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ORIGINAL RESEARCH

How Chinese Characters Are Taught: An Analysis of Three Popular Textbooks Used in Macao

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Abstract
In language arts programs in the Greater China Region, textbooks are the primary materials used to teach children to read and write. Learning to read and write in Chinese is particularly challenging because elementary grade students are expected to learn, recognize, and write thousands of characters (the basic linguistic unit in Chinese). Recognizing Chinese characters or words made from a combination of characters provides access to word meanings, which in turn leads to comprehension of text. Likewise, production of Chinese characters and words are essential to writing a meaningful message or text for oneself or to share with others. The current study examined three language arts textbook series approved by the Hong Kong Education Bureau which are used by teachers in elementary schools in Macao, focusing on how character recognition and production (i.e., handwriting) are taught. Across the three textbooks, new characters are first presented in text and characters are taught as words along with their spelling in Pinyin. The total number of characters taught during the elementary grades, however, is less than the number commonly recommended. The number of instructional activities in student textbooks for promoting character recognition, handwriting, and the use of these skills in reading and writing, including reading comprehension, varied considerable across the three series as did the number of instructional recommendations provided to teachers for promoting these same outcomes. Recommendations for instruction and future research are provided.

Keywords Word recognition · Handwriting · Reading comprehension · Writing · Instruction · Chinese

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1 Introduction

As the Simple View of Reading (Kendeou et al. 2009) and the Simple View of Writing (Juel 1988) make abundantly clear, comprehending text read is dependent on recognizing words in text (or characters or combinations of characters in a logographic and morpho-syllabic writing system like Chinese), whereas conveying meaning in writing relies on being able to transcribe ideas into printed letters and words (or characters and combination of characters in Chinese). While there is more to reading and writing than is represented in these two theoretical models (see Graham 2018a, b; Graham and Harris 2000; Kim 2020), they capture two fundamental principles of reading and writing. Text comprehension cannot take place if a student is unable to recognize the words (or characters) written, and there is no text to read if an author cannot write letters (or characters). Moreover, reading comprehension is hampered for students who have not mastered word recognition (or character recognition), and text production is limited for students with slow and laborious handwriting (or character production).

When learning to read and write Chinese, which is the focus of the present study conducted in Macao, recognition of traditional Chinese characters is even more central to understanding text than it is in alphabetic languages. Most words in Chinese are compounds of two or more characters, and the meaning of a compound word can usually be determined from the meaning of the characters that form it (Wu et al. 1999).

Chinese characters, however, are not equivalent to English words (Wang and Leland 2011). The basic linguistic unit of Chinese is the character, and each character represents a syllable in spoken language. A character may be a word by itself or a meaning element (morpheme) used to constitute multi-syllabic words (Tse et al. 2007). Pictographs (象形字) and simple ideographs (指事字) are single character words. A pictograph evokes an image of the object it represents, but it is not an exact visual representation of the object. Rather, it is an outline of an object that can be visualized with a little imagination (e.g., 鳥/niǎo [a bird]). A simple ideograph is even less suggestive of the meaning of a character, as in the case of the characters representing the numbers one (a horizontal dash/一, yī), two (two horizontal and parallel dashes/二, èr), and three (three horizontal and parallel dashes/三, sān). Most characters in Chinese involve two or more characters/components. This includes compound ideographic characters (會意字) which collectively signify the meaning of the character (two symbols for "tree/木" means "woods/林") as well as semantic phonetic compound characters (形聲字) which includes sematic and phonetic elements or radicals which provide clues to character meaning and pronunciation, respectively (e.g., 河/hé＝水＋可 [a river]; 江/jiāng＝水＋工 [a big river; a surname]). As many as 80% of characters in Chinese are semantic phonetic compounds.

Chinese characters are arranged in square-shaped forms and include strokes (the smallest graphic form) and components (cluster of strokes that form radicals). When reading, students must decode a character quickly, retrieving orthographic, semantic, and phonological information (Li 2020). Orthographic information gives some indication of the semantic meaning of characters through their resemblance with the objects they represent (pictographs and simple ideographs), the pairing of specific characters (compound ideographs), and the inclusion of semantic radicals (although the information from semantic radicals is not completely reliable; Wang and Leland 2011). A small difference in the position of strokes, number of strokes, and stroke forms can change the meaning of characters (e.g., 大 [big], 天 [day; sky]; 我 [I; me], 找 [to look for; to give change]; Ho and Siegel 2016; Kong 2020). The connection between the orthography of a character and how it is pronounced is

weak because a relatively small number of phonetic radicals accurately guide pronunciation. Context is especially important in reading Chinese, as context is used to determine word boundaries which are not evident (or marked) in written text.

While there has been a historical trend towards simplifying Chinese characters by reducing the number of strokes, presumably making characters easier to learn and produce (Wu et al. 1999), the construction of Chinese characters and words is not an easy task. While individual characters involve strokes, components, and shape, compound characters include horizontal, vertical, and enclosure structures (Wang and Leland 2011). This is further complicated by a large number of homophones (different characters making the same sound, but having different meanings) and polyphones (a character with two or more pronunciations; Kong 2020). The writing of Chinese characters draws on multiple processes, including visual, linguistic, cognitive, perceptual and motor skills (Hsiang and Graham under review).

Modern Chinese includes at least 6400 characters (Zheng 1982), with 3500 of the characters accounting for 99% of the words in popular reading material. Between 2500 and 3000 characters are considered essential to acquiring basic reading and writing skills (Education and Youth Affairs Bureau 2016a, 2016b; Ministry of Education of the People's Republic of China; National Council of Linguistic Literacy 1988). If students cannot recognize or write these characters efficiently, it creates a bottleneck in text comprehension and production (Yeung et al. 2017). Consequently, the complexities of reading and writing in Chinese makes instruction in the recognition and handwriting of characters essential for school-aged children and later literary success (Hsiang and Graham 2016; Hsiang et al. 2018).

1.1 Purpose of the Current Study

The current study examines how Chinese character recognition and handwriting are taught in three different language arts textbook series in Macao. The focus in this study is on traditional Chinese characters and not simplified ones. We also examined how the teaching of these characters is linked to reading and writing, including reading comprehension, in these three textbooks. Textbooks play a central role in teaching literacy in the greater China region (Hsu and Gau 2016; Lam 2008) as well as other countries (Beerwinkle et al. 2020; Corderio et al. 2020). For instance, teachers in grades one to nine in Macao, Beijing, Hong Kong, Shanghai, and Taiwan indicated textbooks were the most important materials for teaching writing in a series of studies conducted by Hsiang and Graham (Hsiang and Graham 2016; Hsiang et al. 2018, 2020).

Choice in which textbooks are used to teach language arts varies in the greater China region (Smart and Jagannathan 2018), with some regions experiencing greater autonomy in textbook selection than others (Hsu and Gau 2016; Lam 2008). In Macao, the focal point of the current investigation, schools are not required to use a specific Chinese language arts textbook (Macao SAR Government 2020a, 2020b; Shan and Vong 2007). Even so, most primary schools in Macao use textbooks approved by the government of the Hong Kong Special Administrative Region (HKSAR). They do so because these textbooks use the same dialect (Cantonese) and written language system (traditional Chinese characters) as Macao, and they apply Hanyu Pinyin, a Romanization alphabetic system for pronouncing and producing Chinese characters (Education Bureau Textbook Committee 2020; Guo 2015; Hsiang 2012) that is also used in Macao.

