

Asia Pacific Journal of Developmental Differences
Vol. 7, No. 2, July 2020, pp. 249- - 264
DOI 10.3850/S2345734120000137



Evaluating the effectiveness of intervention in Chinese for dyslexics and struggling learners

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Abstract

In this article, an intervention for Chinese literacy designed for dyslexic children was applied to a group of dyslexic children, struggling learners, while a group of dyslexic children who served as controls, received alternative support for their difficulties in Chinese. Interestingly, the results showed that the controls made little or no progress, but both groups undertaking the intervention showed improvement. Moreover, the struggling learners made more significant improvements than the dyslexic intervention group in character reading and word forming, suggesting that their problems may be less entrenched than the dyslexics, and they would benefit from ongoing support using this structured multisensory approach. Results were supported by qualitative feedback from parents, learners and educational therapists.

Keywords: Dyslexia, Chinese, Quantitative, Qualitative, Struggling learners.

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Dyslexia is a specific learning difficulty that affects literacy development, namely in the areas of reading, writing and spelling. It mainly affects the skills involved in acquiring accurate and fluent word reading and spelling (Rose, 2009). Brunswick (2010) pointed out that the depth of the orthography plays a part in determining the extent of the impact on language acquisition because of the difficulties a person with dyslexia encounters with the written form of words. In shallow languages, there is a more direct correspondence between sound and print, which facilitates reading development. On the other hand, languages that have a deep orthography, such as Chinese, where one is unable to pronounce a word based on how it is written, are more complex. Given these linguistic differences, strategies for effective intervention across languages may differ. Hence, the way dyslexia presents itself in each language may differ according to its writing system.

Consequently, children with dyslexia learning to read in Chinese face a very different task from those learning to read in English, because of the nature and structure of the language, based on pictograms. Chung & Ho (2010) in their study pointed out that most of the work on research-based diagnosis and effective intervention has been centred on alphabetic languages. As such, the work done may not be applicable to Chinese which is a non-alphabetic language.

CHARACTERISTICS OF THE CHINESE LANGUAGE IN RELATION TO DYSLEXIA

Relatively few studies to date have focussed on dyslexia in Chinese, however, this situation is now changing. Interestingly, a review of the literature on Chinese dyslexic students, learning to read with Chinese as their first language, derived from studies in China and Hong Kong, suggests that the pattern of difficulties for Chinese speakers is similar in many ways to children learning in English, with subtle differences in the pattern of difficulties. In particular, there is less clear cut and stable evidence of phonological deficit, which typically characterises dyslexia in English, although sensitivity to acoustic cues has been identified as linked to phonological awareness, but not reading skill (Zhang, Meng, Wu, & Zhou, 2017). Good visual orthographic skills are more important to recognise the Chinese characters and identify the radical positions which dictate meaning. Visual-orthographic skills relate to the strategic attempt to split Chinese characters into parts when reading, and the ability to identify the character structure and position of radicals. These skills are needed to allow for accurate reading of Chinese characters which are visually similar such as 他 'he' and 地 'ground'. When learning, a person may write characters that are disproportionate or read and write characters wrongly.

Moreover, morphology is also important in order to differentiate between the large number of homophones/homographs occurring in Chinese. Good morphological awareness helps students to discriminate characters that sound the same but differ in meaning, form words with characters and break down sentences into words and

phrases to read accurately and fluently. For example, when a person hears 'jiǔ', a lexical decision has to be made if it was referring to wine, long or nine. The presence of homophones requires the provision of context to clarify the intended meaning conveyed. When writing the characters, a person may substitute it with another character with another tone or write a similar-sounding character that he is more familiar with how to write. Another characteristic of the Chinese language is that a character can be compounded with another character to give different meanings. The character 大 'big' can form the words 伟大 'noble' and 大象 'elephant'. However, a person with dyslexia has difficulty in recognising that the characters in the two words are actually the same. A combination of visual and morphological deficits have been identified in combination in Chinese dyslexics (Kalindi & Chung, 2018; McBride-Chang, 以及其他, 2011), with visual skills developing further in tandem with improvements in reading, and a link between morphology and naming speed (Chung K. K., 2017; Tong, McBride-Chang, Lo, & Shu, 2017)

In addition, the learning of Chinese characters is usually done through repetitive copying. McBride-Chang, Chung, & Tong (2011) proposed that copying skill itself may be useful in understanding the development of literacy skills in Chinese. Fundamentally, visual-motor integration skills affect one's ability to copy and write. In order to write Chinese characters correctly, writing in the correct strokes, sequence, direction and proportion are required. A wrong proportion can change the meaning of the character entirely, such as 天 'sky' could become 夫 'male adult' when a stroke is longer than it is supposed to be. At times, it may result in a non-word with the reversal of the dot in 头 'head'. It was observed that children with dyslexia would copy significantly slower with greater average character size, variation in size and lower in accuracy, with missing and concatenated strokes (Lan, Au, Leung, & Li-Tsang, 2011).

