The Impact of Teaching Methods on Learning of Chinese Characters among English-Chinese Bilingual Children with Dyslexia

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It is commonly thought that the use of Hanyu Pinyin (or 'Pinyin') can promote the learning of Chinese characters as it assists learners to pronounce new characters via a sub-lexical route (Dai & Lu, 1985; Huang & Hanley, 1997). However, there are also studies suggesting that presenting a Chinese character with its Pinyin depresses the rate at which the Chinese word can be learned (e.g., Solman & Adepoju, 1995; Solman & Chung, 1996). In view of this, this study aims to explore the impact of Pinyin during instruction on the acquisition of Chinese characters by Primary One students with dyslexia. Employing a single case alternating treatments design methodology, two girls and one boy diagnosed with developmental dyslexia were taught to read Chinese characters using two methods. The Pinyin method of teaching involves the pairing of the Chinese character printed on a card with its respective Pinyin transcription together with the teacher reading the word aloud. The Stroke method of teaching presents the order in which the strokes of the Chinese character are written in Pinyin. All three participants recognized more words when presented with the Stroke method across all sets of words. The implications of these findings to the nature of dyslexia and to the language learning of English-Chinese bilinguals with dyslexia are discussed.

Keywords: bilinguals, teaching Chinese, Pinyin, dyslexia

This study sought to examine the implications of teaching Hanyu Pinyin (which we will refer to as 'Pinyin') on the learning of Chinese Language among English-Chinese bilingual children with dyslexia in Singapore. Reading is the process of understanding speech in its written form, with the purpose of gaining access to meaning. It occupies an important role in education as learning to read is an essential skill that forms the basis for subsequent learning. However, unlike speech, reading is not naturally acquired and it often requires deliberate

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instruction. The ease within which single word (or morpheme) reading is learnt varies across languages. Languages with shallow orthographic depth (Frost, Katz, & Bentin, 1987), such as Spanish and Bahasa Melayu, are characterized by relatively straightforward grapheme-phoneme correspondence rules which are easier to acquire. In contrast, languages with deep orthographic depth such as Chinese have relatively little correspondence between the phoneme and its logographic representation. English is an alphabetic language with moderate orthographic depth as its alphabetic script allows the mapping of graphemes upon phonemes on some of its words but not others.

Learning to read in English and Chinese

In research literature studying the reading processes of bilingual children, the contrast between English and Chinese is interesting due to the contrast between the phonology, syntax, and orthography of the two languages (Gottardo, Chiappe, Yan, Siegel, & Gu, 2006). Although English is not considered an orthographically shallow language, the grapheme-phoneme correspondence is more direct than Chinese (e.g., Huang & Hanley, 1997). The reading of Chinese characters, in contrast, requires a memorization of the logographic representation of a word. For example, 'mother' is represented by the (simplified) Chinese character (or logograph) '妈'. To complement the learning of Chinese characters, Pinyin has been introduced in China and Singapore, so that the word can also be represented using alphabets as 'mā'. The phonology of some Chinese words can be guessed from its phonetic radical, for instance

'马' (read Shu & Anderson, 1997 for a fuller discussion) as in the case of '骂' or 'mà' (meaning 'scold') or '马' or 'mǎ' (meaning 'horse'). The rationale for the introduction of Pinyin is based on the assumption that it can promote the learning of Chinese characters via a sub-lexical route requiring less assistance from the teacher (Dai & Lu, 1985; Huang & Hanley, 1997). However, there is also evidence suggesting that the teaching of Chinese vocabulary with a simultaneous presentation of Pinyin depresses the rate at which Chinese words can be learned (e.g., Solman & Adepoju, 1995; Solman & Chung, 1996). The question of how Chinese is best taught remains an issue that is being debated.

There is also evidence suggesting that the processes underlying learning to read in these languages differ. For instance, Huang and Hanley (1994) compared the way in which children learn to read English with how they learn to read Chinese and reported that children learning to read Chinese employed more visual skills than children learning to read English. Likewise, Chen and colleagues (2002) as well as that of Guo, Peng, and Liu (2005) provided evidence for a difference in processing routes in reading Chinese characters and Pinyin. This implies that the process of learning to read in English is different from that of learning to read Chinese characters. Likewise, the reading of Pinyin appears to employ a different set of phonological processes.

