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The Core Components of Reading Instruction in Chinese

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Abstract

The present study aimed at identifying core components of reading instruction in Chinese within the framework of the tiered intervention model. A curriculum with four teaching components of cognitive-linguistic skills was implemented in a Program school for three years since Grade 1. The findings showed that the Tier 1 intervention was effective in enhancing the literacy and cognitive-linguistic skills of children in the Program school. The positive effects were maintained at the end of Grade 2. Progress in both word-level and text-level cognitive-linguistic skills predicted significantly progress in reading comprehension. Based on the present findings, the four core reading components in Chinese were proposed – oral language, morphological awareness, orthographic skills, and syntactic skills. Comparing the Big Five in English and the four core components in Chinese reflects different cognitive demands for reading diverse orthographies.

Keywords: Chinese, cognitive-linguistic skills, reading instruction, tiered intervention

The Core Components of Reading Instruction in Chinese

The Response-to-Intervention Approach

The Response-to-Intervention (RtI) approach has received growing attention in recent years and its effectiveness has been established in studies conducted in North America. This early prevention approach is based on monitoring students' progress, by means of curriculum-based measures, over the course of their participation in appropriate interventions. Students who make little progress are deemed to require a more intensive and specific intervention, and those with continuous non-responsiveness to intervention may be considered as having a learning disability. A three-tiered RtI model is generally used as an alternative to traditional methods for identifying and teaching students with reading disabilities. In this kind of model, Tier 1 is whole-class, quality core reading instruction provided to all general education students. Those who fall below the benchmarks receive more intensive intervention. Tier 2 is small-group supplemental instruction, and Tier 3 is individualized intensive instruction. In general, Tier 1 instruction should meet the needs of around 70-80% of learners. The lowest 20-30% of students may require additional support with Tier 2 intervention, and around 5-10% may need more intensive support from the Tier 3 intervention (see a comprehensive review in the book of Haager, Klingner, & Vaughn, 2007).

The RtI approach has been demonstrated to be effective in decreasing the percentages of children requiring special education. After implementing a three-tiered model in the Heartland Early Literacy project (HELP), the numbers of students who were placed in special education at the participating school were reduced by 14% in kindergarten, by 34% in first grade, by 25% in second grade, and by 19% in third grade (Tilly, 2003). Similarly, another study showed that the incidence of placement in special education in the control group was around 15%, while that in the experimental group, after four years' participation in the project, was 11.8% in Tier 1 and 7.8% in Tier 2 (O'Connor, Fulmer, Harty, & Bell, 2005).

The RtI approach is therefore preventative and meaningfully linked to intervention. Successful implementation of this approach depends on three critical elements: (1) a core reading program based on scientific research findings, (2) benchmark testing and progress monitoring to determine instructional needs, and (3) professional development for teachers to ensure that students receive quality instruction in reading.

A Core Reading Curriculum

To determine what reading intervention components were most effective for helping children learn to read well, The National Reading Panel (2000) examined over 100,000 research studies related to reading instructions. The Panel has identified five core components of reading instruction in English: phonemic awareness (PA), phonics, vocabulary, fluency, and reading comprehension. These are called the Big Five. PA is the ability to notice, think about, and work with individual sounds in spoken words. The overall effect size of PA outcomes was large (e.g., 0.71 for Year 1 to Year 2 change, and 1.08 for Year 1 to Year 3 change in Tilly's study, 2003), and was especially significant on word reading and reading comprehension. Phonics involves systematic instruction of letter-sound relations to reading and spelling of words accurately and quickly. The systematic phonics instruction significantly helps children learn to decode words more effectively. Vocabulary is about how children acquire an understanding of new words and concepts. Vocabulary instruction improves the performance in reading comprehension through better understanding of word meaning. Fluency refers to reading quickly, accurately, and with appropriate expression. Fluency is an indicator of skilled reading and facilitates rapid integration of concepts in sentences and text. Comprehension refers to the process that enables readers to make meaning of text, and to communicate meaning about what was read. Comprehension is the central and ultimate outcome of the reading process. Phonemic awareness, phonics, vocabulary, and fluency are considered as essential components for achieving good reading comprehension.

Progress Monitoring

Assessment in the Tiered Intervention Model serves three functions: (1) screening for children that

may require more attention, (2) progress monitoring for entry and exit decisions, and (3) assessment for informing instructional planning. Benchmark assessments, preferably three times a year, help in early identification of students at risk for reading problems. The data on ongoing progress monitoring help teachers in adjusting their instruction to ensure students' academic growth.

Teacher Training

Teachers play a key role in successful implementation of the RtI instruction (Chhabra, 2006; Danielson, Doolittle, & Bradley, 2007; Kratochwill, Volpiansky, Clements, & Ball, 2007). Recent studies indicate that trained teachers were observed to utilize significantly more explicit instruction than control teachers, and hence students being taught by the trained teachers performed better (Bos, Mather, Narr, & Babur, 1999; McCutchen et al., 2002; McCutchen & Berninger, 1999). To achieve successful professional development for teachers, training needs to communicate a clear rationale to teachers, supply evidence-based curricular materials, and to provide teachers with feedback and support for the new practice (see Al Otaiba & Lake, 2007).

Given the early success of the RtI approach in North America, it is interesting to know whether this approach is effective for learners in non-English cultures, for example Chinese. With different linguistic features in Chinese, the core reading curriculum is unlikely to be the same. The primary aim of the present study was to identify the core components of reading instruction in Chinese. Developing an evidence-based reading curriculum is the foundation for quality instruction in Tier 1 and beyond.