The bilingual policy in Singapore mandates all to learn English and the language of their ethnicity, namely Chinese, Malay or Tamil (Dixon, 2005). A person with dyslexia may face difficulty when learning to read and write in either or both languages. Hence, the provision of literacy support in the learning of languages is particularly vital. While there has been an increase in support for English literacy (Ho, 2015; Toh, 2018; Brookes, Ng, Lim, Tan, & Lukito, 2011; Lim & Oei, 2015), research in testing and intervention in Chinese for learners with dyslexia in Singapore has remained limited. With the Chinese ethnicity making up about 74% of the entire population in Singapore (Singapore Department of Statistics, 2016), the development of a suitable intervention is important. Although children with dyslexia are entitled to apply for exemption from Chinese examinations, in practice the majority of parents are keen for their children to become proficient in Chinese in view of their cultural heritage.

Moreover, over the years, there have been parents who have approached the Dyslexia Association of Singapore (DAS) to seek support for Chinese learning for their child, even

when they have not been labelled with dyslexia based on psychological assessments. Typically, these students are coping well with other areas of learning in school and have no other specific learning difficulty. However, they appeared to share similar traits to dyslexics with their learning of Chinese such as reversals, mirror images and being unable to retain what they have learnt.

However, because there is currently no standardised testing tool for learning difficulties in Chinese in Singapore, children who are struggling are unable to access support in their learning. Unfortunately, assessment tools from China, Hong Kong and Taiwan cannot be directly applied to our setting due to differences in the language environment, and differences in the written script. Research into intervention in these countries has also been scarce (Chung & Ho, 2010). In Singapore, English is the more dominant language while Mandarin or Chinese dialects are the dominant language in these other Chinese speaking countries. Differing in language exposure and expectation of what they are required to learn, it is not possible to directly apply what has been evaluated elsewhere to our context. Furthermore, Taiwan and Hong Kong use the traditional script for Chinese writing while here in Singapore, the simplified script is used. To support this group of struggling learners, it is imperative to understand their areas of learning difficulties and how similar they are to a learner with dyslexia. Given similarities, the question arises, will the intervention then be effective in supporting them in their learning of Chinese?

In an earlier study in Singapore, Shen, Liu, Kong, See, & Sha's (2014) compared learners with dyslexia and those without for differences in their sublinguistic skills in the learning of Chinese. Learners with dyslexia were found to be weaker in their visual-orthographic awareness, morphological awareness and visual-motor integration skills. Based on these findings, coupled with feedback from parents, a Chinese intervention programme was designed at the Dyslexia Association of Singapore (DAS) to support learners with these areas of weaknesses. Teaching principles from the Orton-Gillingham approach were adopted, making the instruction dyslexic friendly. Shen et al., (2014) then evaluated the effectiveness of this intervention programme at the Dyslexia Association of Singapore to help children with dyslexia in Singapore to learn Chinese, with each child acting as their own control. In their study, within-samples t-tests found a significant improvement in overall Chinese literacy scores for the 16 dyslexic students aged between six to twelve. Specifically, these learners showed significant improvement in the areas of character orthographic awareness, character learning and retrieval, character reading and vocabulary knowledge reading. Although there was an increase in scores for writing and oral tests, these were not statistically significant. These suggested that the intervention had been effective for these students with dyslexia while there is a need to continue exploring strategies to develop their spelling and writing abilities. In making suggestions for future study, Shen, et al., (2014) noted the importance of capturing students' view on the Chinese language to evaluate if such intervention does build interest in language learning and the attitude of these learners. There is solid evidence from Shen's study of

improvement for children with dyslexia who have undergone this intervention. It is then imperative to ensure that this progress was not achieved by simple maturation or natural schooling. A control group is normally required for an intervention study of this type to reduce or eliminate gains achieved by schooling or natural maturation. With the introduction of a control group, it is intended to determine if the intervention is truly effective in helping learners with dyslexia in Chinese as compared to other remediation support. At the same time, it is also intended to investigate if learners with dyslexia and those who are struggling to learn Chinese share a similar profile in the areas of weakness (Yap & Van Der Leji, 1993). Consequently, if the intervention will also be beneficial in helping them learn. Conversely, the profiles may differ, and require a range of different approaches, as outlined by Snowling & Hulme (2012) in their review of interventions for language and literacy difficulties.

