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Assessment of the Effectiveness of a Chinese Literacy Assessment tool for School Learners in Singapore

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Abstract

As more school learners face difficulties in learning Chinese and requests for exemption in school, there is no standardised Chinese literacy assessment tool in Singapore that can enable educators to assess and ascertain the learning needs of these learners. Consequently, educators are unable to provide the most appropriate learning support for these learners. Hence, the purpose of this study is to assess the reliability and validity of a Chinese Literacy Assessment tool which could be standardised in future to ascertain a learner's language ability and learning difficulties. The Chinese Literacy Assessment tool (CLA) consists of five components: visuo-orthographic awareness, word recognition and morphological awareness, spelling, reading comprehension and copying. A total of 149 learners between the ages of nine to eleven years old participated in this study and underwent the CLA testing. Test of Cronbach Alpha shows that the orthographic awareness, morphological awareness, word recognition, spelling and copying tasks are reliable test items. Using one-way ANOVA, the CLA is valid in differentiating students with learning difficulties and of different ages and abilities. The results of this study suggest for revisions to be made prior to standardisation with a larger sample of students and potentially be used to inform instruction.

Keywords: Chinese Learning Difficulties, Chinese Literacy, Assessment, Singapore Mandarin, Second Language

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INTRODUCTION

There are four official languages in Singapore - English, Malay, Mandarin and Tamil. Apart from English, the rest are languages corresponding to the major ethnic group in Singapore. The bilingual language policy in Singapore requires all school learners to learn English and their mother tongue language, which is the language of their ethnic group (Mother Tongue Languages Review Committee, 2011). In special cases, learners are exempted from studying their mother tongue language. One of the reasons for exemption could arise from special education needs of a child, such as dyslexia (Chan, 2016). Dyslexia is a specific language learning difficulty that manifests itself differently in different languages (Siok, Spinks, Jin and Tan, 2009).

In Singapore, primary school learners with dyslexia may apply for exemption from studying their mother tongue language, for them to get support to cope with the learning of their other academic subjects, namely English Language, Mathematics and Science. However, difficulties in learning Chinese are not exclusive to learners with dyslexia. Bilingual learners may face difficulties learning either language due to poor foundation in language skills to cope with increasing academic demands in the classroom (Fierro-Cobas and Chan, 2001). Given that English and Chinese languages are fundamentally different (Koda and Zehler, 2008), the current existing assessment tools in Singapore may be insufficient to inform of the difficulties learners face when learning Chinese. In addition, there is currently no standardised tool in Singapore that can be used to assess the difficulties learners face when learning Chinese. Consequently, learners are unable to get the appropriate support required for them to succeed in their learning. Even though there are standardised assessment tools from Hong Kong and Taiwan, they are not suitable for use in the Singapore context as they were developed according to their norms of Chinese being their first language (Shen, Liu, Kong, See and Sha, 2014). Besides language use, the countries also differ from Singapore in the phonetic system used to support Chinese learning. For instance, Taiwan adopts the 'zhuyin fuhao' (a collection of symbols) while Singapore uses the 'hanyu pinyin' system represented by letters in the alphabet. In terms of writing, both Hong Kong and Taiwan uses the traditional Chinese script while the simplified script is used in Singapore.

The interest of this study is then to develop a literacy assessment tool for bilingual learners of Chinese ethnicity. That is, to develop a Chinese literacy assessment tool for school learners in Singapore to help educators to identify learning needs of bilingual learners who struggle with learning Chinese language to provide a more targeted intervention to support these learners. The design of the literacy assessment tool was based on a review of the literature which shows that pertaining to Chinese, children with dyslexia face difficulties with cognitive and literacy-related skills, which include word recognition, phonological sensitivity, morphological awareness, copying, spelling and comprehension.

