shared but the phonetic radical does not provide reliable clues on the character sound. Both regular (phonetic radical with reliable clues on character sound) and irregular (phonetic radicals with unreliable clues on character sound) aspects of ortho-phonological relations constitute another important part of the code-emphasis program. See Appendix A for an example list phonetic radicals.

Table 8

Ten Examples of Phonetic Radicals

Phonetic Radicals	Characters sharing the same phonetic radicals (same syllable or same syllable but different tone)
青 cing1	清(cing1)、蜻(cing1) 、情(cing4)、晴(cing4)
采 coi2	彩(coi2)、採(coi2)、綵(coi2) 、菜(coi3)
方 fong1	坊(fong1)、芳(fong1)、房(fong4)、防(fong4)
加 gaa1	伽(gaa1)、嘉(gaa1)、架(gaa3)、咖(gaa3)
包 baau1	胞(baau1)、鮑(baau1)、苞(baau1) 、飽(baau2)
馬 maa5	碼(maa5)、媽(maa1)、嗎(maa1)、罵(maa6)
其 kei4	期(kei4)、琪(kei4)、棋(kei4)、旗(kei4)
登 dang1	燈(dang1)、凳(dang3)、鄧(dang6)、蹬(dang6)
分 fan1	吩(fan1)、芬(fan1)、氛(fan1)、紛(fan1)
交 gaau1	郊(gaau1)、跤(gaau1) 、皎(gaau2) 、較(gaau3)

Vocabulary Analysis Based on the Meaning-Emphasis Components

One of the key components in the meaning-emphasis program is vocabulary building. In Chinese, vocabulary can be one character ("木" wood), two-character ("森

林" forest), three-character ("巴士站" bus station) or more. In local classroom practice, two-character words are highly used in both oral and written comprehension. In 2008, Curriculum Development Institute of Hong Kong Education Bureau published the "Lexical Lists for Chinese Learning in Hong Kong" (Education Bureau, 2007), it suggested 9,706 words for local primary school students. Among the 9, 706 words, 79% of the words were two-character and 21% of words were composed of three-character. Thus, the current study uses two-character vocabulary found within the 1,000 high frequency characters list and within the reference list of "The Learning of Chinese Lexicons in Hong Kong Schools." to make up the required vocabulary (e.g., 150 vocabularies were used in stories 1 to 5) of the meaning-emphasis program. See Appendix A for an example list of vocabulary for the program.

Passage Construction for Both Intervention Programs

Both programs involve reading fluency and comprehension components. Therefore, appropriate reading passages were chosen to address both approaches. Narrative passages were constructed using the analyzed lists of characters or sub-characters mentioned above. The present study invited some experienced Chinese language teachers and in-training teachers to construct the stories. Each story covers the following story components: (1) main character and his/her personality, (2) time and place of the story, (3) problems and conflicts, (4) main event, (5) reactions of the major characters, and (6) story resolution (Dimino, Gersten, Carnine, & Blake, 1990; Ouellette, Dagostino, & Carifio, 1999). There are twenty-two stories in total (see example in Appendix B). Both programs share the same series of 22 stories. The average number of characters in the instruction texts is 285 and the average number of unrepeated characters per text is about 148. The 22 stories involve 927 characters and

572 two-character words. Table 9 shows the titles and lengths of all reading passages used in both programs.

Table 9

Title of the 22 Reading Passages Created for Both Intervention Programs

Title of the Stories	Characters per Reading Story	Unrepeated Characters per Story
動物旅行記 The Animals' Picnic	225	127
熊爸爸找房子 Papa Bear Is Looking For A New House	198	91
動物唱歌大賽 The Animals' Singing Contest	237	135
校園裡的一棵樹 The Big Tree	253	126
松鼠先生退休了 Mr. Squirrel Is Retired!	210	98
鐵甲人小丁丁 Super Robot Little Ting	254	131
小青蛇歷險記 The Adventures Of Greenie Snakie	219	113
小食店奇遇記 A Special Day At The Food Stall	245	142
小神仙的巧克力 The Magic Chocolates	277	141
早上的星星 Morning Stars	243	122
松鼠老師遊世界 Mr. Squirrel Around The World	278	164
中秋節的晚上 The Moon Festival Night	265	147
河裡的怪聲 The Spooky River	293	155
猴子山 Monkey Mountain	285	158
貝貝的演奏 Babe's Concert	293	156
我的志願 I Want To Be…	274	139
外婆的生日 Grandma's Birthday	200	116
給松鼠老師的信 A Letter To Mr. Squirrel	314	160
迪士尼歷險記 An Adventure In Disneyland	388	183
難忘的旅程 An Unforgettable Trip	447	215
奶奶的寶藏 Grandma's Treasures	470	197
動物奧運會 Animal Olympics	410	228
22 stories in total	285 (average)	148 (average)

3.3 Intervention Intensity

Intervention intensity was defined by frequency, duration and group size. The intervention studies in English reviewed in the previous chapter indicate that effective programs are of at least 3 to 5 days per week (for a duration of 12 weeks to 1 year); each session lasting 30 minutes to 2 hours and group size varying from 1 to 8 students. For the Chinese studies, however, the intensity of intervention programs was inconclusive. Program intensity was greatly dependent on the level of reading difficulties of the participating students and available resources. The present study was conducted in the summer and students were recruited from a local parents' association for children with dyslexia. The programs were implemented 5 days per week for five consecutive weeks. A total of 50 hours (2 hours per daily session) of intensive training was provided for each group. Each group consisted of 11 students (details of participants are given in Chapter 4). Both programs involved the same teacher and teaching assistants.

3.4 Intervention Content and Lesson Plan

The following section illustrates the intervention content and lesson plan of the two programs. Each program consisted of three major activities and short break between different activities. Each major activity was based on the teaching approach. For the code-emphasis approach, it focused on the explicit teaching of the logographic principle of Chinese characters on sub-character unit (semantic radicals and phonetic radicals) and its relation to character meaning and sound. Character copying practice and character reading activities were encouraged in the program to consolidate the knowledge of ortho-morphological awareness, ortho-phonological awareness and characters. The knowledge of characters was transferred to reading fluency and reading

comprehension through practices in the program. There was no direct instruction on vocabulary knowledge in the code-emphasis program because it was assumed that the knowledge of vocabulary would be learned through the enrichment of character and sub-character instruction. For the meaning-emphasis program, explicit teaching on the whole word (two-character compound word) meaning was the core of the program. Direct vocabulary explanation in isolation and in context (story) was encouraged. Writing practice, word reading and story sharing were included to consolidate the knowledge of vocabulary, reading fluency and reading comprehension. There was no direct instruction on the logographic principle (ortho-morphological and ortho-phonological awareness) in the meaning-emphasis program because it was assumed the sub-character knowledge would be learned through the enrichment of vocabulary instruction. Table 10 shows the key teaching components, major activities and intensity of the two programs.

Table 10

Teaching Components of the Two Chinese Literacy Programs

Essential Components of Chinese Literacy	Time Allocation	Code-emphasis Approach	Meaning-emphasis Approach
Character Learning with Meta-linguistic Analysis	30-45 minutes	Direct instruction on character and sub-character relationship (ortho-morphological awareness)	No direct instruction
		Direct instruction on character and sub-character relationship (ortho-phonological awareness)	No direct instruction
		Character copying practice	
Vocabulary	30-45 minutes	No direct instruction	Direct explanation of word meaning
			Vocabulary use in context
Fluency Practice	20-30 minutes	Character list reading transfers character knowledge to story reading	Word list reading transfers the word meaning to story reading
Reading Comprehension	30 minutes	Assigned story / passage reading with partners	Story / passage reading with partners

3.4.1 Lesson Plan of the Code-Emphasis Program

A two-hour daily code-emphasis program was divided into three sessions. Short breaks between sessions were given.

Session One: Character Learning with Meta-linguistic Analysis (30-45 minutes)

In the first session of the two-hour program, direct instruction on ortho-morphological awareness and /or ortho-phonological awareness was given. The teacher showed the target characters sharing the same semantic radicals and explained the meaning of semantic radicals with the characters directly. For example, 說 (speak)、話 (talk)、課 (lesson) share the same semantic radical 言 (speech). Similar instructions were delivered regarding the sound of the phonetic radicals and target characters sharing the same phonetic radical, e.g.,〔吩(fan1)、芬(fan1)、氛(fan1)、紛(fan1) share the same sound and phonetic radical 分(fan1)〕. The teacher followed the teaching sequence based on the corpus analysis and the direct instruction of ortho-morphological awareness and /or ortho-phonological awareness with target characters. As shown in Appendix A, the target characters of each lesson were listed. A 10-minute copying activity with worksheets of three difficulty levels was assigned to students (Appendix B). The first worksheet involved circling the target semantic or phonetic radicals in characters, the second required completing a character by filling in the missing semantic or phonetic radical, and the last worksheet entailed writing the whole character with the newly learned radicals. Students completed the worksheets in ascending difficulty.

Session Two: Reading Comprehension (20-30 minutes)

In the second session of the two-hour program, the teacher read a passage from a story directly to students in the code-emphasis group, (See Appendix C for passage samples) and then proceeded to ask guided questions on the story. Table 11 provides examples of the guided questions of three stories. After the reading and question period, students were asked to trace and circle the target characters learned in the previous session in the story. Students were asked to read aloud the identified character and the story.

Table 11
Examples of Guided Questions of Passage Reading Comprehension

故事名稱 Title of Passage	討論題目 Guided Questions for Discussion (in Chinese)	Guided Questions for Discussion
動物旅行記 The Animals' Picnic	波波、思思和欣欣到森林去做甚麼？ 他們準備了甚麼食物作午餐？ 波波爲甚麼突然大叫起來？ 欣欣說可以用甚麼東西來代替叉子？	What do Billy, Sally, and Mary go to the forest to do? What food do they prepare for lunch? Why does Billy yell all of a sudden? What does Mary say can be used as a fork?
動物歌唱大賽 The Animals' Singing Contest	誰參加了歌唱比賽？ 波波和欣欣爲甚麼不跟思思去玩？ 看見台下的觀眾時，欣欣有甚麼反應？ 波波和欣欣看到甚麼後覺得充滿力量？	Who entered the singing competition? Why doesn't Billy and Mary go play with Sally? When Mary sees the audience, what is her reaction? What do Billy and Mary see that makes them feel powerful?
校園裏的一棵樹 The Big Tree on School Campus	校園裏的那棵大樹有多少歲？ 欣欣、波波和思思最喜歡在大樹下做甚麼？ 老師說大樹的樹枝像甚麼？ 思思向老師提出了甚麼請求？	How old is the tree in the school garden? What is Mary, Billy, and Sally's favorite thing to do under the big tree? What does the teacher say the tree branches look like? What does Sally ask the teacher to do?

Session 3: Fluency Practice (30 minutes)

Students were divided into three to four groups (3-4 students per group) and were guided by teaching assistants (in-training teachers) according to the ability of the students. In the small group, students were instructed to read the story and newly learned characters and play a character cards activity with the teaching assistants. (See Appendix D for the card samples) Teaching assistants gave immediate corrective feedback to students on reading and conducted progress monitoring (Character and Passage Fluency) during this session. The teacher observed the groups during the small group session and gave a five-minute round up to the children at the end of the two-hour session.