While Macao language arts teachers enjoy considerable autonomy in teaching literacy, each teacher is required to follow "The Requirements of Basic Academic Attainments" (BAA) issued by the Macau Special Administrative Region (Macao SAR) that stipulates learning objectives, content and materials, learning activities, and assessments (Education and Youth Affairs Bureau 2016a, 2016b). The textbooks teachers use shape literacy instruction (Lam 2008; Smart and Jagannathan 2018), what is assessed on exams (Chen et al. 2020; Hsiang and Graham under review), and whether the learning objectives specified by the BAA are covered. Consequently, it is important to examine Chinese language arts textbooks to determine how character recognition and handwriting are taught, and whether this instruction is directly linked to the process of reading and writing.

2 Research Questions

In the current study, we systematically analyzed three Chinese language arts textbook series approved by the Hong Kong Education Bureau which are popular in Macao schools. Each series covers grades one to six, with four textbooks per grade.

In examining the three textbook series, we first asked: (Q1) How many characters in each textbook receive instruction for recognition and handwriting? It is expected that by the end of grade six, Macao students can recognize 3000 Chinese characters and write 2000 of them correctly according to the learning objectives established by the BAA and the Macao SAR government (Education and Youth Affairs Bureau 2016b). These goals are considered important because recognizing these characters is a basic skill for reading comprehension (Huang et al. 2018; Luo et al. 2016; Wang et al. 2008); handwriting supports character recognition as it consolidates the connection between orthography, meaning, and pronunciation (Chen 2008; Guan et al. 2015; Liu and Liu 2020); handwriting fluency is an essential foundation for writing text (Graham et al. 2008; Yan et al. 2012); and the number of Chinese characters which students can read and write is one indicator of their learning performance (Huang et al. 2018). The required number of characters elementary grades students are expected to learn in Macao, mainland China, and Taiwan differ (see Table 1), but such guidelines are not available in Hong Kong (Curriculum Development Council 2004, 2008; Curriculum Development Institute 2018). Since the language arts textbooks analyzed in the current study were produced in Hong Kong, it was especially important to answer this question.

We further addressed the following two questions about each language arts series: (Q2) Does recognition and handwriting instruction focus on the teaching of characters specifically or the teaching of characters in words? and (Q3) Are characters or characters in words presented in the context of written text? There is debate among literacy scholars about whether recognition and handwriting instruction should be character-centered or word-centered and whether characters should be presented in isolation or context (Huang et al. 2018; Lam 2011; Li 2020; Wang and Leland 2011). The character-centered approach focuses on teaching individual characters and expanding characters into words. For example, after teaching the orthography, meaning, pronunciation, and handwriting of a character, students learn additional words or idioms involving the character (e.g., 歡喜 [joyful; happy] for the character 喜 [happy; pregnant; hobby; liking]) or extend their learning of a character by combining or replacing simple characters/radicals to form new words (日 [sun] + 月 [moon] = 明 [bright; clear]; 月 + 月 = 朋 [friend]). With the word-centered approach, a target word (歡喜 [gift]) is presented in a sentence (收到這個禮物我很歡

Table 1 Required numbers of Chinese characters for recognition and writing in official documents

Location curriculum standards	Mainland China			Macao		Taiwan		
	Grades 1–2	Grades 3–4	Grades 5–6	Grades 1–3	Grades 4–6	Grades 1–2	Grades 3–4	Grades 5–6
Recognition	1600	2500*	3000*	1800	3000*	1000	1800*	2700*
Writing	800	1600*	2500*	1000	2000*	700	1200*	2200*

Adapted from Education and Youth Affairs Bureau (2016b), Ministry of Education, (2018), and Ministry of Education of the People's Republic of China (2012). *The number is accumulated

喜! [I am very happy to receive this gift!]), the sentence is read and the meaning of the word discussed, and students learn how to write the word and use it in text (Lam 2011; Wang and Leland 2011). Some literacy scholars stress the value of the character-centered approach as it offers explicit instruction on the structure and form of each character (Chen 2008; Ho and Siegel 2016; Hung and Huang 2006; Kong 2020; Lu 2000; Wu 2010). Other scholars emphasize the value of the word-centered approach as knowing only the meanings of individual characters does not automatically lead to knowing the correct meaning of a word, and learning Chinese words in context can facilitate learning the correct meaning of a word (Wang and Leland 2011). Still other scholars recommend a hybrid approach (Chiu and Lin 2008; Liu and Liu 2020; Tse et al. 2007; Wang and Leland 2011), where students analyze individual characters inside a word based on morphological and orthographic rules. At present, there is not enough research to recommend one of these approaches over another (Lam 2011; Li 2020).

In addition to teaching the recognition and production of Chinese characters or words, it is not uncommon for Chinese schools in Macao and Hong Kong to teach students a Romanization alphabetic system such as Pinyin for pronouncing characters in Mandarin Chinese and producing Chinese characters. This is done because in many schools Chinese language arts are taught in Cantonese instead of Mandarin Chinese (the pronunciation of a character in Cantonese is different from its pronunciation in Mandarin Chinese; Education and Youth Affairs Bureau 2016b; Ministry of Education of the People's Republic of China 2012). Adding the Pinyin spelling above characters or words can help students read them when Mandarin Chinese is the medium of instruction and Pinyin is taught during language arts classes (or students are encouraged to use Pinyin skills which are learned in a "Putonghua/ Mandarin Chinese" course; Hsiang and Graham under review). There is concern, however, that children may rely on Pinyin so much that they become less proficient at recognizing characters or reading words made of multiple characters (Tse et al. 2007; Wu et al. 1999). As a result, we analyzed the three target textbook series to answer the following question: (Q4) Are Pinyin spellings emphasized when teaching characters or characters in words?

Our final two questions focused on how handwriting is taught in the three textbook series: (Q5) What instructional activities are provided in each textbook to promote recognition, handwriting, and the use of these skills through reading and writing, including reading comprehension? (Q6) What instructional recommendations were provided in teacher manuals for teaching recognition, handwriting, and connecting these skills to reading and writing, including reading comprehension? There are multiple approaches for teaching Chinese characters (Lam 2011; Wu et al. 1999). For character-centered approaches, this includes activities such as teaching Chinese characters together that share similar characteristics (the same semantic radical or phonetic radical), intensive instruction of each character, learning characters before reading them, and separating recognition, and handwriting. In word-centered approaches, teaching activities include teaching characters that are included in text students read, explaining the meaning of characters in context, listening to text read aloud and then tying the spoken word to the corresponding character in written text, and providing students with opportunities to use the target characters through writing or reading them in other contexts. Hybrid approaches combine teaching elements from both character- and word-centered approaches. Given the focus of this special issue on textbooks and reading comprehension, we were especially interested in how recognition and handwriting instruction was connected to reading and writing as new characters were introduced.

3 Method

3.1 Chinese Language Arts Textbook Series

We examined how recognition and handwriting of Chinese characters was taught in three language arts textbook series used by elementary grade teachers in Macao. Each textbook series was published in Hong Kong and approved by the HKSAR government (Education Bureau Textbook Committee 2020). Each series included four books at each grade level (1–6). The series were *Creatively Studying Chinese* (Man et al. 2016), *Happy to Learn Chinese* (So et al. 2006), and *I Love Learning Chinese* (Yu and So 2011). The 72 textbooks (24 textbooks in each series) were based on the requirements set forth in the Chinese Language Curriculum Guide issued by the Hong Kong Education Bureau (Curriculum Development Council 2004, 2008). All of these textbook series were used in Macao during the 2019/2020 and 2020/2021 school years.