RESEARCH QUESTIONS

This study seeks to investigate the following:

1. Is the intervention effective for learners with dyslexia?
2. a. Do learners with dyslexia and struggling learners have similarities in their learning difficulties?
b. Will the intervention also benefit struggling learners?

METHODOLOGY

The design featured a mixed measures approach. Quantitative measures were used in this study to measure the literacy gains and compare profiles of students at pre and post-test. Qualitative measures were derived from questionnaires and interviews with parents, learners and educational therapists.

Participants

There were a total of three groups of participants in the study – students with dyslexia, struggling learners and the control group who were also dyslexic but not receiving support with Chinese. All participants, aged between six to eleven, were studying in a mainstream primary school and had difficulties in learning Chinese.

Students with dyslexia were recruited from the Dyslexia Association of Singapore (DAS) to form the experimental and control group through letters sent out to the parents. Parents who were interested then registered their interest with the researchers. Students in the control group were informed that they could withdraw from the study to receive intervention at any point of time if they wanted to. While the participants in the experimental group received intervention from the DAS, the control group received other forms of support such as enrichment centres and private home tutors.

The struggling learners were recruited through referrals from DAS psychologists and primary school teachers. They were informed of a trial for struggling learners and registered their interest following a short briefing on what the intervention was about. The criteria for inclusion for struggling learners were failing or getting borderline pass results in spite of other remediation support in the presence of no other known learning difficulties.

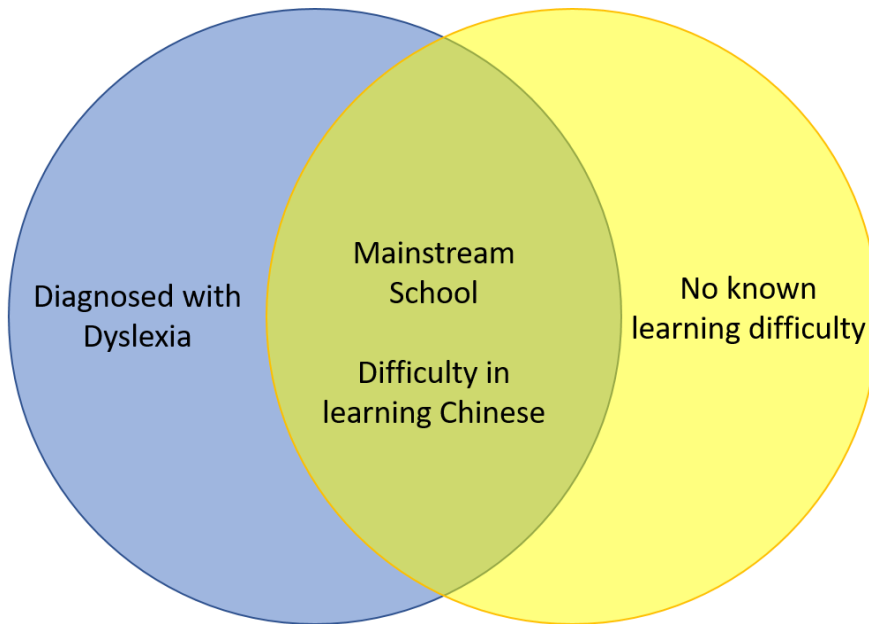


Figure 1. Comparison between learners with dyslexia (left) and learners who are struggling (centre)

Approval for data collection for this study was obtained from the DAS research committee. Informed consent was given by parents for the students to participate in the study. The parents were informed that they could withdraw the child from the study at any juncture and this would have no impact on their access to intervention.