3.4.2 Lesson Plan of the Meaning-emphasis Program

A two-hour daily meaning-emphasis program was divided into three sessions. Short breaks were given between sessions.

Session 1: Vocabulary Building (30-45 minutes)

In the first session of the 2-hour program in the meaning-emphasis program, the teacher gave direct instructions on the meaning and pronunciation of the target vocabulary. For example, 森林(forest), 旅行 (picnic), 空氣 (fresh air) etc. made up the target vocabulary in the story "The Animals' Picnic". The teacher followed the teaching sequence based on the corpus analysis. The target vocabulary of each lesson is listed in Appendix A. The teacher explained the target vocabulary using various methods (e.g., synonyms or antonyms). After introducing the vocabulary, the teacher read the story directly to students, following up with guided questions. After the story and question period, students were asked to trace and circle the target vocabulary learned. Students were asked to read aloud the identified vocabulary and the story.

Session 2: Vocabulary Use in Context (20-30 minutes)

Based on the vocabulary learned in session one, students were instructed to write a short story or a short sentence by using the vocabulary. A worksheet was designed for creative writing in each session. (See Appendix E for a student sample) The teacher encouraged students to share their stories or sentences in class.

Session 3: Fluency Practice and Reading Comprehension (30 minutes)

Students were divided into three to four groups (3-4 students each group) and guided by teaching assistants (in-training teachers) according to the ability of the students. In the small groups, students were instructed to read the story and newly learned vocabulary and play a vocabulary card activity with the teaching assistants. (See Appendix F for the card samples). Teaching assistants gave immediate corrective feedback to students on reading and conducted progress monitoring (Character and Passage Fluency) during this session. Students were also given free time to read their choice of books. The teacher observed the groups during the small group session and gave a five minute round up to children at the end of the two-hour session.

Chapter 4

METHOD

The present study examines the effectiveness of two intervention programs for children with dyslexia in Chinese. The two programs were conducted during summer from mid-July to late August and students were recruited from a local parents' association for children with learning disabilities. The programs were implemented 5 days per week for five consecutive weeks for a total of 50 hours (2 hours per daily session) of intensive training for each group. Each group consisted of 11 students. Both programs involved the same program teacher and teaching assistants. An evaluation was administered to the two intervention groups and one comparison group before and after delivery of the program.

4.1 Participants

Thirty-one Chinese primary school children in Hong Kong between 7 and 10 years of age previously diagnosed as dyslexic by local authorities (e.g., The Hong Kong Education Bureau, The Hong Kong Department of Health) were recruited for the study. All participants met the diagnostic criteria for developmental dyslexia used in Hong Kong according to the Hong Kong Test of Specific Learning Difficulties in Reading and Writing (HKT-SpLD; Ho, Chan, Lee & Tsang, 2000, 2007). Students were at first randomly assigned to three groups before the commencement of the program. Nonetheless due to various reasons (e.g. parents' reluctance to let their children be assigned to "no intervention comparison group"), some parents withdrew from the program and hence made the random grouping not feasible anymore. Consequently, the present study is just a quasi-experimental design because the randomization process was compromised. The intelligence quotients of all participating children were within the average range (IQ: 90-109; Hong Kong Wechsler

Intelligence Scale for Children). The children were assigned to one of the three groups: (a) Code-Emphasis Program (N=11, 7 boys and 4 girls, mean age = 8 years 5 months, S.D. = 0.83 years), (b) Meaning-Emphasis Program (N=11, 6 boys and 5 girls, mean age = 8 years 3 months, S.D. = 0.41 years), and (c) No intervention (N=9, 8 boys and 1 girls, mean age = 10 years 3 months, S.D. = 1.2 years). The third group of children served as the dyslexic comparison group.

4.2 Measures

Participant performance before and after intervention on reading achievement and meta-linguistic awareness was assessed to examine program effectiveness. In addition, a non-verbal intelligence test was also administered in the pre-intervention period. Table 12 depicts the measures employed in this study. Administration procedures and the test battery are listed in Appendix G.

Table 12

Pre-Post Measures of the Intervention Study

Domains	Specific Instruments	Number of Items	Schedule of Assessments		Administration	Cronbach's Alpha
			pre	post		
Intelligence	The Raven Standard Progressive Matrices (Short Form)	36	✓	-	Group	0.87
Meta-Linguistic Awareness	Test of Logographic Principle	40	✓	✓	Group	0.85
	Test of Orthographic Structure (Copying Accuracy)	30	✓	✓	Individual	0.58
	Test of Orthographic Structure (Copying Fluency)	30	✓	✓	Individual	0.57
Reading Achievement	Character Dictation	25	✓	✓	Group	0.90
	Character Reading Fluency	-	✓	✓	Individual	0.91
	Passage Reading Fluency	-	✓	✓	Individual	0.89
	Reading Comprehension	15	✓	✓	Group	0.86

4.2.1 Test of Intelligence

The short form of Raven's Standard Progressive matrices (Raven, Raven, & Court, 2000) was administered to provide information on the participants' non-verbal intelligence. The 36-item test asks children to choose a pattern from eight options that fits into the missing part of a geometric pattern. One point is rewarded for every correct choice and the maximum score is 36.

4.2.2 Measures of Meta-Linguistic Awareness

Measures of meta-linguistic awareness were divided into two tests: The test of logographic principle and the test of orthographic structure. The test of logographic principle aims to assess the understanding of relationships between sub-character components and the formation of characters. The test of orthographic structure evaluates the performance of character copying accuracy and fluency. The ability in basic graphic unit analysis (stroke and sub-character unit) is reflected in copying accuracy and fluency.

4.2.2.1 Test of Logographic Principle

The test of logographic principle consists of 40 items. It is a modified version of the tasks developed by Shiu & Cheng (2007, 2008). The 40 items are divided into the following three parts. Part 1 contains 10 items designed to evaluate a child's ortho-morphological awareness of homophones. For each item, students were asked to form the correct two-character word by circling one character out of three possible choices [e.g., one of 仙，先，鮮) is to be paired with 果; 仙 (sin 1) meaning fairy，先 (sin1) meaning first and 鮮 (sin1) meaning fresh, 果 meaning fruit, the correct choice being 鮮 to form 鮮果, fresh fruit]. Part 2 contains 10 items designed to evaluate a student's ortho-morphological awareness of homophones with similar orthographic configuration. Again students were asked to circle the correct character out of three choices to form a two-character word [e.g., 山 Is paired with one of (波，坡，玻); 波 (bo1) meaning ball, 坡(bo1) meaning hillside and 玻 (bo1) meaning glass and 山 meaning mountain, the correct answer being 山 坡]. Part 3 is an integration task, with 20 items testing the participant's knowledge of various aspects of orthography-phonology-meaning relationships in Chinese characters and word formation. The Cronbach's alpha of the logographic principle test is 0.85.

4.2.2.2 Test of Orthographic Structure

The test of orthographic structure consists of two copying tests; copying accuracy test (un-timed) and copying fluency test (timed). Both tests reflect the ability to grasp the basic graphic unit of Chinese characters. Characters in the un-timed copying test contain the major strokes of forming Chinese characters. Characters in the timed-copying test contain different complexity of strokes and semantic radicals.

Copying Accuracy Test (Un-timed). For the un-timed character copying test, students were asked to copy accurately 30 Chinese characters which contained the major strokes of Chinese characters (EDB, 1990). One mark was given for each correctly copied character. The Cronbach's alpha of the Copying Accuracy Test was 0.58.

Table 13

Samples of Copying Accuracy Tests Classified by types of Strokes

Strokes	Eight basic strokes in Chinese Characters							
	一	丨	丿	丶	亅	乛	丶	𠂉
Examples	十	中	人	大	小	家	主	江

Copying Fluency Test (timed). In the timed character-copying test, students were asked to copy quickly and accurately 30 Chinese characters in three minutes. Only the number of characters copied within three minutes was scored and one mark was given to each correct character copied. The selected characters represented a 3 (stroke complexity) X 2 (semantic radical complexity) design of high-frequency Chinese characters learned by primary school students (See Table 14 for sample characters). A stroke is the smallest unit of a character; thus the "stroke complexity" of the timed copying task was categorized into three complexity levels, which included 1 to 7 strokes (low), 8 to 14 strokes (middle) and 15 to

26 strokes (high). The categorization of stroke complexity was based on the local textbook corpus analysis. The semantic radical is as a graphic unit of a character, and the stroke complexity of semantic radical was divided into two levels of complexity; the semantic radicals with 1 to 5 strokes (low) and semantic radicals with 6 to 16 strokes (high). The Cronbach's alpha of the Copying Fluency Test was 0.57.

Table 14

Samples of Copying Fluency Test Classified by Stroke and Radical Complexity

Stroke Complexity of Semantic Radicals	Stroke complexity	Examples		
Low	Low	世	升	巨
Low	Middle	勇	威	班
Low	High	樂	獵	熱
High	Low	迎	肉	考
High	Middle	紙	降	雀
High	High	築	覽	驚

4.2.3 Measures of Reading Achievement

Reading achievement measures were employed to assess intervention effects on the three main aspects of Chinese proficiency. The three aspects were character dictation, character and passage fluency and reading comprehension.

4.2.3.1 Measures of Character Spelling (Dictation)

A 25 character dictation was constructed to evaluate students' character spelling performance. Targeted characters were of medium complexity (mean stroke=11 $\pm$ 4) and were presented in graded levels of decreasing frequency. The first three characters were given as practice and were not scored. Each target character was presented in the following sequence: (1) the administrator read the character only, followed by (2) a reading of the character in the context of a two-character word consisting of the target character, and finally, (3) the administrator read a sentence which contained the target character in context. The score was the number of characters written correctly. The Cronbach's alpha of the character spelling test was 0.90.

4.2.3.2 Measures of Reading Fluency

Oral reading fluency measures consisted of one-minute Chinese character reading test and a one-minute passage reading test.

Character Reading Fluency Test. This test follows the procedures developed by Hasbrouck (2005) on measuring a student's word fluency (words read correctly per minute). The one-minute Chinese character reading test consists of 150 high frequency characters according to textbook corpus analysis. The test was administrated individually by trained research assistants. The Cronbach's alpha of the Character Reading Fluency Test was 0.91.

Passage Reading Fluency Test. This test consists of reading a passage with 200 high frequency characters. Children were asked to read the passage in one minute and the number of correct characters read was recorded. The Cronbach's alpha of the passage reading fluency test was 0.89.

4.2.3.3 Measure of Reading Comprehension

The reading comprehension Test was modified from the "handbook of Reading Comprehension" (Chang & Yung, 2005). The reading comprehension test was a timed, 10-minute task consisting of 15 short paragraphs to read followed by 15 multiple-choice questions. The test was piloted in a previous study (Cheng & Luk, 2008). Questions were designed on three levels of reading comprehension: the vocabulary level, sentence level, and short paragraph level. The researcher went through two practice questions with the students before the actual test. The multiple-choice questions provided four possible answers. Students were instructed to choose the best answer for each question. The test was administered in groups. One point was recorded for each correct answer. The maximum score of the test was 15. The Cronbach's alpha of the reading comprehension test was 0.86.

