

A development and validation of Traditional Chinese reading chart for students with low vision in Taiwan (I) Sighted subjects

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Abstract: (1) The purpose and scope of the study: This study aimed to develop and validate a Traditional Chinese reading chart for students with low vision in Taiwan. (2) The method used: The Traditional Chinese reading chart for students with low vision in Taiwan was developed regarding the two principles. The main design concept was the principle of continuous text, however some unrelated words were used to avoid semantic and syntactic context. Sighted subjects ($n=10$) ages range between 23 - 29 years old ($M= 25.8\pm 1.7$), visual acuity 0.0 logMAR (SPH: $-2.30\pm 1.37D$; CYL: $-0.68\pm 0.56D$). The subjects were recruited from Taiwanese students who study in University of Tsukuba, Japan. The reading performance investigated on 14 differences in characters size (0.0 logMAR – 1.3 logMAR) and 20 reading items were measured. (3) A summary of results: one way ANOVA analysis result demonstrated that the reading speed in 0.0 logMAR and 0.1 logMAR were significantly slower than other character sizes ($F(13,126) = 25.389, p < .01$), and reading item No. 4 was significantly slower, item No. 6 and No. 11 were significantly faster than other reading items ($F(19,180) = 1.571, 0.05 < p < 0.1$). Therefore, the character size in 0.0 logMAR and 0.1 logMAR, and 3 reading items namely No. 4, 6, 11 were removed. (4) Conclusions: We developed and validated a Traditional Chinese reading chart in 12 characters size and 17 reading items for investigation reading performance in Traditional Chinese with reading ability.

Keywords: Traditional Chinese reading chart; Low Vision; logMAR

INTRODUCTION

The people with low vision are usually have difficulty in reading, many of those people received the rehabilitation services because of their reading problems (Owsley, McGwin, Lee, Wasserman, & Searcey, 2009). According to the exhaustive survey of students who enrolled in Special Needs Education School for the Visually Impaired, approximately 90% of them have visual acuity range from 2.0 logMAR to 0.5 logMAR (2/200 to 20/63) used the regular print (Kakizawa, 2016).

Recently, the reading speed assessments have been used as an indicator for the people with low vision who used regular print to consider their performance in reading (Legge, Rose, Luebker & Lamay, 1989; Radner, Willinger, Obermayer, Mudrich & Eisenwort, 1998; Bailey & Lovie, 1980; Trauzettel-Klosinski, 2012; Mackeben, Nair, Walker & Fletcher, 2015). These assessments can be divided into two categories.

The first category of assessments are composed of continuous text, which require subject to present a dynamic process of reading ability (Legge et al, 1989; Radner et al, 1998). The second category of assessments use unrelated words to avoid semantic and syntactic context (Bailey & Lovie, 1980; Mackeben et al, 2015). According to the former research, indicated that the reading assessments which composed of continuous text are more effected for assessing the reading performance in various characteristic of people with low vision (Xiong, Calabrese, Cheong, & Legge, 2018).

Regarding the number of characters in each reading item, it is possible to keep constant performance during the reading process, such as using few characters in MNREAD. In contrast, it is questioning that the constant reading performance can be maintained when using traditional Chinese reading materials that contained more characters than English reading assessments? In 2016, three publishing companies in Taiwan have

published national language textbooks for grade 5 students, regularly, each book's chapter contain 636 characters in approximately. How does reading performance change, particularly for people with low vision? Therefore, as the first study in this series, this study examine reading in sighted subjects, refers to IReST (Trauzettel-Klosinski et al, 2012), using 153 traditional Chinese characters in each reading item, to explore the relationship between the reading performance and traditional Chinese characters size.

METHOD

1. Validity Evaluation

(1) Trustee:

The trustees are 5 teachers in Taiwan's elementary schools. They have been informed of the

Table 1. The participant profile in Preliminary experiment

participant	sex	age	OD		OS		VA (logMAR)
			SPH	CYL	SPH	CYL	
A	f	24	-3.00	-1.00	-1.75	-1.00	0.0
B	f	26	-2.25	0.00	-3.00	-0.50	0.0
C	f	25	-2.75	-1.00	-1.50	0.00	0.0
D	m	28	-1.75	-0.75	-2.25	-1.00	0.0
E	f	25	0.00	-1.25	0.00	-1.50	0.0
F	m	26	-3.00	-1.50	-2.75	-0.75	0.0
G	f	29	-5.75	-1.75	-5.25	-1.50	0.0
H	f	27	-2.75	0.00	-3.00	-1.00	0.0
I	f	26	-3.00	-1.00	-1.00	0.00	0.0
J	m	27	-2.75	0.00	-3.00	-1.00	0.0

Description of the preliminary experiments, and they have also agreed on th contents.

(2) Procedure:

Since the IReST simplified Chinese cersion chart is made based on the difficulty of teaching materials for the grade 5 students in elementary school, when it comes to content validity, Taiwan's textbooks and Mandarin Daily News should also meet the same standard of difficulty. Hence, the trustees aforementioned were commissioned not only to translate materials of IReST simplified Chinese version into traditional version, but also to select 13 reading items from the grade 5 Mandarin textbook of Taiwan's elementary school in the 2016 academic year, and other 5 reading items have the same difficulty level from Mandarin Daily News that published in August 2016.