According to Shu and Li (2012), studies have found that dyslexic children in Chinese mainly suffered from the accuracy and speed of word recognition and spelling, just as in alphabetic languages. Hence, reading measures widely used in distinguishing dyslexic from normal children are single character or word recognition measures. Yeung, et al. (2014) pointed out that word recognition is one of the major measures in the screening and diagnostic tools used in identifying children with dyslexia among Chinese children in mainland China and Hong Kong.

McBride and Wang (2015) argued that phonological sensitivity, rapid naming and morphological awareness are cores for Chinese learning. Morphological awareness is usually measured by the ability to form vocabulary words with characters, which is also known as single words. In addition, visual-orthographic abilities may be associated causally with Chinese literacy skills over time. The authors pointed out that phonological awareness and naming speed are the two deficits shared by both dyslexic children in Chinese and in alphabetic languages, and that the specific aspects of reading acquisition in Chinese are related to the characteristics of Chinese language and orthography. They concluded that morphological and orthographic awareness are particularly important to consider in understanding Chinese reading development and dyslexia.

With respect to word dictation or spelling (听写) in local context, children with dyslexia performed significantly worse than children with typical development (Cheng-Lai, et al., 2013; Chung, et al., 2011; He et al., 2011). Chung et al. (2011) also found lower performance in Chinese adolescents with dyslexia, indicating that spelling difficulties persist into adolescence. The differences in word dictation performance could be associated with morphological awareness (Chung et al., 2011; He et al., 2011) and weak orthographic representation of characters (Chung et al., 2011; Ho et al., 2006). In addition, Chung et al. (2011) found differences in visual-orthographic knowledge between adolescents with dyslexia and with typical development. Ho et al.(2006) showed that children with dyslexia tended to confuse orthographically similar characters and made higher proportions of orthographic errors.

Lam et.al. (2011)'s investigation of Chinese handwriting performance of primary school children with dyslexia, they found that children with dyslexia wrote significantly more slowly with greater average character size and variation than typical children of the same age group. They also wrote with significantly lower accuracy. Missing strokes and concatenated strokes were commonly observed writing errors. From the discriminant analysis, it was found that writing speed and accuracy could discriminate students into two groups with accuracy of over 70% for every grade.

The study by Chik et al. (2012) found that children with dyslexia performed significantly less well than the chronological age controls but similarly to reading level controls in most measures. Word level skills such as oral vocabulary and word semantics were

found to be strong predictors of reading comprehension among typically developing junior graders and dyslexic readers of senior grades, whereas morphosyntax, a text-level skill, was most predictive for typically developing senior grades. It was concluded that discourse and morphosyntax skills are particularly important for reading comprehension in the non-inflectional and topic-prominent Chinese system. Leong et al.(2007) supported the significance of the role of verbal working memory in reading comprehension, just as in English.

Based on the literature review, a literacy assessment tool that measures orthographic awareness, word recognition, copying, morphological awareness, comprehension and spelling will provide an overview of the learners' literacy-related skills. The tool is then able to assess learners who are having difficulties learning the language.

The purpose of this study is to develop and assess the effectiveness of a Chinese Literacy Assessment tool (CLA) in determining the literacy ability of a learner in relation to the population.

The aims of this study involves the following areas:

1. Is the CLA a valid tool developed to ascertain learners' language ability?
2. Is the CLA a reliable tool developed to ascertain learners' language ability?
3. What are the differences in Chinese literacy skills between learners with and without learning difficulties/differences?

The findings from this study could serve as evidence that the CLA is a reliable and valid tool in determining the learner's Chinese language ability and identifying specific difficulties in learning Chinese. In addition, the CLA is intended for future use to inform teaching pedagogy and instructional materials to cater to the needs of students with learning difficulties in Chinese.

This will shed light for educators on the development of appropriate intervention and support to be given to struggling learners. This study also serves to inform guidelines to the Ministry of Education when planning and developing curriculum and as a platform for standardisation testing in time to come.