4.3 Progress Monitoring

One of the major functions of the progress-monitoring system was to give opportunities for the teacher to respond appropriately to student progress by adjusting instruction (Fuchs, Fuchs, and Vaughn, 2008). Progress-monitoring could also serve as a measure of their contribution to successful reading (Vaughn & Linan-Thompson, 2004). Passage reading fluency task was used as a progress monitoring system because it is the strongest indication of reading improvement for grade two and three students (Fuchs et al.,

2008). Progress monitoring was conducted twice a week to obtain a total of eight measurements per intervention. The score in progress monitoring was recorded as the number of characters read correctly in one minute. With a lack of graded or leveled standardized passages readily available for use in Hong Kong, a set of passages were tailor-made for this study. The passages consisted of approximately 125 characters; for passages with more than 125 characters , the testers recorded the time taken for students to finish reading 125 characters. Only passages with 90% or more characters recognizable to students were used. The passage was replaced by a new one at two to three times intervals.

4.4. Intervention Fidelity

Three lesson observations were carried out by 2 to 4 observers during the 25-day course. The Chinese version of Class Observation Checklist (Appendix H) for this study was adopted from the English version developed by Denton, Fletcher, Anthony, & Francis (2006) and Mathes, Denton, Fletcher, Anthony, & Francis (2005) and was divided into different sections. The first section was an overall appraisal of the learning activities, while the second section focused on the effectiveness of individual learning activities (e.g. creative writing or character card activity). As there were various activities involved in each program, observers selected one of the activities for in-depth observation and evaluation. The checklist adapted a 5-point Likert rating scale, with 1 indicating that the teacher failed to meet the requirements on checklists and 5 indicating all requirements were met.

4.5 Time in Intervention

It is specified in the research design that a 50-hour intervention is to be delivered in each treatment group. During the five-week intervention period, each group had only one student absent from a 2-hour session. 90% of the participants of both treatment groups

attended 100% of reading intervention (i.e. 50 hours). Hence the actual dosages for both treatment groups become irrelevant to the overall validity of the program. The high attendance rate of both treatment groups resulted from parents' commitment and the design of pullout program during school holidays. While parents of students of the two treatment groups promised to commit to only one "reading intervention" activity (i.e. the present experimental program) during the intervention period, it is difficult to persuade parents of students of the comparison group to abstain from offering reading activities for their children during school holidays.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Overview of Data Analysis

This chapter reports research findings related to program effectiveness and relationships between meta-linguistic measures and reading achievement. To examine program effectiveness, the issue of subject heterogeneity was handled carefully. Pre-test differences among groups were examined by preliminary ANOVA tests. If the ANOVA results indicated pre-test group differences, ANCOVA tests were applied in subsequent analyses. The investigator determined the covariate which is linearly related to the dependent variable or employing the pre-test score as the covariate (Jamieson, 2003; Knapp& Schafer, 2009). Planned post hoc comparisons would also be performed.

Furthermore, the effect sizes (Cohen's *d*) between groups and within groups were calculated to reveal the power of different intervention programs in all measures. The effect size analyses followed the procedures employed in the intervention study of O'Shaughnessey & Swanson (2000), using raw scores of pre-post tests to calculate Cohen's *d*. The calculation of effect size was based on "the difference between two means divided by the pooled estimate of the standard deviation of the dependent variable" (Knapp & Schafer, 2009). According to convention and usual practice, a small effect size is less than or equal to 0.25; a medium effect size ranges from 0.25 to 0.50; and a large effect size is larger than 0.50 (Fuchs, Fuchs, & Kazdan, 1999).

There are five parts to the results. First, a general linear model ANCOVA test was used to compare program effects on the meta-linguistic measures and reading achievement

measures. Second, effect size was calculated to show the magnitude of growth within each program. Third, individual student's reading progress was reported with the progress monitoring measure. Fourth, program fidelity was described by inter-rater reliability on the class observation checklist. Lastly, the role of meta-linguistic awareness in literacy development was presented in correlational and regression analyses.

5.2 Demography of Participants

The study involved 31 primary students recruited from the Hong Kong Association for Specific Learning Disabilities, which is a non-profit organization formed by parents with children with specific learning difficulties in Hong Kong. Unlike other studies conducted in a school setting, the age and grade of subjects for this study were not strictly controlled as all subjects participated on a voluntary basis. No differences were found in Raven's IQ score among three groups, $F(2,28)=1.77$, $p=0.19$. However, there was a relatively large difference in age among the three groups $F(2,28)=17.91$, $p=0.00$. Post hoc comparison showed that the age of the comparison group was significantly higher than the age of both intervention groups and there was no significant age difference between the two intervention groups. The demographic of the participants is shown in Table 15.

Table 15
Participants' Demographic Information by Group

Variable	Participant Characteristics		
	Code-Emphasis Program	Meaning-Emphasis Program	Control
Number of Participants	11	11	9
Average Age (years)	8.45 (0.83)	8.26 (0.41)	10.16 (1.24)
IQ (Raven)	95.09 (7.89)	107.72 (11.94)	99.78 (15.57)

5.3 Preliminary Comparisons

ANOVA revealed significant differences among three groups in four tests at the pre-intervention stage. Four tests included copying fluency, F (2,28)=5.11, p=0.01 (Control>Code-emphasis; Control>Meaning-emphasis); character dictation, F (2,28) =3.57, p=0.04 (Control>Code-emphasis; Control>Meaning-emphasis); passage reading fluency, F (2,28)=3.99, p=0.03 (Control>Code-emphasis) and reading comprehension, F (2,28)=7.27, p=0.00 (Control>Code-emphasis; Control>Meaning-emphasis). The pre-intervention differences alerted the investigator to use the ANCOVA test to "adjust" pre-test differences. Berger's suggestion that a good covariate should be linearly related to the dependent variable (2006) was adopted for choosing the covariate. In the present study, the pre-test score was chosen as the covariate because it was linearly related to the dependent variables. Table 16 shows the means and standard deviations of the pre-test and post-test performance of all participating groups.

Table16

Pre-Post Intervention Performance on Meta-linguistic and Reading Achievement Measures

Measures	Specific Instruments	Items	Code-emphasis		Meaning-emphasis		Control	
			pre	post	pre	post	pre	post
			M (S.D.)	M (S.D.)	M (S.D.)	M (S.D.)	M (S.D.)	M (S.D.)
Meta-linguistic Awareness	Test of Logographic Principle	40	27.09 (7.56)	27.63 (8.48)	29.27 (6.65)	31.45 (5.97)	34.55 (5.63)	34.88 (6.25)
	Test of Orthographic Structure (Copying Accuracy)	30	29.09 (1.70)	29.00 (1.00)	29.55 (0.69)	28.73 (1.79)	29.33 (1.12)	29.56 (0.73)
	Test of Orthographic Structure (Copying Fluency)	Characters copied per minute	9.18 (2.40)	9.27 (2.10)	8.27 (1.49)	7.82 (1.72)	11.78 (3.46)	11.78 (2.91)
Reading Achievement	Character Dictation	25	7.18 (3.87)	9.45 (5.09)	7.82 (4.96)	10.09 (4.78)	12.89 (6.52)	13.67 (5.92)
	Character Reading Fluency	Characters per minute	46.82 (19.80)	57.09 (20.30)	51.45 (22.85)	65.18 (19.73)	67.56 (27.95)	73.44 (28.06)
	Passage Reading Fluency	Characters per minute	62.36 (22.54)	76.45 (8.31)	76.73 (35.92)	102.27 (37.69)	109.44 (52.05)	116.11 (50.26)
	Reading Comprehension	15	4.0 (2.65)	5.91 (3.91)	7.73 (4.07)	8.82 (4.77)	10.11 (4.08)	12.22 (3.83)

5.4 Program Effects on Meta-linguistic Awareness

On the two measures of meta-linguistic awareness, ANCOVAs were performed to assess group differences after intervention. The calculation of effect size (pre and post differences) was to show the variance between program effects. The method of analysis (between group pre-post differences effect size) followed the procedures similar to the study of Vaughn, Wanzek, Wexler, Barth, Cirino, Fletcher, Romain, Denton, Roberts, & Fraincis (2010). Table 17 depicts the results of group comparison according to measures.

Test of Logographic Principle

No significant difference was found among the three groups after adjusting post-test scores with the covariate, $F(2, 27) = 0.74$, p=0.48 in the test of logographic principle. Cohen's d was computed and showed a large effect size coefficient of 0.71 favoring the meaning-emphasis group in comparison to the comparison group. There was a medium effect size of 0.39 favoring the meaning-emphasis group (pre-post within group difference between meaning-emphasis group and code-emphasis group). Thus, the result showed that there was no significant difference among the three groups on the test of logographic principle after intervention. However, the effect size analysis (pre and post difference) indicates that the meaning-emphasis group demonstrated relatively greater improvement in understanding the logographic principle of Chinese character construction.

Test of Orthographic Structure

Two measures, copying accuracy and copying fluency, were employed to examine participants' grasp of orthographic structure of Chinese characters. For the copying accuracy test, no significant difference was found among three groups after adjusting post-test score by the covariate, $F(2, 27)$=1.27, p=0.29. Since the score in pre and post

intervention for the three groups approached ceiling, the effect size calculation was for reference only. It did not reflect the magnitude of intervention effect. The results seem to indicate that, by age 8, even dyslexic students have a pretty good grasp of the orthographic structure of Chinese characters. If speed is not taken into account, they are able to produce Chinese characters accurately when sample characters are provided. For the copying fluency test, a significant difference was found among three groups after adjusting post-test score by the covariate, $F(2, 27)=3.79$, $p=0.03$. A planned post hoc comparison showed that the difference between the code-emphasis group and comparison group in copying fluency test was confirmed ($p=0.04$). Cohen's d was computed and showed a medium effect size coefficient of 0.34 favoring code-emphasis group (pre-post within group difference between code-emphasis group and comparison group) though the ANCOVA test showed no statistical difference between the code-emphasis group and meaning-emphasis group in copying fluency test.

5.5 Program Effects on Reading Achievement

On the four tests of reading achievement the ANCOVAs were conducted to assess group differences after intervention. The effect size (pre and post differences) was calculated to show the difference between program effects. A summary of results is shown in Table 17.

Character Dictation

No significant difference was found among three groups after adjusting post-test score by the covariate, $F(2, 27)=0.18$, $p=0.83$. Cohen's d was computed and showed a large effect size coefficient favoring the code-emphasis group (0.56) and the meaning emphasis group (0.51) over the comparison group. The result showed that there was no significant difference among three groups in character dictation after intervention. However, the effect

size analysis (pre and post difference) showed that both the code-emphasis group and the meaning-emphasis group reflected a greater improvement than the comparison group in character dictation test.

Character Reading Fluency

As noted in Table 17 , no significant difference was found in character reading fluency among the three groups after adjusting post-test score by the covariate, $F(2, 27)=0.75$, $p=0.48$. Cohen's d was computed and resulted in a medium effect size of 0.28 favoring the meaning-emphasis group (pre-post within group difference between the code-emphasis group and the meaning-emphasis group) and 0.60 large effect size favoring the meaning-emphasis group over the comparison group.