Characteristics of the Chinese Writing System

Since the reader may not be familiar with the Chinese language, we will first briefly describe the main characteristics of the Chinese orthography. The basic graphic unit in Chinese is a character. The fact that the Chinese character is simultaneously a visual whole, a syllabic unit, and a morpheme contrasts with the units of writing in alphabetic scripts, letters, which indicate sound only and

have no dovetailed relation with meaning. The script-sound-meaning convergence of the Chinese character may facilitate the process of understanding and retrieval of the meaning of multicharacter words (Hoosain, 1991). Knowledge of morphemes allows children to have an educated guess when they encounter unfamiliar words in isolation or in a passage (e.g., foot-ball, basket-ball, hand-ball, etc.) (McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003; Shu, McBride-Chang, Wu, & Liu, 2006).

About 80% to 90% of Chinese characters are ideophonetic compounds, each comprising a semantic and a phonetic component (stroke-pattern known as radical). In general, the semantic radical in a Chinese character signifies the semantic category of the character. There are different degrees of transparency for the semantic implication of different semantic radicals. According to Chung and Leung (2008), 33% of the semantic-phonetic compound characters encountered by grade one students in Hong Kong were transparent, 22% were semi-transparent, and 30% were opaque. The sound of a Chinese character may be derived directly from its phonetic radical or indirectly by making an analogy with other characters having the same phonetic radical. The predictive accuracy of the pronunciation of an ideophonetic compound character from its phonetic radical is about 40% (e.g., Shu, Chen, Anderson, Wu, & Xuan, 2003). This drops to 23% to 26% if tone is taken into consideration (Chung & Leung, 2008; Shu et al., 2003). Overall, semantic radicals are functionally more reliable than phonetic ones. Given the large number of radicals (around 200 semantic radicals [Feldman & Siok, 1999] and over 800 phonetic radicals [DeFrancis, 1984]) and different degrees of positional, semantic, and phonological regularities for radicals, the orthographic rules in Chinese are quite complicated (Ho, Yau, & Au, 2003).

Unlike alphabetic languages such as English, there is no inflectional system, such as subject-verb agreement and case marking in Chinese (Li & Thompson, 1981). Therefore, instead of morphological transformations in alphabetic languages, morphosyntax, or word compounding is used to show tense, number, and degree. Since there is a lack of inflectional system in Chinese, reading to comprehend Chinese sentences and texts means that the reader must be able to solicit syntactic information from the given linguistic constituents and their semantic relationships (Chao,

1968; Li & Thompson, 1981). Given these specific features of Chinese sentence structures, some Chinese linguists have argued that word order is one of the essential elements for readers to comprehend texts in the language (Chao, 1968; Li & Thompson, 1981; Wang, 1955). Another important skill concerns the use of connectives as it is distinctively extensive in Chinese writings and may thus constitute another important syntactic skill for reading comprehension in Chinese.

Important Cognitive-linguistic Skills for Learning to Read Chinese

Examination of the important cognitive-linguistic skills helps to develop a core reading curriculum in Chinese. Using structural equation modeling, Yeung and her colleagues (in press) reported that orthographic skills, morphological awareness, and rapid naming were significant contributors of Chinese word reading in first graders, but phonological awareness was not. Although phonological awareness was found to be correlated with Chinese word reading in some studies (e.g., Ho & Bryant, 1997), it seems to be a relatively weak contributor to reading among Chinese average and dyslexic learners (e.g., Ho et al., 2004; Yeung et al., in press). This is especially the case for schools in Hong Kong where a look-and-say method, instead of Pinyin, is used for teaching reading. Therefore, phonological awareness is not included in the proposed curriculum. In addition, training of some skills (like rapid naming of numbers and phonological memory) are less directly relevant for reading instruction per se.

Oral Language Skills

The relationship between oral language skills and reading comprehension is captured in the Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990; Tunmer & Hoover, 1992). In this model, reading comprehension is taken as a product of decoding and listening comprehension (or oral language). Despite its widespread acceptance and the empirical support to its hypothesis (Gough & Tunmer, 1986; Hoover & Gough, 1990; Perfetti, 1985; Snowling, 2000; Stanovich, 1991), some researchers doubt if listening comprehension can fully capture the influence of specific language skills, such as vocabulary, on reading comprehension (e.g., Braze, Tabor,

Shankweiler, & Mencl, 2007). Evidence may be drawn from some recent studies, in which oral vocabulary remained a significant predictor of reading comprehension, after controlling for word reading skills (Ouellette, 2006; Ricketts, Nation, & Bishop, 2007), or when the effects of initial word reading, phoneme awareness, and letter knowledge were partialled from the analysis (Muter, Hulme, Snowling, & Stevenson, 2004). The role of oral language skills on reading has been relatively less examined systematically in Chinese. The studies by Liu et al. (2010) and Wang, Cheng, & Chen (2006) were among the very few which examined several oral language skills alongside with other predictors, phonological awareness, verbal memory, and rapid naming. Liu et al. (2010) reported that poor and adequate readers at age 7 differed significantly in their age 2 vocabulary knowledge, age 3 articulation, age 4 receptive grammar and story comprehension. Wang et al. (2006) also showed that oral vocabulary predicted Chinese character recognition in Chinese-English bilingual children in the United States.

Word-level Reading Related Skills

According to Snowling (2005), there are two pathways for reading under the Triangle model of reading (Seidenberg & McClelland, 1989): the phonological pathway mapping orthography to phonology and the semantic pathway linking phonological, semantic, and orthographic units. It was suggested that the development of the phonological pathway (the mapping of letters to sounds) was particularly important at the beginning of reading development in alphabetic languages. As for the semantic pathway, it is particularly important in later stages of development and needed for learning exception words, for which pronunciation cannot be directly derived from simple grapheme-phoneme conversion rules. In opaque orthographies, like Chinese, given the convergence of script-sound-meaning, it is expected that the semantic pathway may be more important than the phonological pathway for Chinese readers. However, the phonological pathway may also be useful for Chinese beginning readers to acquire the pronunciation of new characters through the cue of phonetic radicals.