METHOD

Development of assessment tools

The CLA is built on the foundation of the Battery of Chinese Literacy Tests, which was first adapted and revised by Shen, Liu, Kong, See and Sha (2014). The Battery of Chinese Literacy Tests consists of orthographic awareness, word learning and retrieval, stroke copying, word recognition, word forming, spelling, passage copying and oral picture

description. Development of the CLA is made with reference to this Battery of Chinese Literacy Tests and existing literature as discussed above. Subtests of the CLA comprise of orthographic awareness, word recognition, morphological awareness, spelling, reading comprehension and word copying. Description of the subtests are as follow. The developed test items were pre-piloted with a group of students and adjustments were made based on the feedback collected. The revised test was used in this study.

Orthographic Awareness Test

McBride and Wang (2015) considered orthographic awareness as a particularly important factor to consider in understanding Chinese reading development and dyslexia. The orthographic awareness test was designed with reference to commonly used character structures as proposed by 谢锡金 (2002) and the commonly used character list released by the National Assembly of People of Republic of Chinese in 2013 (在线新华字典，n.d.). In order to minimise influence from prior learning, the 30 characters selected were considered rarely and had character structures that were commonly seen in daily life to allow for generalisation. For each structure, there is a correct character, a reversed character and one with wrongly placed radicals. Participants are given a time limit of 5 minutes for this test.

Word Recognition and Morphological Awareness Test

Word recognition was pointed out by Yeung, et al., (2014) as one of the major measures in the screening and diagnostic tools used in identifying children with dyslexia in Chinese. The word recognition test measures participants' ability to recognise characters while the morphological awareness test is used to measure participants' ability and verify further if the word read in the word recognition task was accurate. The 100 items on the word recognition and morphological awareness test was selected from the 新加坡学生日常华文用字频率字典 (林、吴 and 赵, 2014) as it reflects the use of the language in the Singapore setting. Every fifth character was chosen till the 100th test item was selected. Some characters were excluded as the use of these characters is limited to situations such as surnames (李, as in 李白) and honorific terms (您, to refer to a more senior person in place of 'you'). In these instances, the word that comes after will then be selected. Reference was also made to 常用汉字581 (王永强, 2010), a list of commonly used words in China, to verify the soundness of the selection of test items. Participants are given a time limit of 20 seconds for each test item.

Spelling Test

Children with dyslexia have been found to perform significantly poorer than children with typical development (Cheng-Lai, et al., 2013; Chung, et al., 2011; He, et al., 2011) and

this problem persists into adolescence (Chung, et al., 2011). Hence, the use of spelling as a measure in the tool. The spelling test has a total of 50 items. Each item is a word consisting of two characters. The items were selected from 新加坡学生日常华文用词频率字典 (吴、林 and 赵, 2013). The list was filtered to remove words that are made up of either only one character or more than two characters. Every fifth word from the filtered list is then chosen as a test item. If the character in a word was used in an earlier chosen word, the word before or after that would be selected instead. The category of the word chosen was also taken into account, such as nouns, verbs and adjectives. Participants are given a time limit of 30 seconds for each test item.

Reading Comprehension Test

Chik, et al., (2012) in their study found that word level skills were strong predictors of reading comprehension. While students may be able to recognise individual characters, they may be unable to decode the meaning of that vocabulary. The reading comprehension test measures participants' ability to understand texts and answer questions based on their understanding. The reading comprehension test is divided into eight levels of difficulty. Each level has 20 to 30 more characters than the previous level. The words used in the reading comprehension passages are selected based on 新加坡学生日常华文用字频率字典 (林、吴 and 赵, 2014). Characters of a lower frequency are used with each increase in level (refer to table 1).

Table 1. Level of difficulty and corresponding range of character frequency

Level	Characters used
1 and 2	First 400 characters
3 and 4	401st – 800th character
5 and 6	801st – 1200th character
7 and 8	1201st – 1600th character

The theme of the reading comprehension passage and type of questions also broadens with increasing level of difficulty (see Table 2). Question type is based on Bloom's taxonomy from literal skills to higher order thinking skills such as analysis, synthesis and evaluation.