Passage Reading Fluency

For passage reading fluency, a significant difference was found between the three groups after adjusting post-test score by the covariate, F (2, 27)=3.7, p=0.04. A planned post hoc comparison showed that the difference between the meaning-emphasis group and the comparison group on passage reading fluency was confirmed (p=0.05). Cohen's d was computed and showed a large effect size coefficient of 0.80 favoring the meaning-emphasis group (pre-post within difference between the code-emphasis group and the meaning-emphasis group). There was a large effect size of 0.50 favoring the code-emphasis group (pre-post within group difference between the code-emphasis group and the comparison group) and 1.33 large effect size favoring the meaning-emphasis group (pre-post within group difference between the meaning-emphasis group and the comparison group). The meaning-emphasis group displayed greater gains in passage reading fluency, reflecting greater atomicity toward word recognition in connected text which is important for effective comparison.

Reading Comprehension

For reading comprehension, no significant difference was found between the three groups after adjusting post-test score by the covariate, F (2, 27)= 0.58, p=0.56. Cohen's d was computed and showed a 0.52 large effect size favoring the comparison group in comparison with the code-emphasis group and the meaning-emphasis group.

Table 17

Analysis of Covariance on Posttest Scores with Pretest Scores as Covariate (Univariate F-value)

Specific Instruments	Comparison	F	*p*	Cohen's d (Pre-post difference between group)
Test of Logographic Principle	CEP vs. MEP	0.74	0.24	-0.39
	CEP vs. CC		0.77	+0.06
	MEP vs. CC		0.44	+0.71
Test of Orthographic Structure (Copying Accuracy)	CEP vs. MEP	1.27	0.82	+0.43
	CEP vs. CC		0.78	+0.37
	MEP vs. CC		0.32	-0.81
Test of Orthographic Structure (Copying Fluency)	CEP vs. MEP	**3.79***	0.99	+0.24
	CEP vs. CC		**0.04***	+0.34
	MEP vs. CC		0.09	-0.05
Dictation	CEP vs. MEP	0.18	1.00	0.00
	CEP vs. CC		0.94	+0.56
	MEP vs. CC		0.92	+0.51
Character Reading Fluency	CEP vs. MEP	0.75	0.74	-0.28
	CEP vs. CC		0.98	+0.20
	MEP vs. CC		0.60	+0.68
Passage Reading Fluency	CEP vs. MEP	**3.70***	0.19	-0.80
	CEP vs. CC		0.83	+0.50
	MEP vs. CC		**0.05***	+1.33
Reading Comprehension Test	CEP vs. MEP	0.58	1.00	+0.03
	CEP vs. CC		0.78	-0.25
	MEP vs. CC		0.67	-0.52

* $p < .05$; CEP = Code-emphasis Program; MEP = Meaning-emphasis Program; CC= Comparison Group

P value represents a planned post hoc comparison between two groups.

5.6 Program Effect Size Within Intervention Group

Table 18 shows the effect sizes of all test items for the three groups derived from Cohen's *d* formula, that is, the difference between pre and post intervention means (within group) divided by a pooled standard deviation. As shown in Table 18, there were large treatment effects for four measures (character dictation, character reading fluency, passage reading fluency and reading comprehension) in the code-emphasis group. For the meaning-emphasis group, there were two measures (character reading fluency and passage reading fluency) with large within group treatment effects and two measures (dictation and the test of logographic of principle) reflected medium within group treatment effects. For the comparison group, only reading comprehension reached large effects.

Table 18

Treatment Effect Size Within Group

Specific Instruments	Effect Size of Pre-post Difference Within Code-emphasis Group	Effect Size of Pre-post Difference Within Meaning-emphasis Group	Effect Size of Pre-post Difference Within Comparison Group
Test of Logographic Principle	0.06	0.34 (M)	0.05
Test of Orthographic Structure (Copying Accuracy)	-0.06	-0.60	0.24
Test of Orthographic Structure (Copying Fluency)	0.03	-0.27	0.00
Dictation	0.50 (L)	0.46 (M)	0.12
Character Reading Fluency	0.51(L)	0.64 (L)	0.20
Passage Reading Fluency	0.55 (L)	0.69 (L)	0.13
Reading Comprehension	0.57 (L)	0.24	0.53 (L)

L=Large Effect Size= >.50, M = Medium Effect Size =0.25-0.50

5.7 Progress Monitoring and Individual Differences

In order to follow the learning progress of individual students of different groups, progress monitoring was carried out eight times throughout the entire 25-day program. Figure 2 and 3 show the reading fluency of both intervention groups. It is noticeable that students took less and less time to read a 125-word passage suggesting a steady improvement in reading fluency. The variance of individual progress indicates

differences in the benefits students have derived from the programs, pointing to the fact that individual responsiveness varied among dyslexic students.

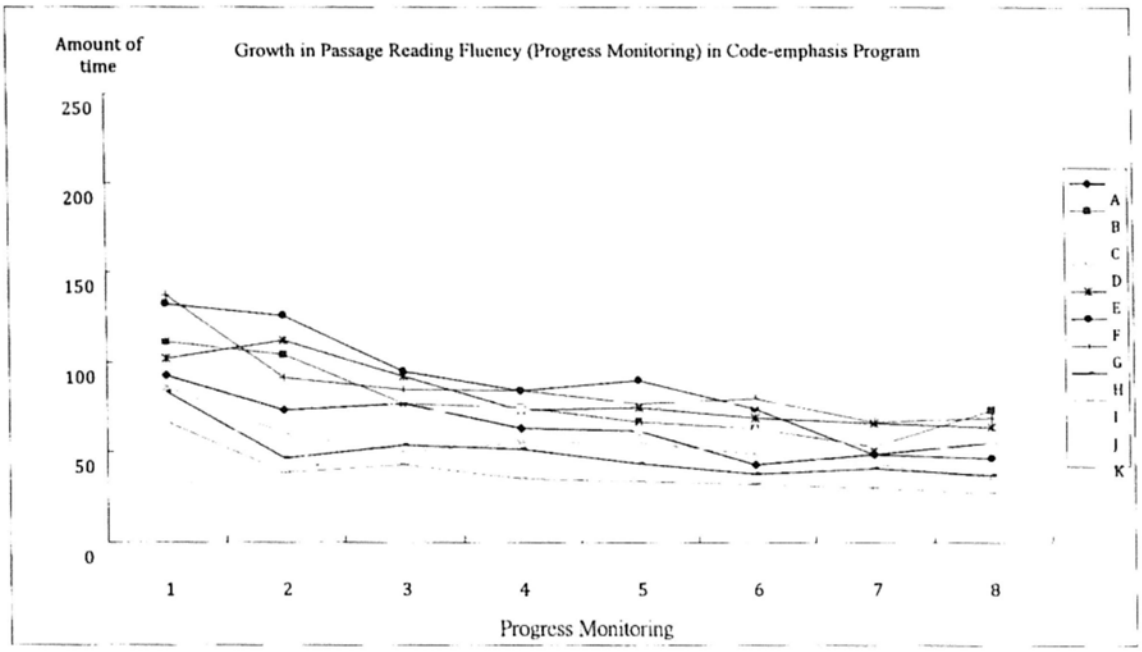

FIGURE 2 *Progress of Reading Fluency of each student in the Code-emphasis group.*

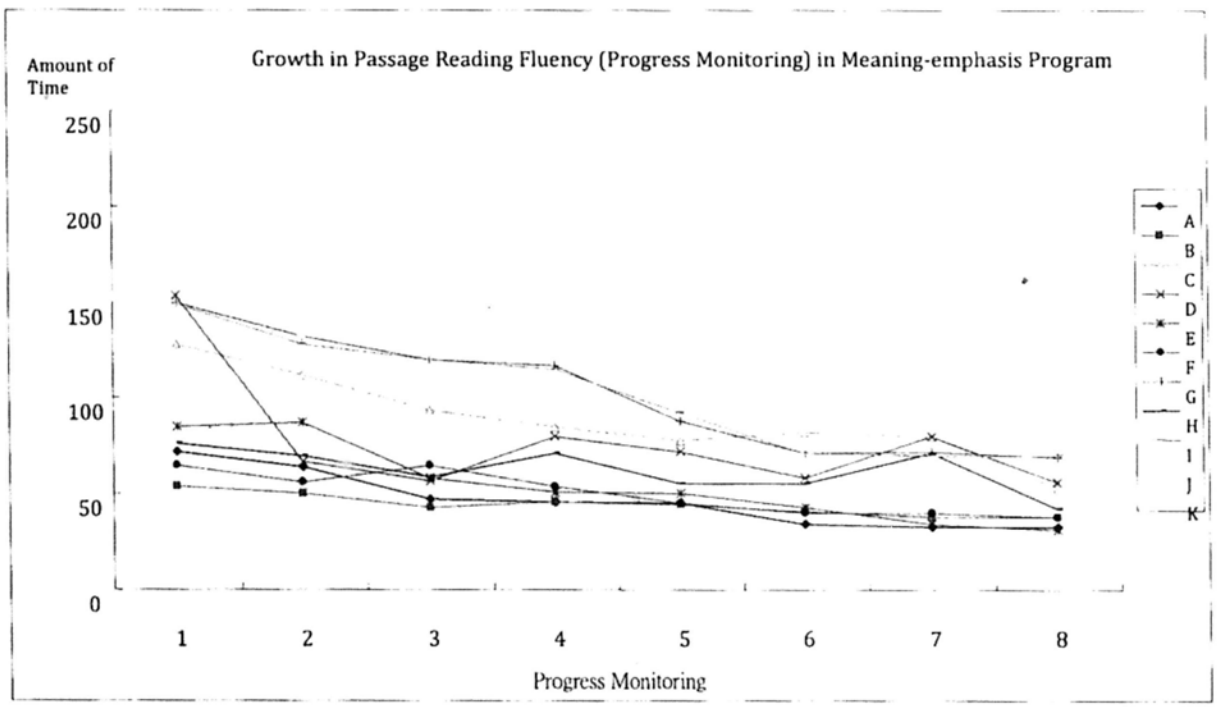

FIGURE 3 *Progress of Reading Fluency of each student participant in the Meaning-emphasis group.*

Figure 4 shows the average number of characters read per minute for both intervention groups over the duration of the program. For the Code-emphasis group, performance improved from 70 characters per minute (cpm) in the first evaluation to 142 cpm in the eighth evaluation. For the Meaning-emphasis group, the figure rises from 89 cpm to 180 cpm. The results show that both groups improved steadily in reading fluency. Although the slope is not collected for the comparison group, the "cpm" of both treatment groups still indicates that intensive and systematic training in fluency may contribute to reading performance improvement. The continual increase of number of words read per minute in both programs demonstrates that structured intervention encourages positive impact on reading fluency.