Morphological awareness. As a demonstration of the significance of the semantic pathway,

morphological awareness has been found to be a strong predictor of learning to read in Chinese in recent years (Ku & Anderson, 2003; Li, Anderson, Nagy, & Zhang, 2002; McBride-Chang et al., 2003; 2005; Shu & Anderson, 1997; Shu, Anderson, & Zhang, 1995; Shu et al., 2006). A series of studies conducted in Mainland China and Hong Kong demonstrated that children's ability to distinguish among meanings of homophones and morpheme construction skills contributed significantly to predicting word reading and reading comprehension in Chinese over and above phonological skills (McBride-Chang et al., 2003; 2005; Shu et al., 2006). Research evidence also showed that performance in morphological awareness distinguished dyslexic children from average readers among Grade 5 and 6 children in Beijing (Shu et al., 2006), and Chinese kindergarten children at risk or not at risk for dyslexia in Hong Kong (McBride-Chang et al., 2008).

Orthographic skills. Because Chinese characters are visually complex and orthographic rules in Chinese are complicated, orthographic skills have been found to be important for learning to read Chinese among normally-achieving children and children with developmental dyslexia. For instance, Ho, Ng, and Ng (2003) have demonstrated that various semantic radical and phonetic radical skills were found to be significantly correlated with Chinese word reading in Chinese elementary school children. Cheung, Chan, and Chong (2007) also reported that ortho-semantic and ortho-phonological knowledge were unique and significant predictors of Chinese character and word reading and reading comprehension after controlling for the effects of age, IQ, and short-term memory in Chinese fourth-graders in Hong Kong. Orthographic deficit, other than rapid naming deficit, was identified as the most dominant cognitive subtype of developmental dyslexia in Chinese in the studies by Ho and colleagues (Ho, Chan, Lee, Tsang, & Luan, 2004; Ho, Chan, Tsang, & Lee, 2002).

Text-level Reading Related Skills

The triangle model extended, recently proposed by Bishop and Snowling (2004), is one of the few models incorporating both single-word processing and processing at the level of sentence or paragraph. On reviewing the evidence on the reading difficulties encountered by children with dyslexia and specific language impairment, Bishop and Snowling (2004) reinstated the importance of

context in language processing. Two major components of context, syntactic skills and discourse skills, were highlighted.

Syntactic skills. As reviewed above, Chinese is usually referred to an impoverished system of grammatical morphology (Li, Bates, & MacWhinney, 1993). Chen and Wong (1991), and Chen, Lau, and Yung (1993) showed that syntactic skills accounted for a substantial amount of variance in Chinese reading among Grade 3 to Grade 5 children in Hong Kong. So and Siegel (1997) showed that their oral cloze task which assessed children's understanding of acceptable word order in the absence of print was a strong predictor of word recognition in Grades 1 to 4. Recent studies also showed that syntactic skills (including word order and connective usage) were significant predictors of reading comprehension among elementary grade students in Mainland China and Hong Kong (Chen & Chen, 2008; Chik et al., in press; Yeung et al., in press). Only syntactic skills were included in the present study with Grades 1 and 2 children as discourse skills is considered to be more relevant for older children than younger ones.

Training of Metalinguistic Skills in Chinese

Although there has been a large number of studies examining the effects of cognitive-linguistic skills on learning to read Chinese as reviewed above, not many studies focus on the formal training of these skills to enhance reading in Chinese. Training studies so far mainly focused on orthographic and morphological training.

Training in orthographic skills generally shows its effectiveness in promoting children's reading performance in Chinese. Studies found that explicit instructions that reminded learners of the radical structures enhanced the memorization of Chinese characters (e.g., Ho, Wong, & Chan, 1999; Taft & Chung, 1999; Wang, Liu, & Perfetti, 2004); learning the functions and regularity of phonological radicals of Chinese characters helped word reading (Ho & Ma, 1999); and explicit teaching of the functions of semantic radicals of Chinese characters also helped learners to extract semantic information from the semantic radical of the given characters (Wang, Liu, & Perfetti, 2004).

Similarly, training in morphological skills was also found to be effective for enhancing children's reading performance through increasing their awareness of the morphosyllabic properties of Chinese characters. For instance, through extensive games and exercises on combining different morphemes to form different Chinese compound words, children were found to be more ready to acquire the print-sound-meaning mappings (Chow, McBride-Chang, Cheung, & Chow, 2008).

In general, training in orthographic and morphological skills was found to enhance children's reading performance. However, the effectiveness of training in other cognitive-linguistic skills in Chinese was rarely examined.

Aims of the Present Study

The present study was a four-year longitudinal project aiming to develop a prevention-focused tiered intervention model in Chinese. The present paper reports the first three years of findings of the Tier 1 intervention. Specifically, the present paper aims to (1) develop an evidence-based core reading curriculum in Chinese; and (2) examine the effectiveness of this curriculum for Chinese readers in the first grade to third grade. As mentioned earlier, there has been accumulating research evidence pointing to the significance of a number of cognitive-linguistic skills in reading Chinese. Yet, few attempts have been made to explicitly help students acquire these skills in a comprehensive and systematic manner. The present study included teaching of a wide range of cognitive-linguistic skills, namely oral language, morphological awareness, orthographic skills, and syntactic skills, which have been proven to be significant in learning to read Chinese.