The participants were profiled using the Revised Battery of Chinese Literacy Tests, developed by Shen, et al., (2014) to determine their suitability for the programme. The results were then used to group students with a similar profile together, which is to say students with dyslexia and struggling learners could be in the same group, receiving intervention together.

There were a total of 51 participants in total – 20 learners with dyslexia (M=117.85 months, SD=13.23), 14 struggling learners (M=116.64 months, SD=13.43) and 17 controls (M=112.17months, SD=17.07).

All participants were required to fill in a language background questionnaire to ensure that they had a similar exposure to the language outside school and also if they were receiving additional support.

DESCRIPTION OF INTERVENTION

Students were grouped according to their age and performance in the character reading and spelling tasks from the Battery of Chinese Literacy Tests (Shen et al., 2014) in order to receive intervention. Both learners with dyslexia and struggling learners underwent at least 18 hours of structured literacy intervention, one hour once per week. The intervention is conducted in a small class size of two to four students in each class. The intervention was targeted to the needs of the participants, specifically targeting visual-orthographic awareness, morphological awareness and visual-motor integration. The key aspects of the intervention are oracy skills, through vocabulary building and sentence structure instruction, and teaching of word recognition strategies. The intervention also places an emphasis on teaching word recognition strategies in a structured, sequential and cumulative manner with the intent of helping students improve their spelling and writing of characters, as discussed in Shen et al.'s study (2014). Reviews of what was taught in the intervention through card drill and spelling tasks were also a key aspect of the intervention and took place on a weekly basis. The educational therapists who conducted the intervention were all familiar with the teaching principles of the Orton-Gillingham approach of cognitive, language-based, simultaneously multi-sensory, diagnostic and prescriptive, structured, sequential and cumulative, and emotionally sound teaching.

MEASURES AND DATA COLLECTION

The Revised Battery of Chinese Literacy Tests was used before and after the intervention period on all three groups of participants to form the pre- and post-test measures. The Revised Battery of Chinese Literacy tests was developed by adaptation from test kits in Hong Kong and Taiwan. The measures used in this study were character reading, word forming and spelling. There were a total of 200 test items on the character reading and word forming tasks. These items were based on the Ministry of Education Primary School Syllabus for Chinese and selected according to the different school levels. Participants were first asked to read the character then form words with the character. The spelling task had a total of 20 test items where participants were required to fill in the missing character in a given word. These items were also pegged to their school level. The test items in the post-test were reordered from the pre-test. Error analysis is also performed to understand the nature of errors committed by both groups – those with dyslexia and those who are struggling to learn.

The results were used to determine the current language ability of the participants, the similarities and differences in the learning profiles of the dyslexics and struggling

learners, as well as, the effectiveness of the intervention in helping students read and write in Chinese.

Due to the smaller sample size, triangulation of data was done to increase the reliability and validity of the results collected. Data was collected from the perspective of the learner, the parent and the therapist.

Parents had to complete a Language Background Questionnaire before the start of the intervention so that we could understand the duration of Chinese language support given to learners outside of the DAS as well as to ascertain the effectiveness of the Chinese intervention received at the DAS

Both parents and the learners had to complete a Parent and Learner Questionnaire before and after the intervention so that we could investigate the learner's language attitudes towards the learning of Chinese, ease in recognising and writing Chinese characters before and after intervention, in order to determine the effectiveness of intervention from both parent and learner's perspective. This was intended also to compare interest and attitude towards the Chinese language.

Educational Therapists were also asked to provide qualitative feedback if there were any differences in the provision of intervention between the learner with dyslexia and the struggling learner based on classroom observations and to raise any other concerns or issues which could not be captured by the pre- and post-test.

RESULTS

Scores on the Battery at pre-test and post-test were tabulated and analysed statistically. Analysis of variance showed no statistically significant difference at the $p < .05$ level in character reading, word forming and spelling scores for the three group of participants prior to intervention. Error analysis showed that the reading and writing errors committed were similar across all three groups, which mainly consisted of visual, phonetic and semantic errors. At the end of the study, analysis of variance showed marginally significant difference in character reading at the $p < .1$ level for the three groups: $F(2, 48) = 2.55$, $p = .08$. Post-hoc comparisons using the LSD indicated that the mean score for the control group ($M = 39.88$, $SD = 27.37$) was significantly different from the struggling learners ($M = 61.79$, $SD = 30.35$) and marginally significant from the learners with dyslexia ($M = 56.40$, $SD = 28.73$). It also showed a marginally significant difference at the $p < .1$ level for word forming for the three groups: $F(2, 48) = 2.93$, $p = .06$. Post-hoc comparisons using the LSD indicated that the mean score for the control group ($M = 35.05$, $SD = 26.80$) was significantly different from both the struggling learners ($M = 57.43$, $SD = 30.92$) and learners with dyslexia ($M = 54.90$, $SD = 29.90$). There was no significant difference in spelling found between the groups.