3.2 Procedures

To answer our first four questions concerning the number of characters taught (Q1), whether instruction was character- or word-centered (Q2), whether characters or characters in words were presented in the context of written text (Q3), and whether Pinyin spellings were written above Chinese characters or words in student textbooks (Q4), we examined all 24 textbooks in each series. For each language arts series, we first listed all Chinese characters presented at each grade (all four books at that grade) according to the original form by which they were introduced (i.e., character or character within-words). We also recorded if a character, whether individually or as part of a word, focused on recognition only or handwriting (all handwriting items included both recognition and production of the character or word). In *I Love Learning Chinese* (Yu and So 2011), characters in some grade five and six student textbooks were labeled as important vocabulary. Since they emphasized both recognition and handwriting, they were coded as handwriting.

For all 72 student textbooks in the three language arts series, we coded the number of *new and unique* Chinese characters and words used to introduce them at each grade by recognition only and handwriting. These characters and words were not presented at an earlier grade. If they were presented more than once in a grade, they were only counted once. These characters and words could be introduced in subsequent grades but they were not counted at that point. To obtain an accurate count of new and unique characters, we counted the number of characters in multisyllabic words used to introduce them. For example, 書包 (shūbāo, schoolbag) is a disyllabic word consisting of two characters: 書 (shū, book) and 包 (bāo, to wrap/bundle/package). We also did not count the following repetitions of a character at a specific grade: (1) characters already coded as recognition only but presented later in the same/different grade; (2) characters already coded handwriting but presented later in the same/different grade; (3) characters already coded as handwriting but presented later in the same/different grade as a recognition only task; (4) reduplications of the same character in a word (e.g., 媽媽 [mother], 笑咪咪 [with a big, full smile], and馬馬虎虎 [just so so; careless]); and (5) polyphones such as 好 (hǎo, good) and 嗜好 (hào, hobby). Polyphones are characters with more than one pronunciation (usually differing in tone).

We further coded the number of *new and repeated* Chinese characters and words used to introduce characters at each grade by recognition only and handwriting. New and repeated Chinese characters and words included any time during the grade where new and unique characters were introduced again and the Chinese word used to introduce a character was reused for this purpose, respectively. This allowed us to determine if the recognition of a character (or word) for recognition only and handwriting was subsequently reinforced at that grade level.

By adding together the number of recognition only and handwriting new and unique characters at each grade, we obtained a count of the total number of new and unique characters taught at that grade. There was no overlap between these two categories. If a character was taught for handwriting, it was not counted in the recognition only category (even though instruction in its recognition was provided). These same principles applied for total number of new and repeated characters, new and unique words, and new and repeated words.

To answer the remaining research questions, we randomly selected one student textbook and teacher manual (that accompanied the student textbook) at each grade level from each language arts series. Consequently, we analyzed six student textbooks and corresponding teachers' manuals in each language arts series to determine (Q5) what instructional activities in students' textbooks were used to teach recognition, handwriting, and connect these skills to reading and writing, including reading comprehension, as well as (Q6) what instructional recommendations were provided in teacher manuals for teaching recognition, handwriting, and connecting these skills to reading and writing, including reading comprehension. For these analyses, we looked at lessons where new characters or words were taught in the student textbook at that grade. This included any instructional activities listed after the presentation of new characters/words in student textbooks or instructional recommendations listed after the presentation of new characters/words in teacher manuals that were part of the same lesson and occurred when recognition or handwriting were taught or followed such instruction as part of the lesson.

When analyzing the activities used to teach recognition and handwriting as well as a lessons subsequent activities in students' textbooks, we applied an inductive approach. We listed all of the activities identified and created categories that captured the basic intent of these activities. We applied the same approach for coding instructional recommendations provided in the corresponding teacher manual. For the teacher manuals, we calculated the number of unique recommendations for each learning activity in a lesson. If a reminder/suggestion was offered more than once in a learning activity it was scored as a single instance.

For learning activities, we devised 44 categories, accounting for 93% of the learning activities coded across the three language arts series. The other 7% were coded as "other". The 44 categories were character recognition (stroke forms or radicals), character recognition (structure), character recognition (simple/non-composite), character recognition (compound/composite), character recognition (polyphonic), word recognition, sentence reading (grammar), sentence reading (rhetorical devices), text reading comprehension, another short text reading, extra reading (online/printed), punctuation marks recognition, using (handwrite) punctuation marks, using reading strategies, character handwriting (stroke forms or radicals), character handwriting (compound/composite character), write down the answers in characters, look at pictures then write the words, write down the answers in words, sentence handwriting, text writing, making sentences orally, speaking/discussion, reading aloud, listening and responding, acting and responding, using a dictionary, knowledge (stroke forms/sequence/structure), knowledge (radicals), knowledge (simple/

compound characters), knowledge (grammar), knowledge (rhetorical devices), knowledge (punctuation marks), knowledge (types of writing/text structure), knowledge (classical novels/authors), knowledge (how to speak), knowledge (reading strategies), knowledge (writing strategies), knowledge (rhetorical devices), knowledge (punctuation marks), knowledge (handwriting position), pinyin (recognize and spell), using (handwrite) punctuation marks, and other.

For the instructional recommendations in the teacher manuals, we devised 36 categories, accounting for 94% of the instructional recommendations coded across the three language arts series. The other 6% were coded as "other". The 36 categories included use life experience, teach a group of characters, distinguish the types of character structure, compose word(s), explain the meanings of words; use flash cards, read aloud words, silent reading of words, analyze sematic relationships, give further examples, comparing, use learnt words to make sentences orally, expend sentence, use learnt sentence structures/figure of speeches to make sentences orally, demonstrate handwriting, demonstrate handwriting position, emphasize neatness of handwriting, have students demonstrate handwriting, group learning, games, role playing, have students learning by associating (e.g., 八 [eight] is fathers' mustache; stroke sequence is the sequence which you cut a cake), offer additional vocabulary, have students form an image, use reading aloud strategies, use reading strategies, demonstrate reading, have students consult dictionaries, invite more student participation, use knowledge of grammar, use writing strategies, have students analyze words, have student write, offer extra reading materials, give a commendation, and other.

3.3 Reliability of Coding

For the 72 student textbook, two coders recorded the number of characters taught for recognition only and handwriting at each grade in the three language arts series, including if they were: new characters, unique or repeated characters at that grade, and introduced as characters or characters in words. Reliability between coders was calculated as number of agreements divided by the number of agreements plus disagreements multiplied by 100%. Reliability was collectively 99% for these scoring procedures.

One coder scored each of the 18 randomly selected student textbooks and accompanying teacher manual that were scored for the types of procedures used to teach Chinese characters (including activities where students applied the character in reading, writing, or other activities). A second coder scored one third of these student textbooks and teacher manuals (randomly selected). For learning activities in student textbooks, reliability was 90%. Reliability for instructional activities recommended in teacher manuals was 86%.

4 Results

4.1 Number of Characters Taught (Q1) and Word-Centered Instruction (Q2)

After collating the new Chinese characters taught in student textbooks at each grade level in the three language arts series, it was evident that the presentation of characters was word-centered. This was the case for recognition only and handwriting for all three series. Some individual Chinese characters were presented for learning as single entities, but these characters were actually single-morpheme words. These single character words were mostly presented in the primary grades (1–3), and commonly represented pronouns,

Table 2 The number of new and unique characters introduced by grade for recognition and handwriting in textbook series

Version	Creatively studying Chinese			Happy to learn Chinese			I love learning Chinese		
Grade	R	HW	Total	R	HW	Total	R	HW	Total
Grade 1	176	179	355	480	275	755	432	310	742
Grade 2	199	199	398	231	217	448	185	366	551
Grade 3	148	180	328	312	183	495	208	340	548
Grade 4	153	176	329	191	257	448	105	219	324
Grade 5	128	159	287	172	171	343	0	182	182
Grade 6	123	147	270	148	143	291	78	164	242
Grades 1–3	523	558	1081	1023	675	1698	825	1016	1841
Grades 4–6	404	482	886	511	571	1082	183	565	748
Total	927	1040	1967	1534	1246	2780	1008	1581	2589

R is the number of new and unique characters introduced for recognition only; *HW* is the number of new and unique characters introduced for handwriting*; Total* is the total number of new and unique characters introduced for recognition only and handwriting (this represents all new and unique characters introduced in a specific grade)

nouns, verbs, and adjectives. To illustrate, in *Creatively Studying Chinese,* the first lesson in the first textbook in grade one introduces the following single character words 我 (wǒ; I/me; a monosyllabic pronoun), 書 (shū; book; a monosyllabic noun), 好 (hǎo; good; a monosyllabic adjective), 背 (bēi; to carry on the back; a monosyllabic verb), 新 (xīn; new; a monosyllabic adjective), 放 (fàng; to put; a monosyllabic verb), and 叫 (jiao; to call; a monosyllabic verb).