Developmental dyslexia in English and Chinese

There is an established understanding

that developmental dyslexia among alphabetic scripts is characterized by difficulties in learning to decode print (Vellutino, Fletcher, Snowling, & Scanlon, 2004). Vellutino and colleagues have argued that this phonological impairment is observed even among children with dyslexia who learn a non-alphabetic Chinese script. However, this view is by no means universal as there are also researchers who have proposed that orthographic (Ho, Chan, Lee, Tsang, & Luan, 2004) or morphological (Shu, McBride-Chang, Wu, & Liu, 2006) difficulties underlie Chinese dyslexia. Consequently, it is likely that children diagnosed with developmental dyslexia in one language can possibly present with different or no difficulties in another language (Bishop & Snowling, 2004). By applying the same logic, developmental dyslexia is expected to have a differential impact upon different written forms of the same language (e.g., Chinese written logographs and Pinyin). This situates Singapore as an ideal location for the examination of this issue.

Research objectives

All children in Singapore, with few exceptions, receive their education in the English medium and learn a second language, which is determined by their ethnic group. As ethnic Chinese children account for the largest group of children in the education system, Chinese is the most common second language learnt in Singapore. As part of the national curriculum for Chinese language, all children learn Pinyin during their first two years of primary education. However, this potentially poses a problem to students who have been diagnosed with developmental dyslexia in English language learning.

This study sought to understand the impact of Pinyin instruction alongside Chinese character instruction among Primary One students diagnosed with developmental dyslexia. It is hypothesized that the learning performance of Chinese characters with the co-presentation of Pinyin will be inferior to a method where only the characters are taught.

Method

Design

Single case design was adopted as this design involves repeated measures of participants' results allowing a visual examination of patterns in the dependent variable over time. This controls major threats to internal validity and enhances external validity (Martella, Nelson, & Marchand-Martella, 1999). The complex nature of bilingualism in Singapore makes the grouping of participants difficult as although practically all children in Singapore are bilingual, the relative strength in English and Chinese varies across each child. Given the nature of single case design where each child serves has his or her own control (Kennedy, 2005), it is particularly suited for heterogeneous populations such as the ones in this study. Likewise, the heterogeneity of dyslexia and its associated conditions make comparisons between individuals difficult. Furthermore, the exploratory nature of this study makes an approach examining fewer participants more appealing. More importantly, the alternating treatments

Table 1. Description of Study Participants

Participant	Gender	Chronological Age (in years)	Reading Age (in years)	Months of Remediation at DAS
Cara	Female	6	4	3
Lina	Female	7	5	7
Jack	Male	6	4	12

design allows the comparison of two teaching approaches in a small group of participants. These two treatments are alternated in rapid succession and changes are plotted on a graph to facilitate comparison (Cooper, Heron & Heward, 2007).

Participants

The three children who participated in this study are Cara, Lina, and Jack (two girls and one boy). They were attending Primary 1 at the point of recruitment and were recruited from the Dyslexia Association of Singapore (DAS) where they were receiving regular intervention (see Table 1). Although diagnostic information was not available, all children who receive support from DAS would have received a diagnosis of

dyslexia from a psychologist. None were reported with any speech or hearing impairment or other diagnoses. All participants received between three to 12 months of intervention at DAS. They also come from English-speaking home environments and all were reported to be stronger in the use of English in comparison to Chinese. All participants learn Chinese as their mother tongue and none of them had previously learned foreign languages other than Chinese. In addition, Lina's mother provides extra time to support her in her learning of Chinese.

Materials

The teaching materials employed in this study were developed based on the following procedure. First, a corpus of 100

Character-Pinyin Cards
(a)

Character-Stroke Cards
(b)

Character-Recognition Cards
(c)

Figure 1. Examples of Character Cards used for Teaching

Chinese characters with between 10 to 12 strokes per character ranging were selected from the Ministry of Education's primary school Chinese Language Syllabus Primary 1 and 2 wordlist. Following that, each participant was asked to recognize each of these characters. Only Chinese characters which were not recognized were adopted as teaching materials and the teaching materials were customized for each participant. The teaching materials for this study comprised three types of character cards (see Figure 1): (a) cards that presented the Chinese characters and their respective Pinyin transcription (Character Pinyin for Treatment A: Pinyin Condition), (b) Chinese characters and their corresponding sequence of strokes (Character Stroke for Treatment B: Stroke Condition), and (c) cards which were used to elicit recognition of characters (Character Recognition) that consisted of Chinese characters printed on the cards. The grade level and level of complexity varied between sessions but the stroke complexity was held constant between conditions. All character cards were plain white cards 15.2cm x 10.1cm in size.