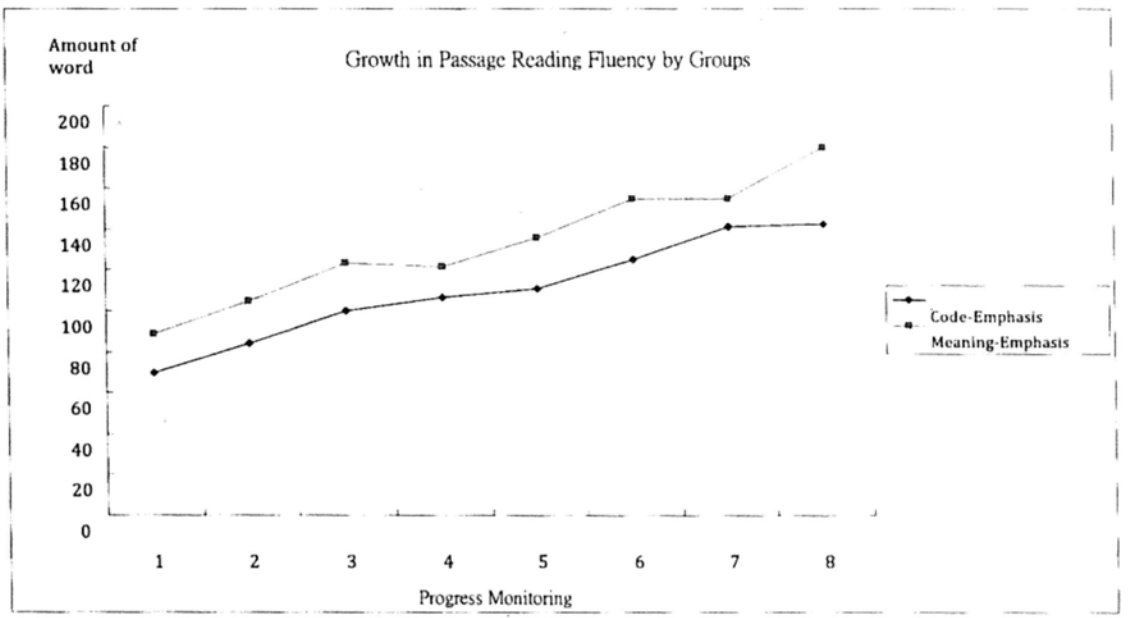

FIGURE 4 Progress in Reading Fluency of both programs.

5.8 Intervention Fidelity

Three lesson observations were carried out by 2 to 4 observers during the 25-day course. The Chinese version of the Class Observation Checklist (Appendix H) for this study was adopted from Denton et al. (2006) and Mathes et al. (2005) and was divided

into two sections. The checklist adapted a 5-point Likert rating scale, with 1 indicating that the teacher failed to meet the requirements on checklists and 5 indicating that all requirements were met. The average ratings given by the observers which provide additional information on the course implementation are listed in Table 19. On the whole, the overall appraisal of the learning activity is above average (mean=4.3) for both programs. For particular activities (e.g., character card activity), selected by the observers for in-depth observation, similar ratings were found.

Table 19

Average Scores of Class Observation of Both Intervention Programs

Class Observation Checklist (5-point scale)	Code-emphasis Program	Meaning-emphasis Program
1. Rating of the Lesson as a Whole		
Did the teacher have his/her materials ready?	5.0	4.7
Did the teacher arrange student seating appropriately?	4.3	4.2
Did the teacher demonstrate a warm and enthusiastic manner?	4.5	4.2
Did the teacher teach at an appropriate pace?	4.3	4.0
Did the teacher monitor student performance?	4.1	4.7
Did the teacher provide immediate feedback to the students?	4.1	3.8
Did the teacher communicate expectations to students clearly and explicitly?	4.0	4.8
Overall Average Rating	4.3	4.3
2. Rating of Particular Activities (e.g. character card activity)		
Did teacher and students follow the teaching procedures?	4.2	4.0
Did the teacher correct errors?	4.1	3.8
Did the teacher scaffold and re-teach as necessary?	3.6	4.0
Are students attentive and engaged?	3.4	4.0
Overall Average Rating	3.8	4.0

5.9 Meta-linguistic Awareness and Literacy Development

Pearson Correlations among measures were calculated to show the relationship between measures at the pre-intervention stage. The pre-intervention score was used in the

correlational analyses because it gave statistical information to the investigator at the early stage. As presented in Table 20, these correlations indicate that the test of logographic principle results in significant correlations with all four measures of literacy achievement. Copying fluency was highly correlated to character dictation, character reading fluency and passage reading fluency. Its correlation to reading comprehension was not significant. In contrast, copying accuracy as measured in the present study bore minimal correlations with the literacy achievement measure.

Table 20

Correlation Among Measures at Pre-intervention Stage (N=31)

Specific Instruments	Test of Logographic Principle	Test of Orthographic Structure (Copying Accuracy)	Test of Orthographic Structure (Copying Fluency)	Character Dictation	Character Reading Fluency	Passage Reading Fluency	Reading Comprehension
Test of Logographic Principle	1.00						
Test of Orthographic Structure (Copying Accuracy)	0.02	1.00					
Test of Orthographic Structure (Copying Fluency)	0.32	-0.07	1.00				
Dictation	0.86**	-0.02	0.52**	1.00			
Character Reading Fluency	0.64**	-.001	0.66**	0.73**	1.00		
Passage Reading Fluency	0.68**	0.08	0.67**	0.80**	0.90**	1.00	
Reading Comprehension	0.77**	0.02	0.21	0.72**	0.53**	0.65**	1.00

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

To determine the variables of meta-linguistic awareness that would together best account for literacy achievement, stepwise multiple regression analyses were carried out using measures of reading achievement as criterion variables. At each step in the analysis, the variables tested accounted for the most residual variance in the specific area of reading achievement when entered into the regression equation. Stepwise inclusion continued until the improvement in the regression sum of squares at a given step became non-significant (p>.05). The results are presented in Table 21. The test of logographic principle was the first variable entered into the equation of all four regression analyses, accounting for 68%, 40%, 53% and 62% of the variance in character dictation, character reading fluency, passage reading fluency and reading comprehension respectively. Copying fluency was the second variable entered into the equations, accounting for an additional 8%, 16%, 10% and 5% of the variance in character dictation, character reading fluency, passage reading fluency and reading comprehension respectively. It appears that meta-cognitive understanding of the logographic principle of Chinese character formation is an important contributor to both the character/word level and the passage level of literacy achievement. Furthermore, the additional unique contributor of copying fluency to the four areas of literacy achievement indicates that increased practice in character production may facilitate character recognition reading fluency and to a certain extent reading competencies.

Table 21

Regression Analyses Predicting Four Aspects of Reading Achievement for Participating Students (N=31)

Dependent Variable/ Predicators	R^2	R^2 change
Character Dictation		
Logographic Principle	0.68	0.68***
Logographic Principle Copying Fluency	0.76	0.08*
Character Reading Fluency		
Logographic Principle	0.40	0.40***
Logographic Principle Copying Fluency	0.55	0.16*
Passage Reading Fluency		
Logographic Principle	0.53	0.53***
Logographic Principle Copying Fluency	0.63	0.10**
Reading Comprehension		
Logographic Principle	0.62	0.62***
Logographic Principle Copying Fluency	0.66	0.05*

* $p < .05$, ** $p < .01$, *** $p < .001$.

5.10 General Discussion

Development of Intervention Programs

Development of intervention programs for Chinese children with dyslexia was the primary goal of the present study. Previous intervention studies in Chinese literacy as reviewed in chapter two mainly focused on skill training of isolated components (e.g., reading comprehension strategies or the knowledge of phonetic radicals) (e.g., Ho & Ma, 1999, Ho & Cheng, 2004). The present study attempted to

develop intervention programs based on an integration of five essential components. These essential components in Chinese literacy are suggested in the present study and they are found to be part of the important knowledge in helping children with dyslexia. Among the reviewed intervention programs in Chinese, only two studies employed the information from textbooks to consolidate the components skill (Tsuei, 2006; Chyn & Sheu, 2000). In view of this, the programs developed in the study attempted to strengthen the components skills by utilizing the information derived from local textbooks.

Effectiveness of Intervention Programs

The evaluation of the effectiveness of the two programs is the most important objective of the study. The two intervention programs were based on two different approaches in reading instruction (the code-emphasis and the meaning-emphasis approach). Five teaching components were taught either explicitly or implicitly in the two programs. For the code-emphasis program, four components (ortho-morphological awareness, ortho-phonological awareness, fluency and comprehension) were addressed. For the meaning-emphasis program, three components (vocabulary, fluency and comprehension) were involved. Both programs aimed to enhance the literacy performance of children with dyslexia. Through the quasi-experiment, two questions are to be answered regarding the effectiveness of the intervention programs.

Research Question 1. Would children in either program demonstrate significant gains in both meta-linguistic awareness and reading achievement measures when compared with the no intervention control condition?

In answering the first research question on the effectiveness of intervention, the investigator conducted a series of statistical analyses. The results indicated that children in the code-emphasis program performed better on the copying fluency test in comparison with the comparison group after a 50-hour intervention. The copying fluency test is one of the measures of the orthographic structure in meta-linguistic domain and reflects children's ability to perceive the graphic unit and radicals efficiently. The results also showed that children in the meaning-emphasis group performed better in passage reading fluency in comparison with the comparison group after intervention. The passage reading fluency test is one of the measures in reading achievement domain and reflects children's ability to read passage fluently and accurately. Previous intervention research in Chinese reported positive impact in post-intervention stage for those children with dyslexia in comparison with the non-intervention dyslexic group. Positive gains were also found in the present study on both intervention programs. However, the two programs were directed to different domains of intervention outcome. The code-emphasis program promoted orthographic structure knowledge while the meaning-emphasis program promoted passage reading fluency. The magnitude of effect size of pre-post within group differences, on the other hand, indicated considerable gains in all four areas of reading achievement for both intervention groups.

Research Question 2. Would children with dyslexia demonstrate improvement in reading skills as a result of the carefully designed instructional approach implemented in this study?

The answer to this second research question was reflected in the statistical analyses of pre-post within group differences. This study anticipated that the students' reading performance would improve as a result of the intervention programs. As shown in Table 19, there were large within group treatment effects for four tests (character dictation, character reading fluency, passage reading fluency and reading comprehension) in the code-emphasis group after a 50-hour intervention. For the meaning-emphasis group, there were two tests (character reading fluency and passage reading fluency) with large within group treatment effect and two tests (character dictation and the test of logographic principle) that reflected medium within group treatment effect. For the comparison group, only the test of reading comprehension reached large effect. The results reflected that both intervention groups received large within group pre-post treatment effects in character reading fluency and passage reading fluency. The effect size also reflected that the code-emphasis group received large treatment effect in greater literacy achievement than the other two groups.

The Relationship between Meta-Linguistic Awareness and Reading Achievement

Two aspects of meta-linguistic awareness, based on analyses of the characteristics of Chinese orthography and previous research findings, were hypothesized to be critical for literacy achievement in Chinese. It was speculated

that understanding of the logographic principle would facilitate character recognition (e.g., Wang &Yang, 2008). Also, being able to copy characters efficiently was assumed to be a skill of grasping the orthographic structure of Chinese characters. This skill has been regarded as particularly important for character recognition and dictation (e.g., Tan, Spinks, Eden, Perfetti, & Siok, 2003). The correlational and regression analyses of the present study offered some support to these arguments, indicating that understanding of the logographic principle and mastering of the orthographic structure of Chinese characters are associatde with literacy achievement in Chinese. The results were also consistent with findings of previous studies (e.g., Tan et al., 2003; Chen, Song, & Lan, 2003)

In sum, the findings from the study offer information on the development of intervention programs based on the components of Chinese literacy, textbook corpus analyses and the differentiated needs of dyslexic children. The 50-hour intervention showed that the code-emphasis group performed significantly better than the comparison group on copying fluency. The meaning-emphasis group performed significantly better than the comparison group statistically on passage reading fluency. Both programs were beneficial to participating students especially on character reading fluency and passage reading fluency in the pre-post within group difference analyses. Correlational and regression analyses confirmed the close relationship between meta-linguistic awareness and reading achievement.