Table 2 presents the number of new and unique Chinese characters introduced at each grade, grades one to three, grades four to six, and all grades combined for recognition only, handwriting, and recognition plus handwriting (total new and unique characters) for the three language arts series. The fewest number of new and unique characters were introduced in the *Creatively Studying Chinese* (1967 total; 927 recognition only; 1040 handwriting). The number of new and unique characters introduced in *Happy to Learn Chinese* (2780 total; 1534 recognition only; 1246 handwriting) and *I Love Learning Chinese* (2589 total; 1008 recognition only; 1581 handwriting) were relatively equivalent, except the former language arts series placed greater emphasis on teaching characters for recognition only and the latter focused more on teaching characters for handwriting. *Creatively Studying Chinese* placed almost equal emphasis on teaching characters for recognition only (523) and handwriting (558) in grades one to three, whereas *Happy to Learn Chinese* placed more emphasis on teaching characters for recognition only (1023 recognition only; 675 handwriting) and *I Love Learning Chinese* placed more emphasis on teaching characters for handwriting (825 recognition only; 1016 handwriting). In grades four to six however, *Creatively Studying Chinese* placed slightly more emphasis on teaching characters for handwriting (482) than recognition only (404), as did *Happy to Learn Chinese* (571 handwriting; 511 recognition only). At these grades, *I Love Learning Chinese* moved almost exclusively to teaching characters for handwriting (565 handwriting; 183 recognition only), with no new and unique characters for recognition presented in grade five and only 78 in grade six.

Table 3 The number of new and repeated characters introduced by grade for recognition and handwriting in textbook series

Version	Creatively studying Chinese			Happy to learn Chinese			I love learning Chinese		
Grade	R	HW	Total	R	HW	Total	R	HW	Total
Grade 1	225	212	437	774	354	1128	615	393	1008
Grade 2	298	285	583	531	306	837	389	650	1039
Grade 3	331	321	652	675	324	999	495	786	1281
Grade 4	330	359	689	567	481	1048	242	651	893
Grade 5	368	337	705	514	362	876	0	518	518
Grade 6	348	335	683	600	349	949	225	451	676
Grades 1–3	854	818	1672	1980	984	2964	1499	1829	3328
Grades 4–6	1046	1031	2077	1681	1192	2873	467	1620	2087
Total	1900	1849	3749	3661	2176	5837	1966	3449	5415

R is the number of new and repeated characters introduced for recognition only; *HW* is the number of new and repeated characters introduced for handwriting; *Total* is the total number of new and repeated characters introduced for recognition only and handwriting (this represents all new and repeated characters introduced in a specific grade)

We next examined the number of new and repeated Chinese characters introduced at each grade, grades one to three, grades four to six, and all grades combined (see Table 3). This included any introduction, including repeated presentations of a new character for recognition only, handwriting, and both together. Each new character was presented approximately twice in the grade level it was introduced in each of the three series: *Creatively Studying Chinese* (3749 total new and repeated characters in Table 3 vs. 1967 new and unique characters in Table 2), *Happy to Learn Chinese* (5837 total new and repeated characters in Table 3 vs. 2780 new and unique characters in Table 2), and *I Love Learning*

Table 4 The number of new and unique Chinese words for recognition and handwriting in textbook series

Version	Creatively studying Chinese			Happy to learn Chinese			I love learning Chinese		
Grade	R	HW	Total	R	HW	Total	R	HW	Total
Grade 1	133	141	274	410	241	651	386	279	665
Grade 2	167	165	332	273	170	443	205	364	569
Grade 3	163	166	330	316	155	471	250	392	642
Grade 4	171	172	343	272	220	492	115	302	417
Grade 5	187	159	346	212	153	365	0	208	208
Grade 6	179	147	326	247	151	398	100	200	300
Grades 1–3	463	472	935	999	566	1565	841	1035	1876
Grades 4–6	537	478	1015	731	524	1255	215	710	925
Total	1000	950	1950	1730	1090	2820	1056	1745	2801

R is the number of new and unique words used to present characters for recognition only; *HW* is the number of new and unique words used to present characters for handwriting; *Total* is the total number of new and unique words used to present characters for recognition only and handwriting (this represents all new and unique words used to introduce characters in a specific grade)

Chinese (5415 total new and repeated characters in Table 3 vs. 2589 new and unique characters in Table 2). The same general pattern of similarities and differences described above for the teaching of new and unique Chinese characters for recognition only, handwriting, and both by grades one to three, grades four to six, and all grades were also evident for number of new and repeated Chinese characters.

Because the presentation of Chinese characters in the three language arts series was word-centered, we further examined the number of new and unique Chinese words at a grade used to present Chinese characters for recognition only, handwriting, and both by grade, grades one to three, grades four to six, and all grades (see Table 4). Across all grades, *Creatively Studying Chinese* used the fewest new and unique words to present characters for recognition only (1000), handwriting (950) and both together (1950). The total number of new and unique Chinese words used to present characters (recognition only plus handwriting) across all grades was relatively similar for *Happy to Learn Chinese* (2820) and *I Love Learning Chinese* (2801), but *Happy to Learn Chinese* used more new and unique words to present recognition of characters (674) than *I Love Learning Chinese* and *I Love Learning Chinese* used 655 more new and unique words to present characters for handwriting. When we examined the number of new and repeated Chinese words used to introduce Chinese characters for recognition only, handwriting, and both (see Table 5), there was little difference from the statistics reported for new and unique Chinese words, as these series rarely used the same Chinese word twice during a grade/or in different grades to introduce a character. With *Creatively Studying Chinese* only one word was repeated for this purpose; *Happy to Learn Chinese* used 58 words twice, and *I Love Learning Chinese* used 32 words twice. How the three series used Chinese words to introduce new characters (see Tables 4 and 5) mirrored the patterns described above for the introduction of new and unique characters (see Table 2).