Method

Participants

Two hundred and twenty-three Grade 1 children were recruited from two ordinary primary schools in Hong Kong. The average age of the participants was 6 years at the beginning of the study. There were 109 boys and 114 girls. One of these two primary schools adopted the Tiered

Intervention Model (Program school) in their first grade to third grade Chinese curriculum. The other school (Control school) did not and used the traditional approach of teaching Chinese language. The traditional approach teaches reading through a set of Chinese passages. Reading-related cognitive skills are not taught explicitly or systematically. Both schools used Cantonese as the medium of instruction for Chinese language lessons. Teachers of both schools were qualified and experienced language teachers. Table 1 shows that participants of the two schools were matched on IQ [$t(221)=-.73, p=.47$]. However, the mean age of the children at the Control school was significantly higher than that of the Program school at three of the five assessment points (all $t_s > 2.39$, all $p_s < .05$) because the former school was often tested about one month later than the latter school. The participants were assessed five times in three academic years. The first three assessments were conducted at the beginning, middle, and end of the school year of Grade 1 (Time 1 to Time 3), the fourth assessment at the end of Grade 2 (Time 4), and the fifth assessment at the end of Grade 3 (Time 5).

Characteristics of the Chinese Tier 1 Curriculum

As mentioned earlier, successful development and implementation of the RtI model in Chinese depends on three critical elements, namely (1) an evidence-based reading program in Chinese, (2) progress monitoring, and (3) teacher training.

Core teaching components. The Tier 1 curriculum aimed at strengthening and consolidating the skills necessary for the development of Chinese reading skills. Adopting a psycholinguistic perspective and skill-based approach of students' literacy learning, the curriculum emphasized oral language as the basis, then proceeded to word-level and text-level skills building. Some reading related cognitive skills which were identified as important to Chinese reading acquisition were included in the curriculum design. A total of four core components of cognitive-linguistic skills were developed and grouped into the three levels of skill building -- oral vocabulary and expression (oral language skill building), morphological skills and orthographic skills (word-level skill building), and syntactic skills (text-level skill building). Instruction of the first term of Grade 1 focused on oral

vocabulary and word-level skill training. From the second term of Grade 1 onward, text-level skill training was added to the curriculum. This matched well with the progressive learning of the students from oral language, to word acquisition, and to sentence and passage comprehension.

More specifically, instruction on oral language skills included building and expanding children's oral vocabularies (including appropriate use of vocabularies, use of synonyms and opposites), and oral expression (including the use of complete sentences and systematic description of events) through vocabulary learning, sentence expansion activities, and guided oral composition with everyday themes or scenarios (e.g., useful vocabularies in a supermarket). Since the children's spoken language, Cantonese, differed greatly from the standard written Chinese both in vocabularies and syntax, oral-written language conversion was explicitly taught. For the instruction on morphological skills, the children were first taught the correspondence between a syllable and a meaning (i.e., a morpheme), and then some syllables with multiple meanings (i.e., homophones) through pictures and sounds of common objects. Later characters with multiple meanings (i.e., homographs), and some simple word compounding rules were introduced. The students were taught how to use the combination of morpheme meaning to understand unfamiliar words and sentences. Instruction on orthographic skills included knowledge about basic Chinese character structures (left-right, top-bottom, and enclosed structures), functions, positions, and regularities of semantic and phonetic radicals. Knowledge of basic character structures helps students identify different components (semantic and phonetic radicals) of a Chinese character and hence enhance their mastery of the radicals' positional and functional regularities. The students were also taught how to make use of the meaning of semantic radicals and sound of phonetic radicals to help word reading, and hence improve sentence understanding. For syntactic skills, the children were taught simple word classes (e.g., nouns, verbs, and adjectives), short phrases (e.g., adjective + noun, and adjective + verb), main components of a sentence, correct word order (e.g., subject-verb-object), and the use of common connectives (e.g., because-therefore, although-but). Students were taught how to use these skills for

reading comprehension (e.g., finding the actor of an event) and writing syntactically correct sentences.

Progress monitoring. Progress was measured through the use of standardized assessments or experimental measures developed for the current study. Comprehensive assessments were administered to each student three times in Grade 1, once in Grade 2 and once in Grade 3. A total of 10 measures, which will be described later, were developed to provide information for assisting the research team and teachers in planning instruction and to monitor student progress.

Additionally, short informal continuous assessment exercises were designed for each learning unit for the purpose of evaluating students' learning in class. These short formative assessment tasks were designed to be conveniently administered, with the assessed goals closely linked to the content being taught in class. Teachers were expected to re-teach the concept in the coming lessons before moving on to something new if the results revealed that most students did not grasp the concept fully.

Teacher professional development. Five Chinese language teachers from the Program school participated in this project. Each teacher received around 8.5 hours of professional training on the teaching components in the first year of this project. Apart from attending these training seminars, Program school teachers also received ongoing support from research team members once every two weeks across the first two intervention years, to discuss the prescribed lesson plans, their observations of the children's progress, the obstacles or progress in conducting the classes, and the timelines of implementation. Teachers of Grade 3 students were expected to integrate the curriculum and their teaching by themselves after two years' implementation experience. Each teacher was also observed once by research team members during the Chinese language class in the first intervention year and by their head teacher in the second and third intervention years. Discussion meetings were held between teachers and research team members immediately after the observation to provide feedback and to support their instructional skills, classroom management, and strategies to motivate students.

Supports on the implementation of the RtI model provided by the research team were evaluated annually. At the end of each academic year, teachers of the Program school were asked to complete an evaluation questionnaire, on which they gave ratings ranging from 1 (strongly disagree) to 5 (strongly agree) on a number of items to indicate to what extent they agreed that the research team were providing adequate and useful supports. The supports included those on curriculum development, monitoring of students' progress, teaching and learning, and administrative and logistic arrangements.