Table 2. Analysis of level of difficulty according to theme and question types

Level	Theme	Question Type
1 to 2	Personal, Family, School	Knowledge, Comprehension
3 to 4	Personal, Family, School	Knowledge, Comprehension, Application, Analysis
5 to 6	Personal, Family, School, Society, Nation-Related	Comprehension, Application, Analysis, Synthesis, Evaluation
7 to 8	Personal Growth, Friendship, Interests, Nation-related	Comprehension, Application, Analysis, Synthesis, Evaluation

Copying Test

The copying task is developed based on the findings of Lam, Au, Leung & Li-Tsang (2011) that show that children with dyslexia wrote significantly slower, with greater average character size and variation in size, and with lower accuracy. Writing errors include missing strokes and concatenated strokes. Writing speed and accuracy were found to be good discriminators for the dyslexic group. A total of 25 Chinese characters were selected as test items following the 14 basic character structures (谢, 2002) and the 25 basic Chinese strokes (在线新华词典, n.d.). The characters are arranged in a manner that all 14 character structures are tested before repeating them. If participants were unable to complete the test in five minutes, the tester can terminate the test once the student has copied the first 13 characters.

Participants

As the researchers were from the Dyslexia Association of Singapore (DAS), they had access to students who were diagnosed with dyslexia based on full psychological IQ assessments plus measures of literacy skills in English, conducted by educational psychologists. A research proposal was also submitted to DAS to gain permission to access these students for the study. For access to participants from schools, the researchers first approached the principals of these schools and sought their consent. A signed copy of Form for Collection of Data from Schools was then submitted to the Ministry of Education (MOE) Data Administration Centre for approval.

A total of 149 primary school children participated in this study. 140 participants were

recruited from four neighbourhood primary schools located in different parts of Singapore and representative of typical mainstream primary schools in Singapore. Out of which, there were 4 students below the age of 9 years and 1 student above 12 years old. Hence, their data were excluded from the study. Of the remaining 136 students, one student was reported to have dyslexia. The remaining nine dyslexic participants were recruited from the DAS. As such, there were 10 students in the dyslexic group while 135 in the non-dyslexic group.

The participants were from three different school levels, primary three, four and five. They were also controlled for their gender, types of Chinese syllabus (Chinese, Higher Chinese and Foundation Chinese) that they were studying and their school performance (Table 3). School teachers assisted in identifying and selecting students of different ability (high, mid and low) in their Chinese language based on their latest school results (see Table 3 also).

Table 3. Age, Gender and Ability Level of Participants

Age Range (Gender)	Low Ability (school results 49 and below)	Mid Ability (school results 50 to 79)	High Ability (school results 80 and above)
9 years 0 to 9 years 11 months (Total=53; boys=24, girls=29)	17	24	12
10 years 0 to 10 years 11 months (Total=53; boys=24, girls=29)	17	19	17
11 years 0 to 11 years 11 months (Total=39; boys=15, girls=24)	12	15	12

Test Administration

Five research assistants were recruited for data collection. They were each given a four-hour training session. Training content includes assessment objectives, assessment items, test administration and scoring, and administrative matters.

The five literacy tasks were administered individually in the following sequence: orthographic awareness, word recognition and morphological awareness, spelling, reading comprehension and copying. The entire test took about an hour for each student. One assessor tested one student each time. Students were assessed either during or after school hours in a classroom or a computer lab in their school.

Orthographic Awareness Test

Participants were shown a character at a time and asked to indicate if the shown character was a real word or non-word. Non-words have character parts that are wrongly placed or reversed. The order of the items was randomised for each participant. This task was done online using the QuizEgg web site. There were four practice items prior to the actual test.