Table 5 The number of new and repeated Chinese words for recognition only and handwriting in textbook series

Version	Creatively studying Chinese			Happy to learn Chinese			I love learning Chinese		
Grade	R	HW	Total	R	HW	Total	R	HW	Total
Grade 1	133	141	274	413	244	657	389	279	668
Grade 2	167	165	332	273	171	444	207	365	572
Grade 3	164	166	330	317	155	472	250	393	643
Grade 4	171	172	343	274	222	496	115	316	431
Grade 5	187	159	346	227	160	387	0	209	209
Grade 6	179	147	326	267	155	422	101	209	310
Grades 1–3	464	472	936	1003	570	1573	846	1037	1883
Grades 4–6	537	478	1015	768	537	1305	216	734	950
Total	1001	950	1951	1771	1107	2878	1062	1771	2833

R is the number of new and repeated words used to present characters for recognition only; *HW* is the number of new and repeated words used to present characters for handwriting; *Total* is the total number of new and repeated words used to present characters for recognition only and handwriting (this represents all new and repeated words used to introduce characters in a specific grade)

4.2 Introducing Chinese Character in Context (Q3)

In all three language arts series, new Chinese characters and the words used to introduce them were presented in context (i.e., written text). To draw more specific attention to the characters to be taught in a specific lesson, new characters were listed under the text to be read as recognition only, handwriting, or both. In some lessons in grades 1 to 3 textbooks in each series, characters to be learned shared common structural elements (orthographic, phonological, or semantic). To illustrate, in *I Love Learning Chinese*, among the sixteen lessons in the third textbook in grade one, twelve lessons are taught through text reading comprehension, while 6 lessons were designed for students to learn a group of characters (i.e., to learn the characters which have the same radicals such as 手/扌 [hand], 足 [foot], 鳥 [bird], 草/艸 [grass], 口 [mouth], and 木 [tree; wood]) from the text. This did not mean, however, that the material students read in student textbooks in all three language arts series always focused on introducing one or more new characters. Only 40% of the text included in *Creatively Studying Chinese* was connected to recognition only or handwriting instruction. In contrast 100% of texts in *I Love Learning Chinese* and 94% of text in *Happy to Learn Chinese* supported these purposes.

4.3 Pairing Pinyin Spelling with Chinese Characters (Q4)

In all three language arts series, Pinyin was taught to support the learning of Chinese characters and words. As a result, Pinyin spellings were presented above all new characters, words used to introduce these characters, and text that included these words in the student textbooks. The only exception to this involved in *Happy to Learn Chinese* grade six where the Pinyin spelling was only provided above some characters or paragraphs (including new characters) in text. In the other two series, Pinyin spellings were presented above each character in each text at all grades.

4.4 Instructional Activities in Student Textbooks (Q5)

The number and types of instructional activities included in each of the six student textbooks books (one for each grade) for the three language arts series analyzed are presented in Tables 6, 7 and 8. This included the instructional activities used to teach character/word recognition and handwriting as well as other activities in a lesson following such instruction. An obvious distinction between the three series involved the number of instructional activities included in each series: 356 instructional activities in *Creatively Studying Chinese*, 584 in *Happy to Learn Chinese*, and 713 in *I Love Learning Chinese*.

There were also differences in the distribution of activities used to promote recognition only and handwriting. For *Creatively Studying Chinese*, activities to promote recognition (26% of all activities; see A1, A2, A13, A16, and 7 instructional activities from "other"; Table 6) were 3.25 times more common than activities to promote handwriting (8% of all activities; see A9, A10, A15, and 12 instructional activities from "other"; Table 6). With *Happy to Learn Chinese*, recognition instructional activities (20% of all activities; see A1, A2, A3, A4, A21, A23, and 12 instructional activities from "other"; Table 7) and handwriting instructional activities occurred with almost equal frequency (21% of all activities; see A11, A12, A13, A14, A21, A22, A30, and 8 instructional activities from "other"; Table 7). Instructional activities listed for A21 (recognition and spelling of Pinyin) were counted as

Table 6 Learning activities in creatively studying Chinese

Grade	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	Others	Total
1	11	1	10	9	0	6	0	3	2	4	2	0	1	6	4	0	9	0	2	6	76
2	8	6	1	9	2	6	2	0	3	0	4	0	1	7	4	4	4	3	1	10	75
3	14	0	2	12	1	6	4	1	0	0	3	2	1	7	0	0	6	1	1	9	70
4	8	0	2	10	0	4	0	0	0	0	5	2	1	3	0	0	3	0	1	0	39
5	6	0	4	9	0	4	2	0	0	0	7	2	1	3	0	0	5	0	1	1	45
6	8	0	3	10	3	5	3	0	0	1	7	1	0	2	0	0	5	2	0	1	51
Total	55	7	22	59	6	31	11	4	5	5	28	7	5	28	8	4	32	6	6	27	356

A1 character recognition (stroke forms or radicals); *A2* character recognition (structure); *A3* word recognition; *A4* sentence reading (grammar); *A5* sentence reading (rhetorical devices); *A6* text reading Comprehension; *A7* another short text reading; *A8* punctuation marks recognition; *A9* character handwriting (stroke forms); *A10* look at pictures then write the words; *A11* write down the answers in words; *A12* sentence handwriting; *A13* using (handwrite) Punctuation marks; *A14* making sentences orally; *A15* knowledge (stroke forms/sequence/structure); *A16* knowledge (simple & compound characters); *A17* knowledge (grammar); *A18* knowledge (rhetorical devices); *A19* knowledge (punctuation marks); *Others* character recognition (stroke sequence), character recognition (simple/non-composite), character recognition (compound/composite), character handwriting (stroke sequence), character handwriting (structure), character handwriting (simple/non-composite character), character handwriting (compound/composite character), write down the answers in characters, listening and responding, acting and responding, knowledge (radicals), knowledge (calligraphy), calligraphy (grip), calligraphy (strokes), calligraphy (how to maintain the pen), knowledge (how to consult a dictionary), knowledge (type of writing), knowledge (classical novels)

Table 7 Learning activities in happy to learn Chinese

Grade	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31	Others	Total
1	2	0	0	21	15	0	12	7	1	0	3	1	5	0	0	5	5	1	5	1	0	4	0	6	0	1	4	0	2	0	0	8	109
2	3	0	2	7	7	0	12	6	1	4	0	0	3	1	0	1	4	1	1	1	8	0	3	4	0	1	0	4	2	4	0	6	86
3	2	2	5	6	7	7	14	5	0	0	1	2	9	3	1	4	2	1	2	1	7	1	1	4	6	0	0	5	2	0	0	5	105
4	2	2	2	5	4	2	10	2	2	5	0	2	10	3	1	1	2	2	0	1	1	0	0	7	3	2	0	10	3	3	1	2	90
5	1	1	1	2	7	6	19	2	2	6	0	1	8	5	2	1	4	5	2	1	5	0	0	2	2	1	0	7	0	1	2	2	98
6	0	2	0	6	7	6	15	2	0	2	0	0	13	3	1	0	1	7	3	1	5	0	0	4	4	0	0	2	1	1	4	6	96
Total	10	7	10	47	47	21	82	24	6	17	4	6	48	15	5	12	18	17	13	6	26	5	4	27	15	5	4	28	10	9	7	29	584

A1 character recognition (stroke forms or radicals); *A2* character recognition (polyphonic); *A3* character recognition (compound/composite); *A4* word recognition; *A5* sentence reading (grammar); *A6* sentence reading (rhetorical devices); *A7* text reading comprehension; *A8* another short text reading; *A9* punctuation marks recognition; *A10* using reading strategies; *A11* character handwriting (stroke forms or radicals); *A12* character handwriting (compound/composite character); *A13* write down the answers in words; *A14* sentence handwriting; *A15* text writing; *A16* making sentences orally; *A17* speaking/discussion; *A18* reading aloud; *A19* listening and responding; *A20* acting and responding; *A21* pinyin (recognize & spell); *A22* knowledge (stroke forms/sequence/structure); *A23* knowledge (radicals); *A24* knowledge (grammar); *A25* knowledge (rhetorical devices); *A26* knowledge (punctuation marks); *A27* knowledge (handwriting position); *A28* knowledge (types of writing/text structure); *A29* knowledge (how to speak); *A30* knowledge (reading strategies); *A31* knowledge (writing strategies); *Others* character recognition (stroke sequence), character recognition (structure), character recognition (simple/non-composite), extra reading (online/printed), character handwriting (stroke sequence), character handwriting (simple/non-composite character), write down the answers in characters, paragraph writing, copy and memorize, using (handwrite) punctuation marks, pinyin (handwriting), pinyin (write its character), knowledge (simple/compound characters & six methods), knowledge (dictionary), knowledge (Chinese culture), knowledge (pinyin)