Delivery and duration. The present study's Tier 1 curriculum was designed to enhance and supplement, but not replace the traditional Chinese curriculum. To implement the Tier 1 curriculum in the Program school, 60 to 90 minutes per week were spent on teaching the core skills in Grade 1 and Grade 2 with the activities developed by the research team. The Program School also implemented its own language instruction which was primarily textbook-based and guided by whole-language philosophy. Each student therefore received 3.5 hours of traditional Chinese language instruction enhanced by 1.5 hours of Tier 1 curriculum each week in Grade 1 and Grade 2. The total class time of the Chinese language instruction for the Program school and the Control school were about the same. In other words, to add the Tier 1 teaching components, the Program school had reduced the time on the traditional curriculum. The cognitive-linguistic skills were taught separately and explicitly in the Program school in Grade 1 and Grade 2. These skills were gradually integrated into regular teaching (e.g., orthographic skills were used in learning characters in the passages of the traditional curriculum) and the skills were not taught separately in Grade 3. In other words, there was no separate Tier 1 curriculum per se in Grade 3, but rather a consolidated and integrated curriculum on language instruction.

Lesson plans stating the steps and procedures of conducting the learning activities were provided. Each new concept was explicitly introduced with visual presentation of PowerPoint slides, supplemented with multisensory games or activities, and consolidated with worksheets or exercises. Therefore, the intervention consisted of whole-class explicit teaching, teacher-directed games, and

multi-sensory activities to learn oral, word-, and text-level skills that are important to Chinese reading acquisition.

Measures

To examine the effectiveness of the curriculum, the children from the two schools were assessed by trained research assistants on an intelligence test, eight cognitive-linguistic measures (oral language, morphological awareness, orthographic skills, and syntactic skills), and two reading measures at various assessment times of the study (see Table 2). Measures of syntactic skills and reading comprehension were not included at Time 1 because teaching of such skills only started after Time 2 (i.e., the second term of Grade 1). Apart from the oral vocabulary, morphological construction, and word reading measures, all other measures were administered in group. Each testing session, either individual or group, lasted for about 20 to 60 minutes.

Raven's Standard Progressive Matrices. This is a standardized test for measuring nonverbal intelligence. The test included five sets of 12 items each, that is with a total of 60 items. Each item consisted of a target visual matrix with a missing piece. The children were required to pick, from six to eight alternatives, the best part to complete the target matrix. The short form of the test, made up of the first three sets of the full form, was administered to participants of younger than 8.5 years old in the present study. Scoring procedures were based on the local norm established by the Education Department of The Hong Kong Government (Hong Kong Education Department, 1986).

Oral language

Oral vocabulary. The same oral vocabulary task was administered at Time 1 and Time 2 to measure vocabulary knowledge of the children. The children were presented with a color picture showing a classroom context. They were asked to name the objects and describe the activities as depicted in the picture. The score of this task was the number of nouns, verbs, and adjectives in children's answers that were relevant to the context of the picture. Repeated tokens of the same answer were not awarded any score.

Oral sentence construction. An oral sentence construction task was given at Time 3 and Time 4

to measure the children's ability in oral sentence expression. The children were presented with 5 and 4 two-character words (nouns, verbs, or adjectives) at Time 3 and Time 4 respectively, and were asked to construct orally a sentence with each word. The children's responses to each item were recorded, and scored using a rubric consisting of 4 scoring dimensions: content, sentence structure, vocabulary, and use of rhetoric. A maximum of 9 and 10 points were given to each item at Time 3 and Time 4 respectively.

Morphological awareness

Homophone awareness. Format and procedures of this task were similar to that in McBride-Chang et al.'s (2003) study. In each item of this task, the children heard three two-syllable Chinese words presented to them orally, and the words had an identical syllable at the same position. For example, the words 男廁 [naam4] [tsi3] (meaning male washroom), 男仔 [naam4] [dzai2] (meaning young boy), and 南極 [naam4] [gik9] (meaning south pole), shared the same syllable [naam4], but the syllable in the first two words shared the meaning of male, whereas the syllable in the last word meant south. At Time 1, the children were asked to identify, among three words, the one with the syllable having a different meaning. We later found out that the participants were more used to identifying similar items than identifying the odd one. So at Time 2 and Time 3, the children were asked to identify the two words that had a syllable sharing the same meaning instead. There were 12 items at Time 1 and Time 2, and 15 items at Time 3.

Morphological construction. This task was adapted from McBride-Chang and colleagues' (2003; 2005) studies to measure morphological structure awareness of the children. In each item, an object or a concept was presented orally with a scenario in Cantonese. The children's task was to construct new compound words for the presented objects or concepts based on previously learned morphemes. Each answer was given a score of 0, 1 or 2. For example, "If we called a flower that is big and yellow as big-yellow-flower 大黃花 ([daai6][wong4][faa1]; meaning a big and yellow flower), what should we call a flower that is big and purple?" The correct answer for this item should

be, a big-purple-flower 大紫花 ([daai6] [dzi2] [faa1]; meaning a big and purple flower) and was given a score of 2. An answer that contained all major morphemes but did not conform completely to the morpheme construction rules (e.g., in this case, 紫大花 ([dzi2] [daai6] [faa1]; meaning purple and big flower) was given 1 score. There were 10 items at Time 2 and 12 items at Time 3 and Time 4.

Orthographic skills

Orthographic training in the Tier 1 curriculum included a variety of orthographic skills.

Children found the knowledge of basic Chinese character structures easy to understand and most of the first graders had no difficulty in discriminating different Chinese character structures after several lessons. Measures on orthographic skills, therefore, focused on testing the understanding of the functions, positions, and regularities of semantic and phonetic radicals.