Procedure

Approval to conduct this study was obtained from the university's Institutional Review Board before this study commenced. After parental consent and child assent was obtained, appointments were made for the participants to be assessed for their Chinese character recognition skills.

The Assessment *Phase* occurred only once before any teaching was conducted. During this phase, participants were tested on a corpus of Chinese characters drawn from the primary school curriculum. Each character was individually presented for five seconds or until a response was provided. Participants were asked to read them or to say "pass" if they did not know the answer. The teacher (the first author) did not provide any feedback on whether the words were read correctly during this phase. The correctly named characters read by the respective participants were excluded and the remaining characters were selected as teaching material for this study. Each participant hence had an individualized set of words that he or she learnt in this study.

This was followed by a *Teaching Phase* which consisted of eight teaching sessions. Each of the eight 20 minute teaching sessions employed either the Pinyin or the Stroke method. These teaching methods were alternated. Each teaching session introduced 10 new words to the participants. Different sets of words are used per session but word complexity (as measured by the number of strokes per character) was held consistent across respective teaching sessions. In the Pinyin Condition (Treatment A), each participant was presented with a character card of a Chinese character with its corresponding Pinyin printed under it. The teacher pointed to the Pinyin and said, "This character is pronounced as _____." The participant was asked to repeat the word, with the teacher underlining the Pinyin with her finger. A correct response was followed by the teacher saying, "Good". When the participant provided an incorrect response, the teacher would provide feedback saying, "Good try, but

the character is pronounced as _____". Once the participant was able to repeat the word, the teacher then pointed to the Chinese character saying, "the meaning of _____ is _____". The participant was then asked to repeat the meaning after the experimenter. This method of teaching was repeated for each of the ten characters. In the Stroke Condition (Treatment B), the teacher introduced each word saying "This character is pronounced as _____". As with the previous condition, the participant was asked to repeat it, with the teacher tracing the Chinese character with her finger. The feedback procedure for correct and incorrect responses is similar to that of the Pinyin Condition.

The *Posttest Phase* occurs after each teaching session. The participant was presented with each character was represented with a Character-Recognition card (see Figure 1) for up to ten seconds

and was encouraged to read the character on the card. No feedback regarding their responses was given, but the participant was informed of the total number of words they recognized.

Results

The number of words identified correctly is presented on the y-axis for each respective participant in Figures 2 to 4. Each figure presents the learning accuracy for each of the four teaching sessions across the two conditions. The learning performance across each condition is presented as a line and a linear trend is also presented in the figures.

Visual analyses of Figures 2 to 4 reveal several trends. First participants consistently learn more words under the Stroke condition. Next, the trend line for the Stroke method is consistently positive
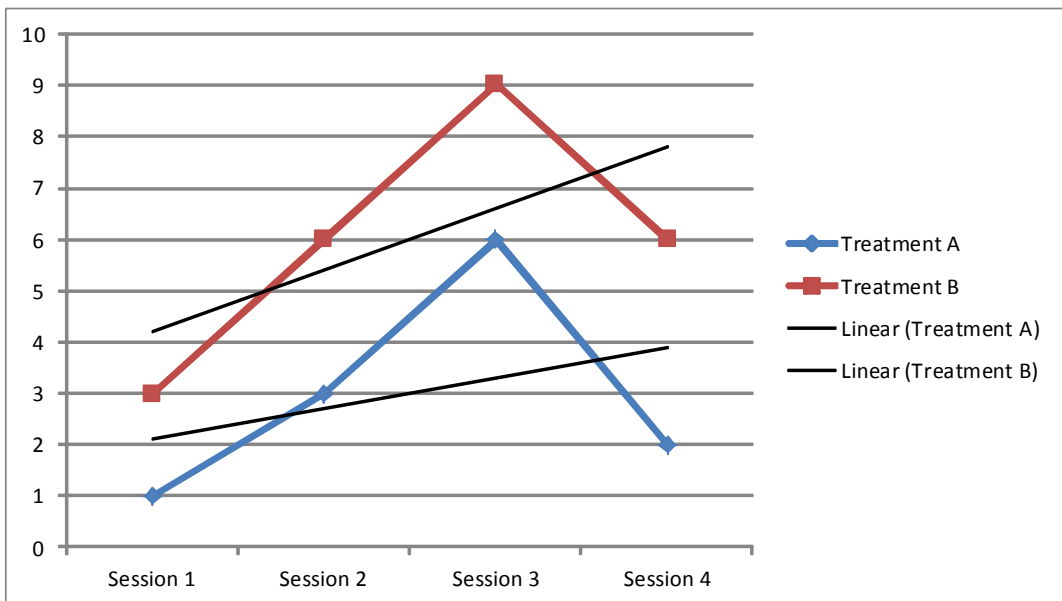