CHAPTER 6

CONCLUSION

6.1 Summary of the Study

This study evaluated the effectiveness of two supplemental intervention programs for children with dyslexia in Chinese. Thirty-one children who were formally diagnosed with dyslexia participated in the present study. Nine children were assigned to the non-intervention comparison group. Eleven children were assigned to the Code-Emphasis program received explicit and systematic instructions in character recognition with meta-linguistic analysis (ortho-morphological and ortho-phonological awareness), fluency and reading comprehension. Eleven children in the Meaning-Emphasis program received explicit and systematic instructions on vocabulary building, fluency and comprehension. Both groups received 25 two-hour sessions (i.e., 50 hours in total) of intervention led by the researcher and teaching assistants for five consecutive weeks in the summer when the children did not attend regular classes.

Pre- and post- intervention performances were measured in terms of (1) reading achievement measures: character dictation (spelling), character reading fluency test, passage reading fluency test and reading comprehension test and (2) meta-linguistic measures: test of logographic principles and test of orthographic structure (copying accuracy test and copying fluency test). In the course of the intervention, students' progress was monitored eight times by measuring the students' character and passage reading fluency. Results indicate that (a) Meaning-Emphasis students demonstrated greater gains over the comparison group

at the end of the 50-hour intervention on one of the reading achievement measures (passage reading fluency test) after adjusting pre-intervention differences; (b) Code-Emphasis students showed an advantage over the comparison group on one of the meta-linguistic measures (copying fluency test) after adjusting the pre-intervention differences; (c) for the pre-post within group intervention effect, there were large treatment effects for four reading achievement measures (character dictation, character reading fluency, passage reading fluency and reading comprehension test) in the code-emphasis group. For the Meaning-Emphasis group, there were two tests (character reading fluency and passage reading fluency) with large within group treatment effect and two tests (character dictation and the test of logographic principle) reflected medium treatment effect. For the comparison group, only the test of reading comprehension reached large effect. It is concluded that both intervention approaches promoted dyslexic students' literacy achievement in similar ways and with some specific patterns. On the whole, both intervention groups demonstrated greater effect size (within group pre-post intervention) in most areas of reading achievement than the comparison group. Specifically, Code-Emphasis promoted copying fluency and meaning-emphasis encouraged passage reading fluency. Furthermore, progress monitoring showed that children in both groups performed with steady improvement in passage reading fluency. Correlational and regression analyses showed that meta-linguistic awareness of the features of Chinese orthography, in particular, meta-cognitive understanding of the logographic principle is highly related to literacy achievement.

6.2 Contribution of the Study

The present study attempted to construct a comprehensive and integrated framework for reading intervention in Chinese. The integration of the five essential components into the intervention programs involved several steps. First of all, a systematic literature review of intervention approaches was conducted. Second, curriculum materials were developed based on the data and analyses of the local primary school texts. Third, program size, duration and frequency grounded on the findings of previous research literature were meticulously scheduled. The effect of the two programs was tested with a pre-post intervention and quasi-experimental and comparison group design. In brief, this study makes a unique contribution to the field in that it is one of the few studies offering systematic and theory-based intervention for children with dyslexia in Chinese.

The present study suggests that five components (ortho-morphological awareness, ortho-phonological awareness, vocabulary, fluency and reading comprehension) are essential in Chinese reading development. The suggestion is based on a systematic literature review of the characteristics of Chinese orthography, cognitive processes of Chinese dyslexic children and Chinese intervention studies. The contribution of the five essential components in Chinese reading development is partly verified by both correlational and regression analyses reported in Chapter 5. The statistical analyses showed that the understanding of logographic principle and copying fluency (one of the tests of orthographic structure) are important predictors of reading achievement including achievement on such measures as character dictation, character reading fluency and passage reading fluency and reading comprehension. The significant correlations between the meta-linguistic awareness

measures and reading achievement measures provide some evidence that mastering of the logographic principle and copying fluency may be essential to literacy achievement in Chinese.

The ultimate goal of this study is the evaluation of intervention effectiveness. In recent years, the "Three-tier Intervention Model" has been implemented in Hong Kong for supporting students with dyslexia. However, the application of the three-tier model in Hong Kong still remains at a preliminary stage. Tier 1 refers to whole class quality reading instruction; Tier 2: small-group supplemental instruction; Tier 3: individualized intensive instruction (Fetcher et al., 2007). Despite the fact that it has been introduced to most front-liner practitioners, not many of them are experienced in implementing this model in schools. Though tier-1 instruction is receiving attention in the research field (e.g. Cheng et al., 2008, 2009), research efforts devoted to tier-2 and tier-3 interventions are very limited. One of the contributions of the study is to address the difficulties teachers encountered in implementing small group intervention in schools.

The current study shows that, after a 50-hour of intervention, the code-emphasis group and the meaning-emphasis group showed significant gains over the comparison group on certain aspects of literacy achievement. For example, the code-emphasis group demonstrated significant improvement in copying fluency, indicating greater awareness of the orthographic structure of Chinese characters. In contrast, the meaning-emphasis group displayed greater gains in passage reading fluency, reflecting greater automaticity toward word recognition in connected text, which is important for effective comparison. Furthermore, pre-post intervention

differences within groups showed that, children in the code-emphasis group demonstrated large treatment effects size for all four areas of reading achievement: character dictation, character reading fluency, passage reading fluency and reading comprehension. Children in the meaning-emphasis group showed large treatment effect size in both character reading fluency and passage reading fluency. The overall results indicated both programs benefited children with dyslexia.

6.3 Limitations and Implications for Future Studies

While the objectives of the current study were basically achieved, there are several limitations that need to be addressed. First, with respect to the framework of reading instruction, five components were recommended in the present study. The validity of the suggested components, the meta-linguistic elements in particular, have to be further examined and validated in future studies. Although ortho-morphological awareness and ortho-phonological awareness are two key elements in Chinese characters construction, the opaque and complex orthography-phonology-morphology relationships in Chinese orthography point to the fact that one has to master many more aspects of the logographic principle to be proficient in Chinese character recognition and dictation. As pointed out by Perfetti (2002), the transition from speech to print is an interaction between the three constituents of orthography, phonology, and morphology. Three constituents operated in an "interlocking" manner during the reading development. The current study took a bold step in linking speech to print for dyslexic students in two major aspects of the Chinese orthography. Further delineating the interlocking relationship of orthography, phonology, and morphology in Chinese, with direct implications for reading instruction, requires more carefully-planned research studies in the future.

Secondly, there are a number of limitations in this study regarding program design. The content of the two intervention programs was based on the corpus analysis of the local primary textbooks. The first 1000 high frequency characters and vocabulary word formed by these characters were used in the two programs respectively. Analyses of semantic radical and phonetic radical components involved in the 1000 characters were also conducted. However, the selected semantic radicals and phonetic radicals represented 57% and 9% of the 1000 characters pool respectively. It appears that more specific analyses of the characteristics of the characters are needed for further program development. For example, the number of graphic units (other than semantic and phonetic radicals) and patterns of combinations of graphic units in the 1000 character (orthography), the number of homophones in high frequency characters (phonology) or the semantic web among characters and vocabulary (morphology) are some of the complex linguistic properties that need to be addressed in future intervention studies.

Thirdly, with respect to research design, there are a number of points that deserve further discussion. As the 31 students participated in the program were not randomly assigned to the three conditions, the present study is a quasi-experimental design rather than an experimental one. Even though quasi-experimental design resulting from various school circumstances in literacy research is a commonplace, its influence to the internal validity of the present study should not be overlooked (Vellutino & Schatschneider, 2004). The researcher of the present study addresses this issue by controlling the pre-existing differences among the three conditions with covariates technique suggested by Vellutino & Schatschneider (2004).

Furthermore, the sample size of the present study was far from ideal. Students who participated in this research were recruited through a parents' organization. Therefore, the 31 students recruited were of varied ages. Besides, it should be pointed that generalizations of the current findings are limited and small sample size research commonly "yielded larger estimates of Effect Size than those with larger samples" (Swanson, 1999, p. 516). A higher scaled-up possibility and better representation of sampling may provide significant information if the study were to be conducted in different schools in a manner similar to the study of Denton and her colleagues (Denton et al., 2003, 2010). Also, participants in both intervention groups were mainly grade 3 to 4 children with identified dyslexia. They may have previously had different learning experiences or received different interventions. However, the present study did not consider their prior learning experiences. Moreover, the validity and effectiveness of the program were reflected by the measures employed. The current study applied seven instruments measures in two domains (meta-linguistic awareness and reading achievement). As no standardized reading achievement tests are available for monitoring the progress (or pre-post change) of children in Hong Kong, a set of measuring tools was constructed specially for the study. Although the measures used in this study were of reasonable reliability indexes, further validation and refinement of the measures are needed in future studies. For progress monitoring, the present study uses a set of passages adapted from local primary curriculum characters and vocabularies. In order to counter the effect of variation of difficulties of the passages for oral reading fluency assessment, emphasis is placed on the equivalence of passages used in progress monitoring. Its importance has been acknowledged by those researchers in English reading intervention as they found that "readability formulas" (the equivalent forms

of passages) are essential to remove the form effect of different passages (Francis, Santi, Barr, Fletcher, Varisco, & Foorman, 2008). Future studies need to consider the issue of form equivalence in measuring progress monitoring.

Fourthly, intervention fidelity provided the proof of program implementation and secured the effective transfer of knowledge to other teachers. The present study used a Chinese simplified version of class observation checklist that was developed by Denton and her colleagues (2006) and Mathes et al., (2005). It recorded how the teacher and teaching assistants implemented the programs during the five weeks of intervention. Teachers observers suggested the addition of the "core components" of the Chinese literacy program in the checklist for local use, such as "time spent on teaching and explaining the semantic radicals" or "explaining the vocabulary with synonym" etc, so that teachers could follow the checklist to adjust their teaching; this aspect is crucial for teachers' training in implementing the program in the future.

Fifthly, the study was conducted over five consecutive weeks during the summer, which may not be practical for schools. Experiences from western studies have shown that the most ideal program duration is between eight and 56 weeks (Gersten et al., 2008, p.41). As the study did not aim to compare the effectiveness of different intensity (e.g., 50 hours vs 25 hours), suggestions for intervention intensity cannot be drawn. Also, future study can focus on the effect of time allocation distributed to different components during the intervention and how it affects reading performance.

Last but not least, what are the key features of effective intervention? The National Research Center in Learning Disabilities provides good reference for researchers on the key features of effective intervention programs. According to NRCLD (2005), they include: high quality classroom instruction, research-based instruction, curriculum-based assessments & classroom performance, universal screening, continuous progress monitoring, research-based intervention and fidelity measures. It should be point out that among the above features, some had been attempted in this study. We still have a lot to learn from the experience of western countries in developing effective intervention programs for Chinese students with learning difficulties.