Pseudo-character meaning judgment. This task was adapted from Ho, Ng, et al.'s (2003) study to measure the children's overall awareness of positions, functions, and semantic categories of different Chinese semantic radicals. Each pseudo-character was composed of a semantic radical and a phonetic radical in their legal positions but the combination was not a real Chinese character. Both lexical and nonlexical semantic radicals were used to construct pseudo-characters. In each item, the pseudo-character was placed next to four picture choices. The children were asked to circle the picture that might be semantically related to the meaning of the pseudo-character. There were 15, 15, 16, and 12 items of the task at Time 1 to Time 4 respectively.

Phonological-relatedness judgment. This task was also adapted from Ho, Ng and Ng's (2003) study to measure the children's awareness of the function of phonetic radicals. Pseudo-characters were constructed the same way as in the pseudo-character meaning judgment task. In each item, a target pseudo-character was presented together with three choice characters, from which the children were to select the one that might have the same or similar pronunciation as the target pseudo-character. The three choice characters were: A character sharing the same semantic radical

with the target pseudo-character, a character sharing the same phonetic radical (the correct answer), and a control character. There were 18, 18, and 12 items for the task at Time 2 to Time 4 respectively.

Syntactic skills

Connective usage. This task measured the children's syntactic skills, especially the ability of using connectives at appropriate places of a sentence. There were 6 and 13 items at Time 2 and Time 3 respectively. In each item, the children were asked to insert one to three given connectives to the appropriate places in the given sentence. Four choices of connectives were given in five of the items at Time 3. In each of these items, the children were asked first to select two appropriate connectives and then insert them in the appropriate places in the sentence. All the selected connectives were common ones in Chinese textbooks and exercise books for Grade 1 students.

Word order. This task was used to measure the children's awareness of some basic Chinese sentence structure rules, e.g., subject-verb-object, subject-verb-verb, and special sentence types using 被 ([bei2]; meaning passive voice) or 把 ([baa2]; meaning active voice), etc.. There were 8, 14, and 20 items of this task at Time 2 to Time 4 respectively. The children were asked to arrange three to six sentence fragments to form a syntactically correct sentence.

Reading

Chinese word reading and sentence reading comprehension were selected as the outcome measures of literacy skills as the four-component curriculum focused mainly on reading-related training. Chinese word reading was assessed because being able to recognize individual words is fundamental for all kinds of basic and advance literacy learning. Reading comprehension, i.e., to be able to make meaning of words, is the central and ultimate outcome of the reading process. As young readers start to read from sentences to text, a sentence reading comprehension measure may be suitable to compare the children's comprehension performance from Grade 1 to Grade 3.

Chinese word reading. At Time 1, 60 Chinese two-character words of medium to high frequency were selected based on the Hong Kong Corpus of Primary School Chinese (Leung & Lee, 2002). Thirty of these words were repeatedly used together with the 150 Chinese two-character

words from the Chinese Word Reading Subtest of the Hong Kong Test of Specific Learning Difficulties for Reading and Writing (HKT-SpLD) (Ho, Chan, Tsang, & Lee, 2000) at Time 2. Only the 150 words from the HKT-SpLD were used at Time 3 to Time 5. Each time, the words were arranged in ascending order of difficulty. The children were asked to read the words aloud one by one. The task was discontinued when the child failed to read 15 consecutive words. One score was given if the child read both characters of a two-character word correctly.

Sentence reading comprehension. In this task, the children were asked to choose from four choices the most appropriate word that could complete a sentence with a missing word. The missing words might be nouns, verbs, adjectives, or adverbs. Two practice items were presented before the test items for warm-up. There were 12, 12, 16, and 16 test items at Time 2 to Time 5 respectively.

Results

Table 3 shows the reliability coefficients, the means, and standard deviations of the various measures for the Program school and Control school at the five assessment points. Internal reliability of the measures was generally satisfactory (ranged from .54 to .98).

Effectiveness of the Reading Curriculum

To examine the effectiveness of the Chinese reading curriculum, the children were assessed five times in three academic years. Since there were age differences between children in the two schools at the time of testing, age was included as a covariate in the analyses of group comparisons. All baseline performance (i.e., score of the same task at the previous assessment point) was controlled for when comparing the performance of the two schools in order to examine the training effect. Table 3 shows that at the beginning of Grade 1 First Term (i.e., Time 1), the Control school significantly outperformed the Program school in morphological awareness, orthographic skills, and Chinese word reading (all $F_s > 4.70$, all $p_s < .05$), even with age differences being controlled for. These baseline assessment results showed that children at the Control school appeared to have better reading and

reading-related cognitive skills than those at the Program school before the intervention.

After the children at the Program school received Tier 1 intervention for one term (i.e., at Time 2), Table 3 shows that they slightly caught up with the children at the Control school and even displayed better improvement in morphological awareness, $F(1, 220) = 9.30, p < .01$. The training effect was obvious by the end of Grade 1 (i.e., Time 3). Table 3 shows that the Program school performed significantly better than the Control school in all the measures, except morphological awareness, when age and task performance at Time 2 were controlled for (all F s > 4.21 , all p s $< .05$). The positive intervention effect of the Program school was maintained one year later at the end of Grade 2 (i.e., Time 4) in most measures, except syntactic skills and Chinese word reading, when age and task performance at Time 3 were controlled for (all F s > 4.23 , all p s $< .05$). The effects of the curriculum in some aspects (e.g., morphological awareness and syntactic skills) seemed to be not stable over time. This pattern might be partly due to different training components being implemented at different school terms. For instance, in the Grade 1 instruction, morphological skills were systematically taught in the first term but not in the second term, while syntactic skills were introduced in the second term. This might explain why the training effect on morphological skills was shown at the end of the first term (i.e., Time 2) but not at the end of the second term of Grade 1 (i.e., Time 3). The result pattern was reversed for that of syntactic skills.