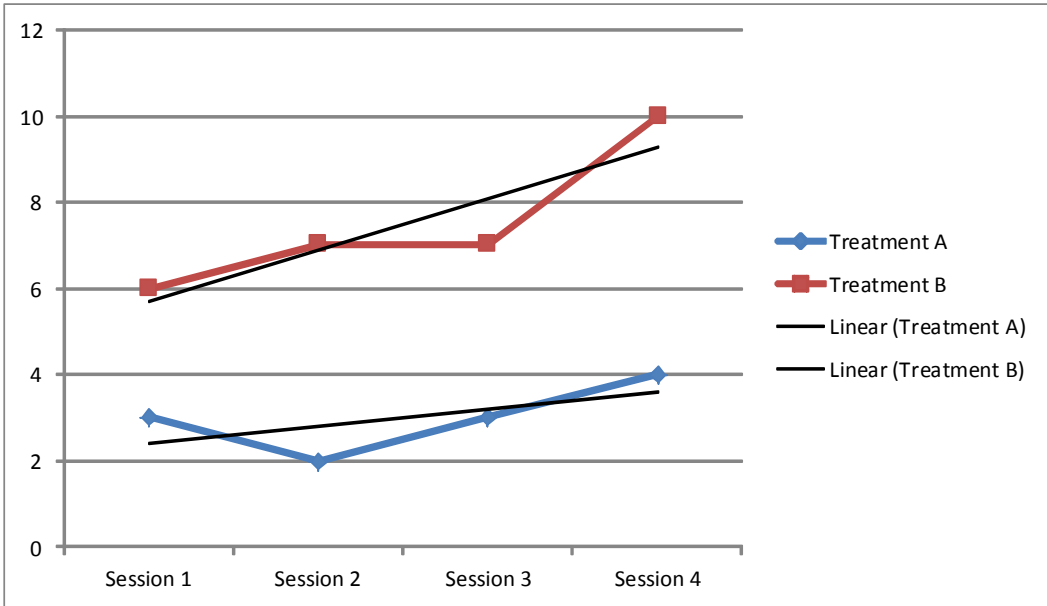Figure 2. Graphic Representation of Cara's Word Recognition Under Each Condition

Figure 3. Graphic Representation of Lina's Word recognition Under Each Condition
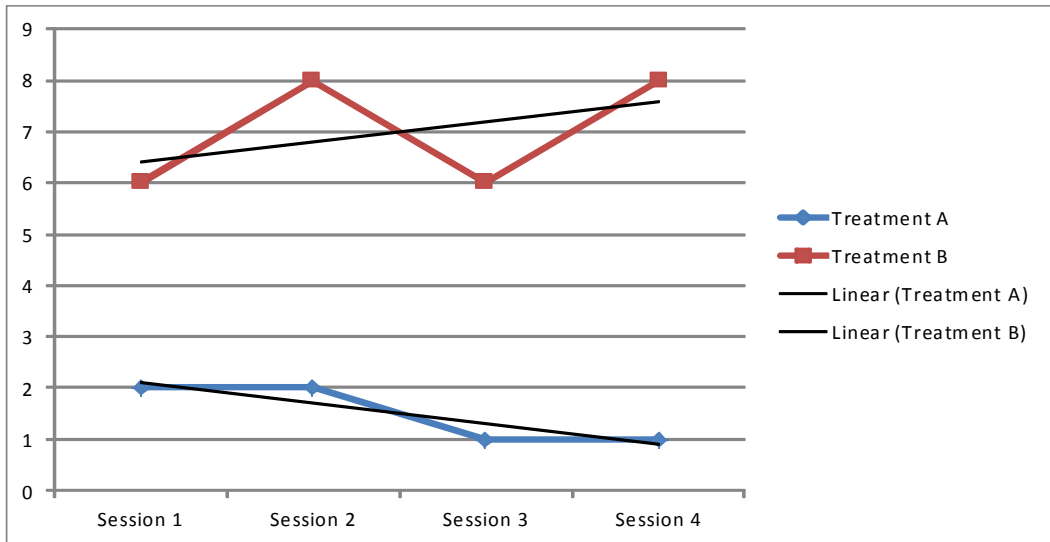