Word Recognition and Morphological Awareness Test

Participants were asked to read the single word shown on PowerPoint and then form a vocabulary word with it, e.g. "演", they read "yǎn" and could form the vocabulary word "表演", "演员" etc. If it was not possible to form a vocabulary word with the single word, they could form a phrase, e.g. "的", they could form the phrase "你的书包", "这是我的铅笔" etc. This is to provide flexibility in accepting responses, as some single words may be more difficult to form vocabulary words and participants may be more familiar with the use of the single word in a phrase. However, the names of people were not accepted. The participants responded to the test items verbally. Participants attempted two practice items before the actual test. The task was discontinued when the participants failed to read and form words with nine consecutive characters. Word recognition and morphological awareness are scored separately. For morphological awareness, the accurate forming of a vocabulary word or phrase is awarded one point. Answers are also recorded for the purpose of error analysis.

Spelling Test

Participants were asked to listen to audio recordings of the test items using earphones and write their answers on the student's booklet, e.g. "我们", "应该" etc. They heard the word first, followed by a sentence containing the word, and the word again. This gave them a context for it. The task was discontinued when the participants failed to write seven consecutive words correctly.

Reading Comprehension Test

Based on the age of the participants, the administrator chose the appropriate level to start with (9 years old - level 3; 10 years old - level 4; 11 years old - level 5). Passages are administered to participants in progressive levels. Participants were asked to read the passage first, then listen to the questions in the audio recordings through earphones, and answer verbally. Participants were also provided with a whiteboard marker to make annotations during reading if they wanted to. The task was discontinued when the participant failed two levels consecutively or obtained a zero mark at one of the levels.

Copying Test

Participants were asked to copy the characters from left to right on the grid paper in the student's booklet as accurately as possible. The research assistant recorded observations made on six areas - strokes, stroke sequence, proportion, overlapping of strokes, missing strokes and additional strokes.

RESULTS

To test the reliability (Table 4) and validity (Table 5) of the tests, Cronbach's Alpha and one-way ANOVA were used for statistical analysis.

Table 4. Reliability Statistics (Cronbach's Alpha) for each Test.

Subtests	No. of Items	Cronbach's Alpha (α)
Orthographic Awareness	30	.643
Word Recognition	100	.971
Morphological Awareness	100	.971
Spelling	50	.967
Reading Comprehension	17	.567
Copying	25	.711

Most of the tests were found to have a high level of reliability. The Word Recognition and Morphological Awareness Test both consisted of 100 items ($\alpha = .975$), the Spelling Test consisted of 50 items ($\alpha = .967$), and Copying Test consisted of 25 items ($\alpha = .711$). However, the Orthographic Awareness Test which consisted of 30 items and Reading Comprehension Test which consisted of 17 items (8 levels) were found to have relatively lower levels of reliability: the Cronbach's Alphas for these were $\alpha = .643$ and $\alpha = .567$ respectively.

Table 5. Descriptive Data and ANOVA Results by Age Groups (1 = 9yrs 0mths to 9yrs 11mths; 2 = 10yrs 0mths to 10yrs 11mths; 3 = 11yrs 0 mths to 11yrs 11mths)

Subtests	Age Group	N	Mean	Std. Deviation	ANOVA	Significance
Orthographic Awareness	1	53	25.302	3.4227	F (2,142) =8.85 p<.001	3>2=1
	2	53	26.170	2.8739		
	3	39	27.872	2.0797		
Word Recognition	1	53	61.019	28.4885	F (2,142) =5.96 p=.003	3>2=1
	2	53	65.019	33.9556		
	3	39	81.744	24.0610		
Morphological Awareness	1	53	59.717	29.7557	F (2,142) =6.05 p=.003	3>2=1
	2	53	64.396	34.3222		
	3	39	81.128	23.6467		
Spelling	1	53	44.604	27.9892	F (2,142) =9.29 p<.001	3>2=1
	2	53	52.660	32.4760		
	3	39	71.385	28.2467		
Reading Comprehension	1	48	23.604	12.3336	F (2,142) =8.37 p<.001	3>2=1
	2	51	28.098	14.4489		
	3	33	35.424	10.4344		
Copy Duration	1	53	207.547	71.5288	F (2,142) =5.49 p=.005	3=2, 2=1, 3<1
	2	53	190.547	70.9942		
	3	39	161.487	48.8321		
Copying	1	53	16.547	3.8857	F (2,142) =2.87 p=.060	NS
	2	53	16.849	3.5104		
	3	39	18.359	3.9034		