Overall speaking, after one to two years' Tier 1 intervention, children in the Program school showed significantly better improvement in all the related cognitive-linguistic and reading skills than those in the Control school. However, progress of the Program school in word reading and sentence reading comprehension was slow down at the end of Grade 3 (i.e., Time 5). We suggest that text-level reading comprehension may be a better indicator of progress at this grade level.

Principal Component Analyses

We would like to validate whether the selected measures did fall into their corresponding proposed cognitive-linguistic domains. Since Time 2 and Time 3 measures covered all the eight measures in the four cognitive-linguistic domains, principal component analyses were conducted on

the Time 2 and Time 3 measures. Table 4 shows the results of principal component analyses with four factors. The measures more or less fell into their corresponding domains: syntactic skills, morphological awareness, orthographic skills, and oral language, with the exception that the Pseudo-character meaning judgment task (a measure of semantic radical knowledge) clustered together with the syntactic measures. There were also considerable loadings of morphological measures on Factor 1. It appears that processing of syntactic skills also involves some semantic skills at the sub-character and morphemic levels.

What Predicts Progress in Reading Comprehension

We further examine whether the selected training components are the core ones for effective reading instruction in Chinese. Since reading comprehension is the ultimate outcome of the reading process while learning word recognition is only an intermediate goal for later reading comprehension, hierarchical regression analyses were conducted with the change in reading comprehension scores in two adjacent time points as the dependent variables. Age and IQ were entered in Step 1 as control variables. In Step 2, change in word-level cognitive scores (i.e., oral language, morphological awareness, and orthographic skills) were entered as predictors in the model. In Step 3, change in syntactic score was entered as the final predictor. Tables 5a and 5b show that in general progress in word-level cognitive skills, namely pseudo-character meaning judgment, homophone awareness, and oral sentence construction, was a significant predictor of progress in reading comprehension of the same assessment periods, whereas progress in syntactic skills (both connective usage and word order) from Time 2 to Time 3 was a significant and unique predictor of progress in reading comprehension one year and two years later even after controlling for age, IQ, and progress in word-level skills. These results suggest that the four cognitive-linguistic skills are significant training components for promoting improvement of reading in Chinese.

Discussion

The aim of the present study was to develop a core curriculum for reading instruction in Chinese that could be used in a tiered intervention model. Multi-component intervention programmes have been rare (Wanzek, Wexler, Vaughn, & Ciullo, 2010), and this study was rather comprehensive in covering the major important cognitive-linguistic components for reading. The present findings of this longitudinal study show that the curriculum was effective for Chinese readers in Grade 1 and the positive effects were maintained one year later in Grade 2. There was still some improvement in word reading and sentence reading comprehension for children in Grade 3 of the Program School but the progress was not greater than that of those in the Control School. We believe that not having intensive and direct support to teachers of the Program School on teaching and curriculum integration in Grade 3 may be a possible factor for the slowing down of improvement. In addition, children in Grade 3 started to read longer text with more complex themes and structures. More advance text level processing skills may be required for children from Grade 3 or Grade 4 onward. From the prediction of progress in reading comprehension, we have identified several core components of reading instruction in Chinese, namely oral language, morphological awareness, orthographic skills, and syntactic skills.

Tier 1 Intervention for Chinese Junior Elementary Students

The traditional way of teaching Chinese in Hong Kong and in Mainland China has been the use of textbook passages. Students learn to recognize new words, vocabularies, sentence structures, passage types, etc. mainly through reading a number of prescribed passages. Particular cognitive-linguistic skills, for example morphological awareness and syntactic skills, are seldom or never taught explicitly and systematically in schools. The present study is a pioneer of its kind to incorporate research-based important cognitive-linguistic skills to regular class teaching of Chinese. Since some of the concepts, e.g., morphological awareness, were relatively new to the Chinese teachers, much teacher training and support was needed to implement the curriculum successfully. Although a formal fidelity study was not conducted, through information collected from class

observation, lesson preparation meetings, review meetings, interview with the head teacher and parents, and completed worksheets and formative assessment exercises of students, the research team believed that the teachers had followed the curriculum closely as prescribed by the research team.

In a review paper, Marston (2005) has indicated that the effectiveness of tiered intervention programmes has been measured in three ways. First, effectiveness is reflected in measures of student growth. For instance, the average gain in words ranged from 30 per term (Tilly, 2003) to 60 (Vaughn, 2003). The second indicator is the contrasts among student performances. Research findings generally show significant differences in student performance between program schools and control schools in each tier. The third indicator is placement outcomes. For instance, Tilly (2003) reported a decrease in special education placement rate from 55% in kindergarten to 19% in Grade 3 in schools with tiered intervention programs.

The present study employed contrasts of student performance as a measure of program effectiveness. Children at the Control school showed better literacy and cognitive-linguistic skills than those at the Program school before the intervention. After receiving the intervention for one academic year, progress of the first graders of the Program school was better than that of the Control school in most word-level and text-level skills. The positive intervention effect of the Program school was maintained one year later in Grade 2. Although we did not have information regarding the placement outcomes of the children in the two schools, we did have information of the proportions of children in the two schools not reaching the local benchmark of Chinese reading test. These figures were indicators of those having reading difficulties that might require intervention. The number of children in the Program school not reaching the benchmark was 13.5% in the mid-year of Grade 1 and this dropped to 9.9% at the end of Grade 2 and to 6.5% at the end of Grade 3. The corresponding figures for the Control school were 14.3%, 11.6%, and 9.8%. With the Tier 1 intervention, 7% less of the children in the Program school might require remedial teaching while it was only 4.5% less in the Control school. To summarize, the Tier 1 intervention is effective for improving literacy and cognitive-linguistic skills of Chinese beginning readers resulting in less number of children who may

require remedial teaching, and the positive effect is persistent.