Table 8 Learning activities in i love learning Chinese

Grade	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31	A32	A33	Others	Total
1	5	5	3	4	8	7	4	12	3	0	3	1	6	6	3	1	3	5	3	2	2	0	5	5	4	8	4	3	1	0	0	0	0	4	120
2	5	2	1	5	7	13	2	9	0	0	3	2	3	12	1	1	3	3	2	0	2	2	3	6	3	9	1	3	1	0	2	3	0	4	113
3	2	0	0	2	6	11	3	20	0	1	2	2	1	17	4	0	8	5	0	0	0	0	0	2	0	15	2	3	9	0	2	2	0	2	121
4	3	0	0	1	9	10	9	15	1	2	0	4	2	15	11	1	4	4	5	1	1	2	1	0	0	10	9	0	7	1	3	4	2	1	138
5	1	0	0	0	9	16	1	14	2	1	2	0	1	24	4	0	4	5	1	1	4	1	1	0	0	11	3	3	4	3	5	0	6	1	128
6	0	0	0	0	5	7	6	13	1	0	0	1	0	16	3	2	0	6	1	0	0	0	0	0	0	4	5	0	7	3	2	0	10	1	93
Total	16	7	4	12	44	64	25	83	7	4	10	10	13	90	26	5	22	28	12	4	9	5	10	13	7	57	24	12	29	7	14	9	18	13	713

A1 character recognition (stroke forms or radicals); *A2* character recognition (structure); *A3* character recognition (simple/non-composite); *A4* character recognition (compound/composite); *A5* word recognition; *A6* sentence reading (grammar); *A7* sentence reading (rhetorical devices); *A8* text reading comprehension; *A9* another short text reading; *A10* extra reading (online/printed); *A11* punctuation marks recognition; *A12* using reading strategies; *A13* write down the answers in characters; *A14* write down the answers in words; *A15* sentence handwriting; *A16* text writing; *A17* making sentences orally; *A18* speaking/discussion; *A19* reading aloud; *A20* listening and responding; *A21* acting and responding; *A22* using a dictionary; *A23* knowledge (stroke forms/sequence/structure); *A24* knowledge (radicals); *A25* knowledge (simple/compound characters & six methods); *A26* knowledge (grammar); *A27* knowledge (rhetorical devices); *A28* knowledge (punctuation marks); *A29* knowledge (types of writing/text structure); *A30* knowledge (classical novels/authors); *A31* knowledge (how to speak); *A32* knowledge (reading strategies); *A33* knowledge (writing strategies); *Others* character recognition (stroke sequence), character recognition (polyphonic), character handwriting (stroke forms or radicals), character handwriting (structure), character handwriting (compound/composite character), paragraph writing, using writing strategies, using (handwrite) punctuation marks, knowledge (dictionary), knowledge (Chinese culture)

both recognition and handwriting for this series. For *I Love Learning Chinese*, there was an equal number of instructional activities for recognition only (16% of all activities; see A1, A2, A3, A4, A5, A22, A24 and 3 instructional activities from "other"; Table 8) and handwriting (16% of all activities; see A13, A14, A23 and 3 instructional activities from "other"; Table 7).

In all three language arts series, students were provided with opportunities to apply the recognition skills taught in the context of reading. In *Creatively Studying Chinese*, *Happy to Learn Chinese*, and *I Love Learning Chinese*, 29% (A4, A7, and A17; Table 6), 20% (A5, A8, A18, A24, and 1 instructional activities from "other"; Table 7), and 26% (A6, A9, A10, and A19; Table 8) of all instructional activities provided students with opportunities to read the Chinese characters and words taught, respectively. In addition, word meanings/reading comprehension was emphasized in another 12% (A5, A6, and A18; Table 6), 23% (A6, A7, A10, A25, and A30 "other"; Table 7), and 22% (A7, A8, A12, A29, and A 32; Table 8) of instructional activities in the same series respectively. Consequently, 41% of instructional activities in *Creatively Studying Chinese* provided opportunities to apply recognition skills while reading; 40% in *Happy to Learn Chinese*, and 48% in *I Love Learning Chinese*.

All three language arts series provided students with fewer opportunities to apply handwriting skills taught than they did recognition skills. In *Creatively Studying Chinese*, *Happy to Learn Chinese*, and *I Love Learning Chinese*, 12% (A11, A12, A13, and 1 additional activity from "other'; Table 6), 7% (A15, A28, A31, and 2 additional activities from "other"; Table 7), and 7% (A15, A16, A18, and 2 additional activities from "other"; Table 8) of all instructional activities involved writing, respectively.

Table 10 Instruction recommendations in teacher manuals: happy to learn Chinese

Grade	A1	A2	A3	A4	A5	A6	A7	Others	Total
1	4	4	3	10	4	6	0	16	47
2	2	1	1	1	5	1	8	9	28
3	0	0	0	2	1	1	0	10	14
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	1	0	0	0	0	1
Total	6	5	4	14	10	8	8	35	90

A1 compose word(s); *A2* explain the meanings of words; *A3* use flash cards; *A4* read aloud; *A5* use learnt words to make sentences orally; *A6* games; *A7* use reading strategies; *Others* use life experience, teach character orthography through character etymology, teach a group of characters, silent reading, analyze the sematic relationships, give further examples, comparing, offer vocabulary, expend sentence, use learnt sentence structures/figure of speeches to make sentences orally, demonstrate handwriting, have students demonstrate handwriting, use handwriting learning strategies, group learning, role play, have students associate, have students image, use reading aloud strategies, demonstrate reading, demonstrate consulting dictionaries, have students analyze, have students write

Table 11 Instruction recommendations in teacher manuals: I love learning Chinese

Grade	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31	A32	Others	Total
1	4	6	4	2	6	4	29	0	2	18	10	1	2	7	12	2	34	6	2	5	4	7	3	2	0	15	3	13	2	21	0	0	2	228
2	3	4	1	2	4	0	15	9	1	13	5	3	0	4	2	7	49	3	3	0	3	3	7	4	7	10	2	10	6	17	0	0	5	202
3	0	3	0	3	0	0	14	9	0	8	3	1	1	4	1	0	44	2	0	0	1	2	19	0	0	25	0	5	10	29	0	0	0	184
4	2	0	0	1	5	0	12	1	3	6	8	3	1	3	0	0	37	5	0	0	2	4	15	0	2	17	2	6	10	17	3	2	1	168
5	1	0	0	1	1	0	5	10	2	0	3	2	0	1	0	0	33	2	2	0	1	3	18	0	2	8	2	11	13	22	2	12	1	158
6	1	0	0	1	2	0	2	2	2	6	1	0	0	1	0	0	23	1	2	1	2	3	5	1	0	1	4	10	12	12	2	10	0	107
Total	11	13	5	10	18	4	77	31	10	51	30	10	4	20	15	9	220	19	9	6	13	22	67	7	11	76	13	55	53	118	7	24	9	1047

A1 use life experience; *A2* teach a group of characters; *A3* distinguish the types of character structure; *A4* compose word(s); *A5* explain the meanings of words; *A6* use flash cards; *A7* read aloud; *A8* silent reading; *A9* analyze the sematic relationships; *A10* give further examples; *A11* comparing; *A12* use learnt words to make sentences orally; *A13* expend sentence; *A14* use learnt sentence structures/figure of speeches to make sentences orally; *A15* demonstrate handwriting; *A16* have students demonstrate handwriting; *A17* group learning; *A18* games; *A19* role play; *A20* have students associate; *A21* have students image; *A22* use reading aloud strategies; *A23* use reading strategies; *A24* demonstrate reading; *A25* have students consult dictionaries; *A26* invite more students; *A27* use grammar knowledge; *A28* use writing strategies; *A29* have students analyze; *A30* have student write; *A31* offer extra reading materials; *A32* give a commendation; *Others* teach character orthography through character etymology, replacing radicals, offer vocabulary, demonstrate consulting dictionaries