Table 1. Means on the Measures of Character Reading, Word Forming and Spelling for all participants at pre and post-test

Participants	n	Character Reading		Word Forming		Spelling	
		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Dyslexic Group	20	54.00	56.40	50.15	54.90	3.60	4.90
Struggling Learners	14	54.93	61.79	51.36	57.43	4.71	4.64
Control Group	17	38.35	39.88	35.88	35.06	3.18	3.06

Paired sample t-tests were carried out to compare the progress each group made over the course of the study by comparing the means on each measure at the start and end of each intervention. There was no statistically significant difference in the scores on all three measures for the control group. There was also a slight dip in their word forming and spelling scores.

For the group of learners with dyslexia, they showed improvement in all three areas although it was not found to be statistically significant except for the spelling score. Spelling scores were significantly higher after intervention ($M = 4.90$, $SD = 3.13$) as compared to prior intervention ($M = 3.65$, $SD = 2.13$), $t(19) = 2.92$, $p = 0.008$.

For the struggling learners, they showed statistically significant improvement in their character reading and word forming scores after receiving intervention. The character reading scores were significantly higher post-intervention ($M = 61.79$, $SD = 30.35$) compared to before intervention ($M = 53.57$, $SD = 25.97$), $t(13) = 3.60$, $p = .003$. The word forming scores were also significantly higher after intervention ($M = 57.43$, $SD = 30.92$) as compared to before intervention ($M = 49.93$, $SD = 25.67$), $t(13) = 2.86$, $p = 0.01$.

Within each group, there is some variability in terms of the distribution in their character reading ability, with a larger group of students who are poorer in the control group.

Table 2 Distribution of Character Reading Scores (Within Group)

Character Reading Scores	Very Weak 0-25	Weak 26-50	Moderate 51-75	Strong Above 76
Dyslexic Group	20.0%	15.0%	35.0%	30.0%
Struggling Learners	14.3%	28.6%	35.7%	21.4%
Control Group	41.2%	29.4%	17.6%	11.8%

One-way ANOVA showed that there was significant difference in performance in the areas of character recognition, word forming and spelling between the learners of different ability within each group of students at both pre- and post-test for the both dyslexic and struggling learners that received intervention.

Table 3 Significant Difference found across Abilities at pre- and post-test (Dyslexic)

Dyslexic	Character Reading								Word Forming								Spelling							
	VW		W		M		S		VW		W		M		S		VW		W		M		S	
Ability	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Time																								
VW					Y	Y	Y	Y					Y	Y	Y	Y					Y	Y	Y	Y
W					Y	*	Y	Y					Y	Y	Y	Y							Y	Y
M	Y	Y	Y	*			Y	*			Y	Y					Y	Y					Y	Y

For the dyslexics who were receiving intervention, there was no significant difference found for the very weak and weak group for character reading, word forming and spelling. For character recognition, the mean difference between the weak and the moderate group was found to narrow and there was no significant difference between the two groups at post-test. This was also observed between the moderate and strong group.

Table 4 Significant Difference found across Abilities at pre- and post-test (Struggling Learners)

Struggling Learners	Character Reading								Word Forming								Spelling							
	VW		W		M		S		VW		W		M		S		VW		W		M		S	
Ability	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Time																								
VW			Y	Y	Y	Y	Y	Y			Y	*	Y	Y	Y	Y							Y	Y
W	Y	Y			Y	*	Y	Y	Y	*			Y	*	Y	Y							Y	*
M	Y	Y	Y	*			Y	Y	Y	Y	Y	*			Y	*							Y	*

For the struggling learners, there was a significant difference between the different abilities for character reading and word forming at pre-test but no such difference was found between the very weak, weak and moderate ability learners for the spelling task. Similar to the dyslexic group, the mean difference between the weak and the moderate group for character recognition was found to narrow and there was no significant difference between the two groups at post-test. In terms of word forming, there was a narrowing of performance difference between the very weak and weak group, weak and moderate group and the moderate and strong group such that there was no significant difference found at the time of post-test. For spelling, only the difference between the very weak group and strong group remained significantly different.