6.4 Concluding Remark

Despite the fact that there've been very few researches on the effectiveness of the intervention methods employed in those programs for children with Dyslexia in Chinese, the present study recognizes the sheer importance of these researches. Two different programs based on different theories are evaluated here for their effectiveness in helping children with dyslexia in Chinese. Apart from exemplifying the contrasting views of these theories on the mechanisms of reading acquisition, the present study shows comprehensiveness in its program development, implementation and evaluation by adapting components based on a thorough literature review of effective instructional practices for learning reading English and using materials stemming from the corpus analysis of the curriculum materials used

in local schools. Although the evaluation methods employed in the present study is by no means exhaustive due to resources constraint, two measures including meta-linguistic awareness and reading achievement are used to ensure sufficient objectivity. Besides offering itself as samples for teacher to develop curriculums and for education authorities to set up small group supplemental instruction (Tier-2), the most important finding of the present study is that students of the two intervention programs did make significant improvements in different aspects of reading that could reasonably be attributed to the successful intervention techniques based on corresponding theories.

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Appendices

Appendix A

Schedule of Teaching of Both Programs Based Corpus Analysis (Samples of Five Stories)

Story	Code-Emphasis Program				Meaning-Emphasis Program
	Core components				
	Ortho-morphological Awareness		Ortho-phonological Awareness		Vocabulary
	Semantic Radicals	Examples	Phonetic Radicals	Examples	Examples
熊爸爸找房子 Papa Bear Is Looking For A New House	木 wood 亻human	森 林 棵 棵 樹 桌 們 個 作	-	-	冬天 温暖 樹葉 桌子 森林 開始 木板 房子 山洞 石頭
動物唱歌大賽 The Animals' Singing Contest	口 mouth 水 water	唱 喝 呢 嘴 喊 呼 波 池 油	-	-	池塘 喜歡 音樂 歌唱 練習 休息 玩耍 成績 他們 歡呼
校園裡的一棵樹 The Big Tree	言 speech 糸 silk	讀 請 訴 認 課 語 經 綠 結	白 baak6 果 gwo2	伯 baak3 拍 paak3 棵 fo2 課 fo3	樹枝 學校 微笑 閱讀 老師 同學 有趣 認真 回答 朗讀
松鼠先生退休了 Mr. Squirrel Is Retired!	心 heart 水 water	思 念 愛 感 忘 想 湯 沙 温	己 gei2	紀 gei1 記 gei3	杯子 朋友 禮物 忘記 決定 約定 明天 感謝 喜歡 外公
鐵甲人小丁丁 Super Robot Little Ting	雨 rain 走 walk 金 gold	雪 雲 電 越 起 趕 鐵 銀 鐘	-	-	可以 眼睛 方向 如果 困難 無論 立即 馬上 閃電 於是

Appendix B

Samples of Copying Activity (Three Levels) in Code-Emphasis Program

挑戰一　　姓名：_____

「木」字在哪裏？請把它圈出來！ 

林	找	們	樹	年
葉	行	棵	有	山
作	板	桌	到	森

你找到多少個「木」？_____

挑戰二　　姓名：_____

請在適當的地方填上「木」字！

木	果	封	反
森	苗	卣	

挑戰三　姓名：_____

請在適當的地方填上「木」字！

木	果	封	反
森	苗	卣	

你還懂得其他有「木」字旁的字嗎？

木	木	木

Appendix C
Samples of Typical Passages (Story 1-5) for Both Intervention Programs

動物旅行記

這天，小羊波波、白兔思思和青蛙欣欣到森林旅行。他們在小路上走，一邊呼吸清新的空氣，一邊欣賞漂亮的花朵，很是快樂。

中午的時候，他們坐在柔軟的草地上，準備吃午餐。白兔思思弄了好吃的紅豆湯丸，青蛙欣欣弄了美味的沙律。這時候，小羊波波突然大叫起來：「啊！我忘了帶叉子，怎麼辦呢？」沒有叉子，他們怎樣吃湯丸和沙律呢？波波急得快要哭起來了。

這時，聰明的欣欣溫柔地對波波說：「波波，不要緊，我們可以找一些短短的樹枝，把它們當作叉子來用呀！」思思也拍手叫道：「好呀！這真是一個好主意！」於是，他們三個好朋友手拉着手，一起拾樹枝去了。

Journey to the Forest

Today Billy the Goat, Sally the Rabbit, and Mary the Frog are going on a trip to the forest. They walk along the path, breathing in fresh air and looking at pretty flowers very happily.

In the afternoon, they sit on the soft grass and get ready to eat lunch. Sally the Rabbit made a tasty cake and Mary the Frog made a yummy salad. Suddenly, Billy the Goat yells, "Oh no! I forgot to bring forks, what should we do?" Without forks, how will they eat the cake and the salad? Billy starts to cry. Clever Mary kindly says to Billy, "Don't worry, Billy, we can find tree branches to use as forks!" Sally claps her hands and says, "Yes! What a good idea!" So the three good friends set off to collect tree branches together.

動物旅行記

有一天，小熊波波、白兔思思和青蛙欣欣到森林旅行。他們一邊走，一邊呼吸著花朵的香氣，很是快樂。

中午的時候，他們坐在柔軟的草地上，把午餐拿出來。白兔思思弄了好吃紅豆湯丸，青蛙欣欣弄了美味的沙律。這時候，小熊波波突然大叫起來：「哦！我忘了帶叉子，怎麼辦呢？」沒有叉子，他們怎樣吃湯丸和沙律呢？波波快要哭起來了。

過了不久，聰明的青蛙欣欣溫柔地對小熊波波說：「波波，不要緊，我們可以用短短的樹枝當作叉子呀！」白兔思思也拍手呼叫說：「好呀，很有趣啊！」

於是，他們三個好朋友手拉著手，一起拾樹枝去了。

動物唱歌大賽

小熊波波和青蛙欣欣很喜歡音樂，參加了歌唱比賽。波波唱歌，欣欣彈樂器。波波為了好好練習，還每天到池塘游泳呢！

有一天，白兔思思看見波波和欣欣，便說：「你們休息一會兒，跟我玩耍吧！」可是，欣欣叫喊道：「比賽快到了，我們要加緊練習，才可取得優異的成績呢！」思思只好獨自回家了。

比賽的大日子到了！波波和欣欣站在台上，波波看見台下有很多觀眾在喝采歡呼，緊張得嘴巴也張不開。這時候，他們忽然看見思思高舉着紫色的布條，布條上寫着：「波波、欣欣、加油！加油！」。

校園裡的一棵樹

小熊波波的學校裏有一棵大樹。這棵大樹已經有八十多歲了，但是還很健壯，有綠色的葉子和粗粗的樹根。青蛙欣欣，小熊波波和白兔思思常常結伴坐在大樹下閱讀。

有一天，老師對同學說：「你們有沒有看到學校有一棵大樹呢？它的樹枝很像一個大魚網啊！」白兔思思聽到老師這麼說，立即舉手說道：「老師，我有一個請求呢！」老師用溫柔的語氣說：「思思，你的想法總是很有趣，告訴我你有什麼請求呢？」思思認真地回答說：「老師，我們今天可不可以到大樹下上課呢？我想朗讀課文給大樹伯伯聽呢！他一定很快樂啊！」

思思說完後，同學拍手和應，老師也點頭微笑呢！

松鼠先生退休了

小熊波波的老師松鼠先生退休了。松鼠先生是一位十分愛護學生的好老師，同學們都很喜歡他。小熊波波、白兔思思和青蛙欣欣決定送一些紀念品給松鼠老師，希望老師不要忘記他們。於是，波波、思思和欣欣約定明天下午在天橋下見面，討論送什麼禮物。

小熊波波說：「我的外公種了很多甜甜的桃子，我送一籃桃子吧！」青蛙欣欣說：「送杯子好嗎？老師看見杯子的時候，就會想起我們了。思思，你送什麼禮物呢？」白兔思思說：「我決定寫一首詩送給松鼠先生，感謝他的教導。」

各位小朋友，你會送什麼給松鼠先生呢？

鐵甲人小丁丁

各位小朋友，你認識鐵甲人小丁丁嗎？他很有本領，可以像小鳥一樣飛在天上，穿越雲霧。他的眼睛可以在大風雪中分辨東、南、西、北的方向，就像指南針一樣。

小丁丁的身上掛着一個銀色的小吊鐘，如果小朋友遇上困難，只要大叫小丁丁的名字，銀鐘便會「叮叮」地響起來。無論日和夜，只要銀鐘響起，小丁丁都會立即趕來幫忙。

昨天晚上，小美被困在山上，那時正下着大雨，天上又閃電，又打雷。這時小美想起了小丁丁，便大聲叫道：「小丁丁，小丁丁，快來救我呀！」小丁丁的銀鐘馬上「叮叮」地響過不停，於是他趕快飛到小美的身旁，帶她下山。小美很感激小丁丁，便抱着他說：「小丁丁，你常在我們的左右，任何時候都會來幫忙，謝謝你！」

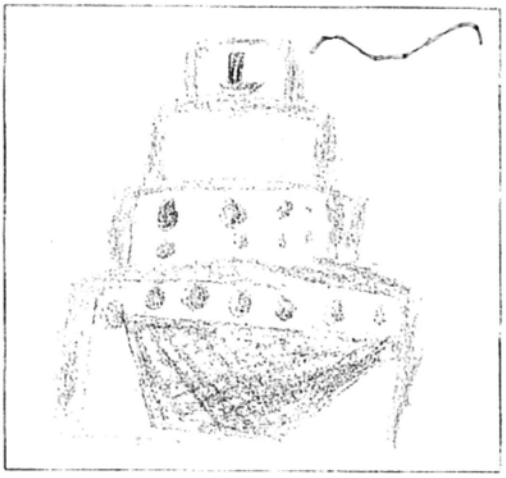
Appendix D

Character Cards used in Code-Emphasis Program

Appendix E

Sample worksheets of Creative Writing in Meaning-Emphasis Program

我要做一個
四層圓形 蛋糕，
在上面加上許多
桃子和草莓 和少許
巧克力 。



圓形 三角形 正方形 長方形 心形
巧克力 桃子 生果 士多啤梨 糖果 草莓

王肖雲 很喜歡
打棒，他還參
加了 [illegible] 比賽。
為了好好練習，
[illegible] 每天也會到
[illegible] 呢！

Appendix F

Vocabulary Cards used in Meaning-Emphasis Program

花朵 故事一	中午 故事一
午餐 故事一	美味 故事一
好吃 故事一	柔軟 故事一
聰明 故事一	草地 故事一

朋友 故事一	快樂 故事一
冬天 故事二	温暖 故事二
樹葉 故事二	桌子 故事二
森林 故事二	開始 故事二

木板 故事二	房子 故事二
山洞 故事二	石頭 故事二
池塘 故事三	喝采 故事三
音樂 故事三	歌唱 故事三

練習 故事三	休息 故事三
玩耍 故事三	成績 故事三
他們 故事三	歡呼 故事三
樹枝 故事四	學校 故事四

微笑 故事四	閱讀 故事四
老師 故事四	同學 故事四
有趣 故事四	認真 故事四
回答 故事四	朗讀 故事四

杯子 故事五	天橋 故事五
禮物 故事五	忘記 故事五
決定 故事五	約定 故事五
明天 故事五	感謝 故事五

喜歡 故事五	外公 故事五

Appendix G

Test battery and Administration Procedures of all Instruments

Character Dictation (Spelling)