Table 9 Instructional recommendations in teacher manual: creatively studying Chinese

Grade	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	Others	Total
1	3	0	6	1	2	6	5	2	7	0	4	1	3	0	7	0	0	7	54
2	1	3	2	4	0	11	10	4	5	0	1	4	2	2	1	4	0	9	63
3	3	1	2	3	2	6	20	1	6	4	0	1	0	1	1	0	6	8	65
4	0	0	5	1	1	2	9	0	1	0	0	0	0	1	2	0	1	2	25
5	2	0	6	4	2	3	6	1	4	0	1	3	0	1	1	0	0	4	38
6	2	0	0	1	0	3	8	0	0	0	0	0	0	0	1	0	0	2	17
Total	11	4	21	14	7	31	58	8	23	4	6	9	5	5	13	4	7	32	262

A1 use life experience; *A2* distinguish the types of character structure; *A3* explain the meanings of words; *A4* read aloud; *A5* analyze the sematic relationships; *A6* give further examples; *A7* comparing; *A8* offer vocabulary; *A9* use learnt sentence structures/figure of speeches to make sentences orally; *A10* demonstrate handwriting position; *A11* have students demonstrate handwriting; *A12* group learning; *A13* have students associate; *A14* use reading strategies; *A15* use grammar knowledge; *A16* neatness of handwriting; *A17* have students analyze; *Others* teach a group of characters, combine simple characters/radicals, replacing radicals, compose word(s), use flash cards, silent reading, use learnt words to make sentences orally, demonstrate handwriting, use handwriting learning strategies, games, have students image, use reading aloud strategies, demonstrate reading, have students consult dictionaries, invite more students, use writing strategies, dictation, have student write, offer extra reading materials

4.5 Instructional Recommendations in Teacher Manuals (Q6)

The number and types of instructional recommendations included in the teacher manuals that accompanied the six student textbooks books analyzed (one for each grade) for the three language arts series are presented in Tables 9, 10 and 11. The amount of guidance provided in the three series varied considerably, with 262 instructional recommendations included in *Creatively Studying Chinese*, 90 in *Happy to Learn Chinese*, and 1047 in *I Love Learning Chinese*.

Instructional recommendations to teachers in *Creatively Studying Chinese* (Table 9) mostly focused on word meaning/reading comprehension (54%; A3, A5 – A8, A13, A14, and A17), followed by teaching handwriting (9%; A10, A11, A16, and 8 recommendations from "other") and recognition (8%; A4 and 6 recommendations from "other"), and facilitating text reading (7%; A4 plus 4 recommendations from "other) and writing (2%; 4 recommendations from "other"). For *Happy to Learn Chinese* (Table 10), most recommendations focused on word meaning/reading comprehension (30%; A2, A7, and 14 recommendations from "other") and facilitating reading (22%; A4 and 6 recommendations from "other"), followed by teaching handwriting (14%; A1 and 6 recommendations from "other") and recognition (4%; A3). Little emphasis was placed on facilitating writing (2%; 2 recommendations from "other"). Lastly, with *I Love Learning Chinese* (Table 11), the most common recommendations involved word meaning/reading comprehension (26%; A1, A5, A9 – A11, A20, A21, A23, A25, A29, and 4 recommendations from "other"), followed by facilitating writing (17%; A13, A28 and A30) and reading (14%; A7, A8, A22, A24, A31). Recommendations for handwriting (6%; A2 – A4, A15, A16, and 5 recommendations from "other") and recognition (2%; A6 and A23) were less common.

4.6 Other Observations

There were many similarities between the three language arts series for teaching recognition and handwriting. Each series presented text in which the recognition and Chinese characters or words were embedded, and words for recognition only and handwriting were listed separately. In addition, all three series emphasized the importance of stroke sequence, forms or radicals, and structure as well as simple/non-composite and compound/composite characters in recognition and handwriting.

Reading and writing activities were provided to facilitate the use of the characters and words taught, although the frequency of these activities differed across series.

Since these were language arts series, the development of other skills and knowledge were also emphasized. This included reading comprehension, writing, Pinyin, calligraphy, learning strategies, speaking and listening, grammar, dictionary use, and subject-matter knowledge.

5 Discussion

Teaching reading and writing in the Greater China region relies heavily on textbooks (Hsiang and Graham 2016; Hsiang et al. 2018; Smart and Jagaanathan 2018). In the current study, we examined three popular language arts series used by elementary grade teachers for literacy instruction in Macao. Our analyses of student textbooks and teacher manuals in each of these series focused specifically on the teaching of character recognition

and handwriting. Learning to recognize and produce Chinese characters and words created from different character combinations is a challenging task, but an important one because these skills provide access to word meanings for reading and writing, making them central to comprehending or creating connected text. In our analyses, we examined the three series to determine how many characters received instruction for recognition and handwriting, whether instruction was character- or word-centered, whether characters or characters in words were initially presented in the context of written text, whether Pinyin spellings accompany the presentation of characters or characters in words, and what instructional activities and teacher recommendations were used to teach character recognition and handwriting as well as facilitate the use of these skills through reading, reading comprehension, and writing activities.

5.1 Inadequate Coverage of Chinese Characters in the Language Arts Series

While there is some variation in the number of characters elementary grade students in the greater China region are expected to master, between 2500 and 3000 characters are considered essential for acquiring basic reading and writing skills (Education and Youth Affairs Bureau 2016a; Ministry of Education of the People's Republic of China 2018; National Council of Linguistic Literacy 1988). If students cannot recognize or write these characters efficiently, they are likely to experience difficulties with reading comprehension and writing (Yeung et al. 2017). In Macao where the current study took place, it is expected that by the end of grade six, students can recognize 3000 Chinese characters and write 2000 of them correctly (Education and Youth Affairs Bureau 2016b). This goal was not met by any of the three language arts textbooks series analyzed in this investigation.

Creatively Studying Chinese covered just 66% of the recommended 3000 characters for recognition in grades one to six and only 52% of the recommended 2000 characters for writing. *Happy to Learn Chinese* and *I Love Learning Chinese* came closer to meeting the prescribed goal for recognition, covering 93% and 86% of the recommended 3000 characters. They were less successful in meeting the 2000 character goal for writing, covering 62% and 79% of the recommended characters. It must be noted that textbooks are not the only potential source for learning characters, as teachers can teach characters outside of textbook lessons and new characters can be learned as students read and write.

It is possible that these three language arts series did not meet the Macao requirements for number of characters because the series were developed in Hong Kong. The Hong Kong government does not provide regulations on the number of characters to be taught in the elementary grades (Curriculum Development Council 2004, 2008; Curriculum Development Institute 2018). This mismatch illustrates an important policy dilemma faced by schools and teachers in Macao as well as other regions in China. Using textbooks developed in another region may not satisfy local requirements. Because some regions experience greater autonomy in textbook selection than others in the greater China region (Hsu and Gau 2016; Lam 2008), educational agencies, schools, teachers, or some combination of these groups may need to devote considerable diligence to the selection of textbooks, making sure that the selected materials meet local goals and objectives. Specific regions may further want to develop supplemental materials to accompany selected textbooks in order to ensure that all local goals are met. Moreover, it may be beneficial for regional governing bodies to encourage publishers to develop textbooks that are responsive to their local situation.