Questions may be raised regarding the effectiveness of the curriculum, given the modest magnitude of variance accounted for in the regression analyses with cognitive-linguistic change scores predicting reading comprehension change scores reported in Table 5. The result may be partly due to the limited range of change scores between two measurement times that has restricted their predictive power. In fact when using the status scores of the same set of variables (having a wider range of scores), the total variances of the status scores of reading comprehension being accounted for in the regression analyses ranged from 41% to 50%. Of course, another reason for the relatively low predictive power may be that some important factors (e.g., text-level skills, motivation, home support etc.) were not included in the present study.

Recently the effectiveness of RtI for early identification and intervention has been under hot debate (e.g., Gerber, 2005; Kavale, 2005; Wagner, 2008). For instance, Wagner (2008) suggested that the RtI was not a cure for the “wait to fail” problem as children were identified with specific reading problems after months of Tier 2 or Tier 3 intervention. This approach was not earlier than the traditional approach in identifying poor readers. Around 2 to 5 or 6% of students are nonresponsive to the comprehensive quality instruction of the American regular classrooms and remedial groups. Gerber (2005) also suggested that teacher effort and competency may be a factor that affect students’ responsiveness and hence the reliability of identification. However, this is not the case in China. It is still a long road for Chinese educators to develop an effective evidence-based quality reading instruction before the effectiveness of the RtI approach could reliably be tested in the Chinese population. In any case, the development of an effective evidence-based reading curriculum in Chinese is a worthwhile attempt.

We echoed previous suggestions that successful implementation of the RtI model depends on three critical elements. For teacher training, as mentioned above, we have done a lot to train and support teachers at the Program school. Their feedback on annual evaluation questionnaires shows

that we have done a great job to provide them with good teaching materials and give them valuable feedback to improve teaching. The teachers' overall average ratings of 4.2 out of 5 indicated their satisfaction with the programme.

For progress monitoring, we have introduced short informal continuous assessment exercises for each learning unit. These short assessment tasks were designed to be conveniently administered and to give teachers timely feedback on how much students have mastered the concepts. These short assessment exercises were found to be quite effective.

For the third critical element, an evidence-based core reading curriculum, we propose the Chinese reading curriculum to include training of four core cognitive-linguistic skills. Details will be discussed below.

The Core Components for Reading Instruction in Chinese

The present findings have shown that the reading intervention has successfully booster the children's cognitive-linguistic skills and reading performance, and progress in cognitive-linguistic skills also significantly predicted progress in reading comprehension. Based on these findings, we propose that the core reading components in Chinese are oral language, morphological awareness, orthographic skills, and syntactic skills. This list of proposed core components overlaps with the Big Five in English on oral language skills (especially of vocabulary). This suggests that oral language skills are universal fundamental for learning to read any language. The dissimilar core components reflect the different cognitive demands needed for reading in diverse orthographies - phonological training is essential for learning to read English, whereas morphological and orthographic training is significant for reading success in Chinese. It is noted that the significance of word compounding and complicated orthographic rules require good morphological and orthographic skills for word learning in Chinese.

We have also found that syntactic skills are some of the important correlates of text-level processing in Chinese. Chinese syntax is known to be non-inflectional, and there are no clear word boundaries. Sensitivity to word order and connective usage is therefore important. There are also

large discrepancies in the use of vocabularies and word order between spoken Cantonese and written Chinese. Ordinary children may be able to acquire these complicated and elaborate rules of syntax through exposure to language and print. However, struggling readers may require explicit and systematic instruction on syntax in order to enhance their reading comprehension. We therefore propose this to be one of the core components in any Chinese reading curriculum.

The present findings are highly consistent with Yeung et al.'s (in press) proposed model of reading in Chinese. In the model, morphological awareness and orthographic skills are significant predictors of word reading but phonological awareness is not; and orthographic skills (namely semantic radical knowledge) and syntactic skills are significant predictors of sentence reading comprehension. As also reflected in our results of regression analyses, both semantic (morphological awareness and semantic radical knowledge) and syntactic skills are essential for effective reading comprehension in Chinese. The present results of principal component analyses also suggest that syntactic and semantic processing may be intertwined in the process of reading. In fact, morphosyntactic skills have recently been found to be an important predictor of reading comprehension in Chinese (Chik et al., in press). As mentioned earlier, there is no inflectional system, such as subject-verb agreement and case marking in Chinese (Li & Thompson, 1981). Morphosyntax is used to show tense, number, and degree. Readers need to be able to solicit syntactic information from the given linguistic constituents and their semantic relationships within and among sentences in order to understand Chinese texts (Chao, 1968; Li & Thompson, 1981). The role of morphosyntax in Chinese reading comprehension requires further examination in future research. In addition, future research may also include orthographic measures that do not involve any semantic processing.

It is noteworthy that phonological awareness is not included in the present proposed Chinese reading curriculum with the look-and-say teaching method. However, phonological awareness may play an important role for learning to read Chinese characters with the Pinyin system. Future research may look into the effect of phonological training in learning to read Chinese via Pinyin. In

addition, the role of discourse skill, a component skill proposed in the triangle model extended, may also be examined in future research on passage comprehension in older children.

Conclusions

The present findings show that Tier 1 quality intervention is beneficial for Chinese beginning readers and it is effective in enhancing their cognitive-linguistic and literacy skills. The positive effects were maintained at least one year later till the end of Grade 2. Based on the present findings, we propose the core components of reading instruction in Chinese to be oral language, morphological awareness, orthographic skills, and syntactic skills. Comparing the Big Five in English and the core components in Chinese reflects the need for different cognitive demands for reading diverse orthographies.

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