By comparing the survey done with the students prior and after the intervention, the students who underwent intervention found Chinese characters easier to learn and were able to use different methods to help themselves learn Chinese, such as with the use of pictures and short stories. They were also more confident to write in Chinese. This is consistent with the improvements shown by these students in their character recognition and word forming.

In addition, the learners with dyslexia who received intervention also reported increases in retention, being able to remember the Chinese characters they have learnt better and found them not as difficult as before. It was also reported that they started to enjoy reading Chinese books and would borrow books to take home to read. These results were consistent with what parents reported in the surveys. The parents of both groups of parents also agreed that their children had shown improvement in their Chinese language ability and were no longer as resistant to learning the language. They were also willing and looked forward to coming for classes every week.

Qualitative feedback was collected concerning the learning progress of 12 struggling learners. The educational therapists pointed out a few areas of observed similarities between the struggling learners and the learners with dyslexia who received intervention. The key areas that were identified were the inability to recognize characters and retain what they have learnt in school, not able to identify word parts and their meaning and disproportionate writing. However, word recognition strategies taught during intervention were found to help them recall characters that they have learnt when they came back for intervention in the following weeks. In terms of their learning pace, 7 of them were found to be comparable with their intervention group while three were advancing at a faster pace. The remaining two that were found to be needing more support were from a non-Chinese speaking family and suspected to have dyslexia but not labelled due to resistance from parents. While most have real difficulties in recognizing characters to read in Chinese, the additional observed reasons for the difficulties of the struggling learners includes poor motivation, no or little confidence in their ability in the language, need for attention and absence of language exposure in the home setting.

DISCUSSION

A study of the impact of intervention on 2 groups of learners showed that their performance improved after intervention, although there were no significant differences between the groups. In terms of our main research questions, this suggests that both dyslexics and struggling learners benefitted from participating in the intervention. Most strikingly, this could not be attributed simply to maturation. This is an endorsement for the intervention, which seemed to be equally effective with those struggling with Chinese, whether dyslexic or non-dyslexic.

There were no significant differences in the measures of character reading, word forming and spelling for all three groups prior to the start of intervention. This means that all three groups had a similar baseline. Although there were no significant differences found between the three groups of participants prior to the intervention, it is important to note that the control group had a lower mean score for character reading ($M = 38.35$, $SD = 28.23$), word forming ($M = 35.88$, $SD = 25.30$) and spelling ($M = 3.18$, $SD = 2.63$) as compared to the other group of participants with dyslexia and struggling to learn Chinese who took part in the intervention. We double-checked our data, because it was surprising that the controls were not significantly different at pre-test, but we concluded that this was attributable to the high degree of variability within all three groups. This meant that scores for character recognition ranged from 11 to 112 in the dyslexic group, 7 to 94 in the control group and 7 to 106 in the struggling learners. The distribution of scores within each group was also not equivalent, with more in the lower scoring bands for the control group.

The weak and moderate group of learners in the dyslexic group were found to have made more progress in their character recognition as compared to the very weak and strong learners. This is consistent with literature suggesting that very weak learners possibly need additional support for them to access learning, even in an intervention setting while the strong learners have a smaller margin for making progress.

It is interesting to note that the struggling learners were having similar performance in their spelling ability while there is a significant difference in their character reading ability. This may suggest that the link between reading and writing in Chinese is not as direct as compared to other languages that may be more transparent in its orthography. It may also be worthwhile to further investigate the skills undergirding spelling in Chinese.

While this study has given preliminary insights on the similarities of both groups in terms of errors made when reading and spelling, it is essential that a standardised literacy assessment tool be established in Singapore to accurately classify the learning difficulties a child may have when learning Chinese. Given the similarity in their learning

profiles, it is also suggested that there are possible limitations with current assessment tools in assessing for dyslexia and its application across languages.

By comparing the participants who received intervention and those who did not, the study has mitigated improvements made due to natural growth and school. The group of learners with dyslexia who received intervention showed improvement in all measures of literacy, with the difference in spelling score being statistically significant, while the control group deteriorated in their word forming and spelling scores. The Chinese intervention to some extent is effective in helping learners with dyslexia in their learning of Chinese. The gains in the literacy skills of character reading, word forming and spelling suggested that the intervention is effective in helping both students who are struggling or who had dyslexia in their learning of the Chinese language.