A frequently neglected area in educational research is the study of how educational materials are constructed. We know very little about how publishers of textbooks decide what to include in a series, how much time to devote to it, and why they make these decisions. Given the importance of textbooks and instructional materials to teaching, future research needs to go beyond examining textbooks and study how they are constructed. Research is also needed that examines teachers' use of these materials in the classroom to determine if the developed curriculum is enacted.

Studies are also needed to examine how many characters students need to master for the purposes of recognition and handwriting production at each grade in order to develop adequate reading and reading comprehension skills as well as writing competence (Wang et al. 2008). Without such research, analyses of the adequacy of textbooks to teach these skills must rely on potentially less accurate benchmarks, as was the case in this study.

It is also interesting to note that learning how to write Chinese characters received less emphasis than character recognition in the language arts series reviewed here, and this is also the case in the greater China region as well (Education and Youth Affairs Bureau 2016a; Ministry of Education of the People's Republic of China; National Council of Linguistic Literacy 1988). This is likely due to the policy "recognize more, write less" that is part of the "Compulsory Education Chinese Language Curriculum Standards" in mainland China designed to encourage primary grade students to recognize more characters without the pressure of handwriting (Ministry of Education of the People's Republic of China 2012). Research on the validity of this proposition is needed, as it is possible that it limits the acquisition of both recognition and handwriting (Hsiang and Graham under review; Kong 2020; Liu and Liu 2020; Wang and Leland 2011).

5.2 Teaching Recognition and Handwriting

Our analysis of the three language arts series involved examining if recognition and handwriting instruction was character-focused or characters in words-focused, new characters were initially presented in the context of written text, and Pinyin spellings were included when teaching characters or words. The three series were quite similar in terms of these three aspects of instruction, as characters were presented in words (詞) for both word recognition (認讀詞) and handwriting (書寫詞), Chinese words with the target characters were initially presented in the context of written text with Pinyin above words in order to facilitate word reading, and the words containing the target character(s) were presented under each text and marked as *recognition only* (認讀) or *handwriting* (書寫).

These aspects of instruction are not without controversy. There is debate about whether recognition and handwriting instruction should be character-centered or word-centered, characters should be presented in isolation or context, or some hybrid combination of these instructional should be emphasized (Huang et al. 2018; Lam 2011; Li 2020; Wang and Leland 2011). Moreover, adding the Pinyin spelling above characters or words can help students read them (Hsiang and Graham under review), but there is a concern that students may rely on Pinyin too much impeding their skills at recognizing Chinese character and words (Tse et al. 2007; Wu et al. 1999). Our study was not designed to address the validity of these competing claims. Additional research is needed to directly assess each of these issues. For instance, studies are needed to determine if character-centered, word-centered, or some combination of recognition and handwriting instruction are effective with specific students (e.g., younger vs. older, stronger readers vs. weaker writers) and in different situations (e.g., teaching recognition vs. handwriting). We also need to know how teachers

deliver such instruction in the classroom, do they value it, and do their students value it as well.

We further examined the three language arts series to determine if they differed in the number of recognition and handwriting instructional activities provided in student textbooks as well as the number of instructional recommendations for teaching these two skills in the accompanying teacher manuals. The three series differed markedly in the total number of all instructional activities (356–713) and teacher recommendations (90–1047) for any kind of instruction presented in the six student textbooks and teacher manuals coded. Nevertheless, the actual number of instructional activities for promoting recognition were relatively similar across the three series in the six student textbooks analyzed (93–116), but the language arts series, *Creatively Studying Chinese*, had only 30 activities devoted to handwriting, whereas 121–115 handwriting activities were included in the other two language arts series. The teacher manuals of the three series had fewer recommendations for teaching recognition (ranging from 4 to 26) and handwriting (ranging from 13 to 59). The language arts series with the most recommendations for teachers for recognition and handwriting combined was *I Love Learning Chinese* (85). The series with the fewest number of recognition and handwriting recommendations for teachers was *Happy to Learn Chinese* (17).

As our analyses illustrated, language arts series are likely to differ in terms of the number of practice activities and recommendations provided to teachers for teaching specific skills. Research is needed to determine how many and what types of practice activities and instructional recommendations enhance students learning of Chinese characters. For example, we found that new and unique Chinese characters were on average presented twice during a school year. Is two presentations enough to ensure mastery and maintenance of recognition and handwriting? In any event, determining the effectiveness of specific practice activities or instructional recommendations to teachers will likely differ depending on the capabilities of both teacher and students.

5.3 Using Recognition and Handwriting Skills in Context

Finally, we analyzed the three language arts series to determine if they provided opportunities in textbooks for students to apply the character recognition and handwriting skills taught in reading and writing contexts and if teachers were provided with instructional recommendations for to support such activities in teacher manuals. We divided reading opportunities into ones that promoted reading words in text and comprehension of words in text (word meaning and comprehending text). In each language arts series, we examined one textbook and teacher manual at each grade to determine how frequently these student opportunities or teacher recommendations were provided.

Across the three language arts series there was variation in terms of how often students were provided with opportunities to apply taught character recognition and handwriting skills. With *I Love Learning Chinese*, students had 312 more opportunities to apply these skills in context in the six textbooks analyzed than they did in *Creatively Studying Chinese*, and 201 more opportunities than were afforded in *Happy to Learn Chinese*. Most opportunities for students to apply character recognition and handwriting skills involved reading in the three language arts series (78–88%). Reading comprehension activities accounted for 30–54% of the reading activities in the three series.

Marked differences between these three language arts series were also evident in terms of instructional recommendations to teachers for applying these skills in context. With *I*

Love Learning Chinese, teachers were provided with 491 and 546 more recommendations for applying these skills in context than they were provided in *Creatively Studying Chinese* and *Happy to Learn Chinese*, respectively. Recommendations were overwhelmingly aimed at reading (98% in *Creatively Studying Chinese*, 96% in *Happy to Learn Chinese*, and 70% in *I Love Learning Chinese*), with the majority of reading recommendations focusing on reading comprehension (66% to 87% across the language arts series).

Despite these variations, students were provided with considerable opportunities to apply taught character recognition skills when reading. This included activities where they read text, analyzed word meanings, and comprehended text. To a lesser degree, teachers were provided with a variety of recommendations for applying character recognition skills in context, except in *Happy to Learn Chinese* where just 47 recommendations were provided in the six teacher manuals coded. Opportunities for students to apply taught handwriting skills were also limited as were recommendations to teachers on how to promote such applications. The lone exception involved *I Love Learning Chinese* where an average of 30 writing recommendations were provided in each of the six teacher manuals coded.

Additional research is needed to determine if the types of opportunities provided to students to apply taught Chinese character recognition and handwriting skills in context in language arts series such as the ones studies here are effective. Research is also needed to determine the efficacy of recommendations provided to teachers on how to promote such transfer. An especially pressing issue concerns the lack of attention to promoting transfer from handwriting to writing. Further, as materials become less paper-based and more digital, there will be an increasing need to determine how such materials teach Chinese characters (Hovious et al. 2020). Lastly, the current study did not observe how teachers in Macao actually used the three textbooks under investigations. Such research needs to be conducted in the future.

6 Conclusions

This analysis of three popular language arts series used by teachers in Macao illustrate multiple issues that should be considered when using such materials to teach character recognition and handwriting. Do the materials adequately cover the characters and words students need to learn to become proficient readers and writers? How is recognition and handwriting taught? Is there evidence that these practices are effective? What kinds of activities and opportunities are included in student and teacher materials to promote use of taught characters in context? Is there evidence that these opportunities and activities are effective? How do the materials support teachers and students in learning Chinese characters for recognition and handwriting and subsequently using them in reading and writing contexts? Such analyses by educational agencies, school systems, schools, and teachers will provide them with the information needed to make intelligent decisions about what materials best fit their particular situation.

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