Figure 4. Graphic Representation of Jack's Word Recognition Under Each Condition

and steeper when compared to the Pinyin method. The replication of these findings clearly across three English-Chinese bilingual children with dyslexia suggests that these children with dyslexia consistently learn better via the Stroke method of teaching.

Discussion

This study's findings lend support to the suggestion that Pinyin instruction can impede the learning of morphemes in Chinese among English-Chinese bilingual children with dyslexia. Consistent with the findings of earlier studies (Solman & Adepoju, 1995; Solman & Chung, 1996), the learning rate is lowered when a Chinese word is paired with its Pinyin representation. However, there is a second, possible explanation for the findings. It is also possible that the difficulties with phonological processing, consistent with dyslexia in English (c.f., Vellutino, et al., 2004) could have impeded the facilitatory impact of Pinyin. The findings are consistent with the core impairment underlying dyslexia among English learners is phonological processing and that Chinese language, being logographic and orthographically deep, requires not phonological but rather visual processing skills. It is also possible that both accounts could have an additive impact upon the poorer performance across the Pinyin condition. Thus, whilst there is a clear finding of learning was poorer among the Pinyin condition, this study was unable to explain the reasons underlying these findings.

The findings are also consistent with the findings that developmental dyslexia can be language specific such that phonological processing deficits associated with dyslexia of learning alphabetic scripts such as English do not seem to impact upon the learning of reading in scripts of deeper orthography such as Chinese (Shu, et al., 2006). It is therefore important, to be specific about the underlying processes when identifying bilingual learners with dyslexia.

Implications for practice

Reasons aside, these findings point at one important implication – that English-Chinese bilingual children with dyslexia in this study learn Chinese words more poorly when Pinyin is introduced alongside Chinese characters. However, a large part of the Primary 1 Chinese curriculum involves the introduction of Chinese characters alongside Pinyin. This study findings suggest that the introduction of Pinyin for English-Chinese bilingual children with dyslexia might reduce the learning of Chinese word recognition of these children such that they are likely to be disadvantaged in the learning of Chinese. As such, there is a need to examine the pedagogy of introducing Chinese to bilingual children with dyslexia and/or the content of Chinese curriculum. It also has implications for the common practice of accommodations provided to children with dyslexia in Singapore.

Although some children with dyslexia receive an exemption from having to take the Chinese subject, most receive the accommodation after a few years in primary school. The findings of this study suggest that it may be helpful to receive the accommodation earlier or to learn Chinese in a different way.

Limitations and directions for future research

Although this study findings, replicated across all three participants, seem compelling, the small number of participants in this study limits the extent to which the findings may be generalized. As such, the replication of this study with more participants within a quasi-experimental study may help in understanding the extent to which these findings may be generalized.

Moreover, we had earlier indicated that the exact mechanism involved in the poorer learning of the Pinyin method is still unclear. In addition, we made an assumption that the observed difference in learning is indicative of learning difficulties when Pinyin is introduced alongside the characters rather than learning being enhanced by the Stroke method. Future studies comparing the performance of children with dyslexia against that of typically developing children across a variety of tasks comparing learning across methods can shed some light on this.

It is also possible that the Pinyin method of teaching where the presentation of the Pinyin transcription below the Chinese character may have distracted the participant from the task at hand. It may be helpful in exploring the possibility by adding a third condition with the English translation of the word, and a fourth condition with 'XXXX' or 'OOOO' written under the Chinese character.

Conclusion

Dyslexia impacts upon learning in many ways. In this study, we highlighted the complexity of this issue within English-Chinese bilingual children learning Chinese Pinyin. Specifically, we highlighted how the difficulties of developmental dyslexia manifest themselves differently in different scripts. However, these findings have also identified many other questions. Do these findings get replicated in different aspects of Chinese Pinyin learning? How can these findings guide the pedagogy of children with dyslexia? These remain to be answered but it is hoped that this study is one step in that direction.

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