Table 6. Descriptive Data and ANOVA Results by group, Dyslexic (D) and Non-Dyslexic (ND) Groups.

Subtests	Groups	N	Mean	Std. Deviation	ANOVA
Orthographic Awareness	ND	135	26.378	3.0466	F = (1,143) .947 p=.332
	D	10	25.400	3.3400	
Word Recognition	ND	135	70.252	29.8328	F = (1,143) 10.795 p= .001
	D	10	38.400	25.5439	
Morphological Awareness	ND	135	69.452	30.2373	F = (1,143) 11.10 p= .001
	D	10	36.600	27.7537	
Spelling	ND	135	56.985	31.1340	F = (1,143) 10.53 p= .001
	D	10	24.600	17.3986	
Reading Comprehension	ND	123	28.992	13.2514	F = (1,143) 10.53 p= .001
	D	9	18.778	13.7366	
Copying Duration	ND	135	189.356	68.7044	F = (1,143) .071 p= .790
	D	10	183.400	61.2684	
Copying Accuracy	ND	135	17.444	3.6522	F = (1,143) 13.16 p= .000
	D	10	13.100	3.6953	

There was a statistically significant difference between groups as determined by one-way ANOVA for most tests and their sub-scores, namely the Orthographic Awareness ($F(2,142) = 8.855$, $p < .001$), Word Recognition ($F(2,142) = 5.959$, $p = .003$), Word Formation ($F(2,142) = 6.048$, $p = .003$), Spelling ($F(2,142) = 9.293$, $p < .001$), Reading Comprehension ($F(2,142) = 8.373$, $p < .001$), and Copy Duration ($F(2,142) = 9.293$, $p < .001$). However, for the Copying Test, there was a statistically non-significant difference between groups ($F(2,142) = 2.871$, $p = .060$).

Tukey post hoc tests were conducted to compare each pair of age groups. For Orthographic Awareness, there was a clear effect of age, with both group 1 and 2 performing worse than group 3 ($p < .001$, $p = .017$ respectively), but there was a statistically non-significant difference between Age Groups 1 and 2 ($p = .278$).

For Word Recognition, there was an effect of age, with both group 1 and 2 performing worse than group 3 ($p = .003$, $p = .022$ respectively); though Age Groups 1 and 2 did not differ significantly ($p = .766$). For Morphological Awareness, groups 1 and 2 performed worse than group 3 ($p < .001$, $p = .025$), but groups 1 and 2 did not differ statistically ($p = .703$). For Spelling, again groups 1 and 2 were both worse than group 3 ($p = .009$, $p = .017$ respectively) but did not differ statistically from each other ($p = .347$).

For Reading Comprehension, groups 1 and 2 performed worse than group 3 ($p < .001$, $p = .031$ respectively), but were not statistically different from each other ($p = .191$). For Copy Duration, it was revealed that only Age Group 1 performed statistically significantly lower than Age Group 3 ($p = .003$). There was no statistically significant difference between Age Group 1 and 2 ($p = .383$), and Age Group 2 and Age Group 3 ($p = .096$).

Further analyses were undertaken comparing the students in dyslexic group (N=10) with those in the non-dyslexic group (N=135); together these formed the full group of 145 participants. These analyses were performed to further establish whether there were significant differences between the groups.