Today we are going to dictate 25 characters. Some of them you have already learned and some of them you may not have learned. If there are some characters you cannot write, please write the character you think comes closest, guessing if you have to. Try your best not to leave any blanks, because if you leave a blank you will not receive any score for that answer. Each character will be pronounced three times. The first time I will say the character alone; next, I will say this character within a word; and the third time I will say the character within a sentence. Please listen carefully. (The instruction was the adapted from Shen & Bear , 2000)

Target character for Dictation Test	Target character in the sentence
我	我們去旅行。(trial item)
你	你們去游泳。(trial item)
太	太陽出來了。(trial item)
起	我早上八時起床。
明	我們明天上學去
快	巴士快到了。
每	我每天到公園跑步。
帶	我帶著弟弟去沙灘玩耍。
故	我喜歡聽故事。
睡	小寶寶睡著了。
指	我有五隻手指。
容	今次的考試很容易。
練	今天做練習。
隊	我們排隊上課室。
鞋	我有一對漂亮的皮鞋。
閃	天上的星星閃出光芒。
巨	牆上掛上一張巨型海報。
豆	我喜歡吃青豆。
模	我有一架飛機模型。
圈	我在地上畫圓圈。
勇	哥哥是個勇敢的人。
堂	我們排隊到禮堂。
亞	香港位於亞洲。
訓	運動員要天天接受訓練。
乖	我是一個乖孩子。

Character Reading Fluency Task

The experimenter first presented the Word Reading Sheet to the student and said, "Read those words for me across the page out loud. When you finish a line, go down to the next one (pointed from the left to the right). Read carefully but as quickly as you can. Remember to pronounce each word accurately. If you don't know the word, then say 'I don't know' and quickly move on to the next one. Let's have a go first." The experimenter then presented a sheet containing 20 trial items to the student to read. When the student hesitated for 2 seconds, the experimenter asked the student to read the next one. When the student's volume went low, the experimenter then said, "Please read a bit louder, so I can hear you more clearly." After the student had finished the trial items, the experimenter said, "Now we will start this activity. I will stop you in a minute. Off you go!" After one minute, the experimenter said, "Time's up, stop!"

一分鐘讀字

的	一	我	了	是	不	有	在	來	上	小	人	們	大	地	15
他	子	說	這	到	你	着	個	天	就	媽	看	時	好	得	30
會	裏	下	和	家	要	出	都	也	起	可	把	去	為	學	45
那	爸	麼	中	生	多	過	成	很	心	自	她	以	後	老	60
又	想	還	開	水	用	然	沒	能	像	頭	樣	花	兒	面	75
走	道	回	呢	長	給	年	對	手	動	見	事	明	高	聲	90
十	只	真	國	海	發	同	做	點	最	樹	方	從	甚	前	105
師	笑	聽	色	己	作	如	邊	字	兩	現	身	日	它	快	120
吃	而	孩	氣	物	白	進	啊	嗎	知	叫	光	美	問	太	135
變	意	山	空	三	分	於	書	當	眼	愛	打	文	話	馬	150

Passage Reading Fluency Task

The experimenter presented the Passage Reading Sheet to the student and said, "Now here is a passage for you to read. When you finish a line, go down to the next one (pointed from the left to the right). Again, read carefully but as quickly as you can. Remember to pronounce each word accurately. If you don't know the word, say "I don't know" and quickly move on to the next one. I will stop you in a minute. Let's start from the first line. Off you go!" After one minute, the experimenter said, "Time's up, stop!"

【外婆的生日】

										總字數
		今	天	是	小	美	外	婆	的	8
生	日	，	可	是	，	她	竟	然	忘	16
記	了	給	外	婆	準	備	禮	物	。	25
小	美	心	裏	十	分	着	急	，	所	34
以	一	個	人	躲	在	房	間	裏	，	43
「	嗚	嗚	」	地	哭	了	起	來	。	50
		這	時	候	，	小	美	的	媽	57
媽	走	進	來	問	她	：	「	妳	爲	65
甚	麼	哭	呢	？	」	小	美	告	訴	73
媽	媽	：	「	我	忘	記	了	外	婆	81
的	生	日	，	該	怎	麼	辦	？	」	88
聰	明	的	媽	媽	想	了	一	會	兒	98

，	說	：	「	我	們	現	在	一	起	105
做	一	個	蛋	糕	送	給	外	婆	吧	115
！	我	去	買	材	料	，	你	來	設	123
計	蛋	糕	的	形	狀	和	上	面	的	133
圖	案	好	嗎	？	」					137
		小	美	拍	手	說	道	：	「	143
好	主	意	！	我	要	做	一	個	心	152
形	蛋	糕	，	在	上	面	用	許	多	161
水	果	和	少	許	巧	克	力	砌	一	171
個	哈	哈	笑	圖	案	！	」	媽	媽	179
回	答	說	：	「	你	眞	有	心	思	187
，	外	婆	一	定	很	高	興	呢	！	195
」										195

Reading Comprehension*

We're now having a reading comprehension task for you. Please find the most suitable answer for each question, and circle it. If you find any unfamiliar characters or words, please choose the best answer by inferring the meaning from the context in that question. Remember to put in your answer for each question!

各位小朋友好！我們現在進行閱讀測驗，請找出每題中你認爲最適當的一個答案，並將答案圈出來。 如果發現不太了解的生字或新詞，請依據該題所要表達的意思，來選擇一個你認爲最適當的答案。請注意，每題都要寫上答案啊！

現在我們先來做下面兩題練習題，請將正確答案圈出來。

練習題一：	可愛的小精靈有一雙神奇的眼睛，不管多麼平凡的東西，看起來都會很美麗。他是個小小魔術師，喜歡揮舞着魔棒，玩色彩和形狀的把戲。
	句子中的「他」是指誰？
	(1) 眼睛 (2) 平凡的東西 (3) 魔棒 (4) 小精靈
練習題二：	小花貓和媽媽在河邊釣魚，小花貓一會兒放下魚竿去捉蜻蜓；過了一會兒，小花貓又放下魚竿去捉蝴蝶，小花貓連一條魚也釣不到，貓媽媽卻已經釣了兩條大魚。
	爲什麼小花貓釣不到魚？
	(1) 河裡沒有魚 (2) 魚死了 (3) 小花貓不專心釣魚 (4) 魚很會躲

*The reading comprehension test is a modified version of Chang & Yung (2005)'s Handbook of Reading Comprehension" (in Chinese). Only the two sample questions of the test are presented in Appendix.

The Test of Logographic Principle

Please circle a correct character to form a two-character word.

選出適合的字，把它圈出來。　　學生姓名：_____

例: 作 (頁，業，葉)

習題 1. 幫 (助，坐，座)

習題 2. 日 (旗，其，期)

1	酒 (留，樓，流)	21	(螞，碼，馬) 頭
2	(仙，先，鮮) 果	22	翅 (傍，滂，膀)
3	手 (根，跟，巾)	23	太 (陽，揚，楊)
4	(張，將，章) 來	24	(清，蜻，青) 除
5	(事，是，示) 情	25	(直，值，植) 物
6	頭 (法，髮，發)	26	山 (波，坡，玻)
7	(只，指，紙) 是	27	(誠，城，成) 實
8	空 (氣，汽，戲)	28	(唐，塘，糖) 果
9	(蟲，重，從) 前	29	蝴 (碟，諜，蝶)
10	休 (息，適，色)	30	好 (象，像，橡)
11	(往，住，注) 宅	31	(件，健，偷) 康
12	周 (圍，團，園)	32	(竟，境，鏡) 然
13	(惜，借，錯) 誤	33	(紙，紫，緊) 色
14	(社，肚，吐) 皮	34	氣 (芬，紛，扮)
15	(伯，佔，但) 是	35	牛 (油，游，泡)
16	肥 (脫，服，胖)	36	(級，給，結) 果
17	(容，客，害) 易	37	經 (嘗，賞，常)
18	門 (室，窗，寄)	38	(忙，忘，忍) 記
19	(亮，高，膏) 興	39	器 (才，材，財)
20	(送，這，遠) 近	40	美 (未，味，妹)

Copying Accuracy Test

The experimenter presented the Copying Accuracy Test to the student and asked the student to write down his/her name. The experimenter then said, "Here's another set of words for you to copy. Do it across the page line by line (pointed from the left to the right). No time limit for this turn. I want you to write as fast as and as accurately as you can. Again, if you write it wrong, cross out the wrong word and write the correct one next to it. You need to copy all the words on this sheet. Are you ready? Off you go!"

抄字(二)

亡	日	竟	我	永	危

眾	皮	夕	月	灰	風

陳	及	弟	長	收	山

西	己	壯	巧	接	公

麥	家	書	亞	您	乃

Copying Fluency Test

The Copying Fluency Test was presented to the student. The experimenter asked the student to write down his/her name on the sheet and said, "Now I have some words for you to copy, please copy line by line (pointed from the left to the right). Copy accurately but as quickly as you can. If you write it wrong, cross out the wrong word and write the correct one next to it. To save time, don't use rubbers! Now let's have some practice first." The experimenter then instructed the student to copy 5 words for practice. After the student had finished, the experimenter then said, "We will now start this activity. This time you have three minutes. Off you go!" After 3 minutes, the experimenter said, "Time's up, stop!"

抄字(一)

世	升	巨	步	他	勇

威	班	婆	悄	樂	獵

熱	樣	擺	迎	肉	考

那	角	紙	降	雀	訴

際	築	覽	驚	麗	題

Appendix H

Observation Checklist for Intervention Fidelity (Chinese Version)

閱讀訓練課堂觀察表

Adapted from Denton et al., (2006) and Mathes et al., (2005)

觀察班別： A / B　　**填表日期：** _____

	第一部份：課堂的整體評分					
	於整個隨堂觀察期間，	需要改善--------非常好				
1.	課程材料的準備是否充足？	1	2	3	4	5
2.	學生的座位安排是否恰當？	1	2	3	4	5
3.	課堂的氣氛是否溫暖且熱忱？	1	2	3	4	5
4.	課堂的節奏、速度是否合適？	1	2	3	4	5
5.	老師有否適切地留意學生的表現？	1	2	3	4	5
6.	老師有否對學生作出即時且合適的回應？	1	2	3	4	5
7.	老師有否清楚並明顯地令學生明白自己對他們的期望？	1	2	3	4	5
	第二部份：個別活動的評分 活動名稱：_____					
	於個別活動進行期間，	需要改善--------非常好				
1.	老師有否跟從指定的程序？	1	2	3	4	5
2.	老師有否修正錯誤？	1	2	3	4	5
3.	老師有否因應學生的需要，作出相對的調適及重複指導？	1	2	3	4	5
4.	學生是否留心，並積極參與？	1	2	3	4	5