However, it was also notable that one of the children in the intervention groups showed a severe deterioration from pre- to post-test, which may have been attributable to a change in order at the post-test. It is possible that children lose confidence in their abilities if they fail to make progress in the early stages of the test, and may then continue to make errors, which would depress their scores. It seems that the skills of the dyslexic group, in particular, remain more fragile despite good quality support, a factor that has been identified in studies with English speaking participants. One of the children was noted to be particularly nervous during the post-test, which possibly affected the performance.

The data also suggests that the group of struggling learners were better at recognising characters and generating words from characters while only the group of learners with dyslexia showed improvement in their spelling scores. Although there was an increase in the participants' spelling scores in Shen, et al.'s study (2014), it was not found to be statistically significant. In this study, the learners with dyslexic showed a statistically significant improvement in their spelling scores. This suggests that a more structured literacy setting with reviews is important and necessary to develop their ability to spell and write characters. This difference in areas of progress between both groups that received intervention needs to be further investigated in a future study to examine if there are differences in the cognitive deficits of both groups.

No significant improvement was found on the spelling task for the struggling learners although they made statistically significant improvements in their character reading and word forming scores. This is a key difference between the two groups of learners that received intervention. This suggests that there could be other areas of weaknesses and other sublinguistic skills necessary that underpin the retrieval and writing of characters. On the intervention level, there could be a need for a clearer and more explicit instruction in getting them to write characters. It is also possible that the struggling learners were able to spell better than the learners with dyslexia at the beginning and hence, not making much progress.

It is striking that given structured and consistent support, the struggling learners were able to make greater progress than the dyslexic intervention group. It is also interesting that their starting level was equivalent to the dyslexic intervention group who had been receiving support from the DAS. This does suggest a difference in their pattern of learning, with dyslexic children showing more entrenched difficulties and taking longer to reach an equivalent stage to non-dyslexic children, including even those who are struggling learners. This mirrors the findings of Yap and Van der Leij, 1994 with Dutch children, which suggest that problems in automaticity in learning differentiate the profiles of children with dyslexia and struggling learners matched for literacy levels at pre-test.

It was also noted that participants who were struggling in their learning of Chinese were found to commit similar errors to the participants who had dyslexia, signifying similar difficulties when reading and spelling. The character reading errors committed by participants could be classified into three main types – visual, semantic and phonetic errors. Visual errors arise when one part of the character is similar to another. This is consistent with their weaknesses in visual-orthographic skills. An example is 也, 他, 地 where the characters differed in the semantic radical, which in turn gives a different meaning to the character. Another example would be 问 and 闻 which the difference of a stroke provided with an entirely different meaning. Phonetic errors refer to the mispronunciation of the character. This included the use of the wrong tone, additional sound or deletion of sounds when reading. Semantic errors constituted the third largest group of errors. A learner could confuse the characters in a word with the other, such as confusing 动 with 物. It could also happen for characters that are related in meaning.

LIMITATIONS AND FUTURE STUDY

The character reading task had 200 test items while the spelling task only had 20 test items. This would have made it more challenging than reading to show progress. Moreover, to write a character is considered a higher-order literacy skill as compared to reading. It is important to note the need to have more test items for each difficulty level to determine progress more accurately and representatively.

Through the study, it was also observed that exposure to the language at home plays an important role to the progress that a learner makes. Those with little or no exposure to Chinese in the home setting on a regular basis showed limited growth and progress. Apart from a suitable intervention, it is pivotal that the learner is also exposed to the language regularly.

The sample size in this study was small considering that the participants spanned from ages seven to eleven. It would be useful to replicate the study by increasing the number of participants for each age band to take into consideration developmental differences at different ages and compare if intervention is more effective at a younger age (Ferrer

et al., 2015). The wide spread of scores at pre-test was also notable, and a more consistent and significant result might have been obtained if the groups had been split into good and poor at pre-test.

Noting the improvements made by the struggling learners, the intervention is effective in supporting them to read better in Chinese while support for spelling needs to be looked at more closely. This opens up the possibility of extending support to a wider population of at-risk learners in the absence of a standardised Chinese literacy assessment tool.

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