There was a statistically significant difference between groups as determined by one-way ANOVA for most tests and their sub-scores, namely Reading ($F(1,143) = 10.795$, $p = .001$), Morphological Awareness ($F(1,143) = 11.100$, $p = .001$), Spelling ($F(1,143) = 10.529$, $p = .001$), Reading Comprehension ($F(1,143) = 4.960$, $p = .028$), and Copying ($F(1,143) = 13.155$, $p = .000$). However, for Orthographic Awareness and Copy Duration, there were no statistically significant differences between the groups ($F(1,143) = .947$, $p = .332$, and $F(1,143) = .071$, $p = .790$, respectively).

DISCUSSION

The findings showed that learners with dyslexia or a lower ability performed poorer in word recognition (Shu and Li, 2012; Yeung et al, 2014), word forming as part of

morphological awareness (McBride and Wang, 2015), spelling (Cheng-Lai, et al., 2013; Chung, et al., 2011; He et al., 2011) and copying (Lam et al, 2011), which is consistent with literature. However, the areas of orthographic awareness (McBride and Wang, 2015) and reading comprehension (Chik et al, 2012) did not show as significant results. Future studies would require an in-depth investigation and revision of the orthographic awareness and reading comprehension test items to explain the differences observed with previous studies.

The results indicate good reliability and validity for the Chinese Literacy assessment tool overall. Cronbach's Alpha for each test have generally shown a good level of reliability, except for the Orthographic Awareness and Reading Comprehension tests. For these two tests, items require further review through greater scrutiny in terms of their administration.

The Orthographic Awareness test consists of a short practice session before the actual test items were administered. It was observed that students were deemed to have been "taught" how to identify wrong orthographic structures and hence most students were able to attempt the test with great ease. This is also supported in terms of the test validity as no significant differences were found between dyslexic and non-dyslexic students, as well as students aged between 10 and 11 years. Moving the cursor between the choices in the orthographic awareness task could be a variable as students that are more careful would also end up being slower and hence not able to complete the task given that this is a timed test. A revised version of the tool will be adapted to use the same number of correct answers as the wrong ones. We also discussed changing the design of the task where the student presses a key when it is a wrong answer and allows the correct answer to time out on the task.

For the Reading Comprehension tests, it was observed that there were some errors and inconsistencies between the test administrators in administering this test. Extreme scores or scores that were under- or over-measured were considered "outliers" and removed from the analysis. This has possibly affected the reliability result. The questions were also in an open-ended format, giving rise to variability in answers given.

Comparisons between subgroups of students have shown some significance in test validity in differentiating by age and learning difficulties. Further review is required in terms of level of challenge in each test and its test items. In addition to the limitations of this study, the selection and size of student sample should be reconsidered moving forward. A larger student sample for each age group would yield stronger results and perhaps produce more statistical significance. Also, a more controlled protocol in selecting high, mid and low ability students (including those with learning difficulties such as dyslexia) would provide more representative sub-groups and valid results for each sub-group of students.

The use of technology can help increase the efficiency of testing and reduce the time

required for data entry. The test on orthographic awareness was administered online and test items were shown in a randomised order. It also allowed the test to be completed under timed conditions. The students' answers to each question could also be generated within seconds. Pre-recorded explanations and test items also allowed for greater standardisation and minimised the variation that could have arisen from different testers such as pronunciation and details given for explanation. Moving forward, it is vital that technology is further incorporated to increase the efficiency and accuracy when testing. For example, the technology from the Chinese Handwriting Assessment Tool (Lam, Au, Leung and Li-Tsang, 2011) used in Hong Kong could be adapted to accurately record how students write and the errors when writing.

The CLA will be revised based on the above recommendations and test scores can then be standardised with a larger sample of students. The revised CLA is expected to be used by teachers to assess a learner's Chinese language ability and identify areas of difficulties the child is facing through error analysis. Teachers can subsequently customise curriculum and appropriate teaching strategies to support the learner.

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