2. Reliability Evaluation

Regarding the inter-rater reliability among the participants reading the 3 materials mentioned above (the IReST traditional Chinese version, Taiwan's Mandarin textbooks, and *Mandarin Daily News*), two evaluations were performed in reading items with same contents but various character sizes, and those with same character size and various contents. The unit of measurement is the reading speed (sec) in oral reading.

(1) Participant:

The participants are 10 Taiwanese students studying in University of Tsukuba, Japan. Their best corrected eyesight of 2 eyes is 0.0 logMAR (SPH: $-2.30 \pm 1.37D$; CYL: $-0.68 \pm 0.56D$). Participants' gender and age as showed in Table 1. The practiced experiment was held after participants have been informed and they were agreed for the experiment descriptions.

(2) Reading items:

The study used 10 reading items from IReST traditional Chinese version, 5 readings items of grade 5 Mandarin textbook in Taiwan's elementary school, and other 5 items from *Mandarin Daily News*, each reading item composed of various character size range from 0.0 logMAR to 1.3 logMAR, the character size gradually increased in 0.1 logMAR. Consequently, there were 280 reading items in total.

3. Test Item and Procedure

All 10 participants read with their head fixed on the visual inspection instrument, so that they could perform oral reading of the 280 items mentioned above under the fixed circumstances of 40cm standard reading distance. Participants were asked to read the items orally as quick as possible. The experiments were held totally 4 sections in a month, and each participant only tested 70 items at one time per week.

4. Analysis Method

The statistical analysis software, (IBM SPSS version 22) was applied to analyse variances for the average reading time of the 10 participants. The independent variables were the 14 types of character size and 20 reading items, and the dependent variable was the reading time.

RESULT

1. Validity Evaluation:

After selected 5 reading items of the 5th-graders' Mandarin textbook in Taiwan's elementary school and *Mandarin Daily News*, the 5 entrusted teachers reduce words of these items according to the content and confirm the new items mutually, in order to meet the same number of character of the IReST chart (153 character per item). The main design concept was principle of continuous text, however, some unrelated words have used to avoided semantic and syntactic context (2 unrelated words per page). Regarding the format of the three types of reading items, the Microsoft Word (version 2010) was used to rearrange those reading materials into 8 characters per line, 4 lines per page, and 4 pages per reading items. In total, there were 20 items. Among them, 10 items of IReST were numbered from No. 1 to No. 10, 5 items of Taiwan's Mandarin textbook were from No. 11 to No. 15, and 5 articles of *Mandarin Daily News* were from No. 16 to No. 20.

2. Reliability Evaluation

(1) Evaluation of Letter Size

The average reading speed (sec) for various letter sizes was listed as shown in Figure 2, and the analysis of variances about the character size achieves the significant level ($F(13,126) = 25.389, p < .01$). The reading speed of 0.0 logMAR and 0.1 logMAR (the red point) was significantly more than that of other character sizes. Therefore, the test case of 0.0 logMAR and 0.1 logMAR will be remove.

(2) Evaluation of reading Content

The average reading speed on various reading items were listed as in Figure 3, the Mean of reading speed (sec) was 36.35 ± 1.12 , and the analysis of variance does not achieve the 95% significant level ($F(19,180) = 1.571, 0.05 < p < 0.1$). However, the comparison between reading items No. 4 (IReST) and No. 6 (IReST), and between item No. 4 (IReST) and No. 11(textbook) reach the 90% significant level ($p < 0.1$). Item No. 4 was significantly slower, item No. 6 and item No. 11 were significantly faster than other items Therefore, the 3 reading items (the red point) will be removed. Hence, 8 reading items of IReST, 4 of Taiwan's Mandarin textbook, and 5 of *Mandarin Daily News* will be applied in further experiment. In future, the removed 3 reading items will be used in practice before the real experiment because they do not achieve the 90% significant level.

Figure 1. Example of charts (1.0 logMAR and 0.7 logMAR)

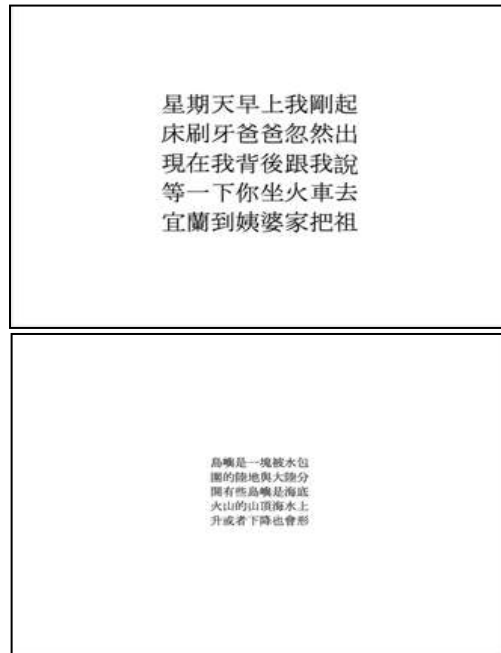


Figure 2. The average reading speed for various letter sizes

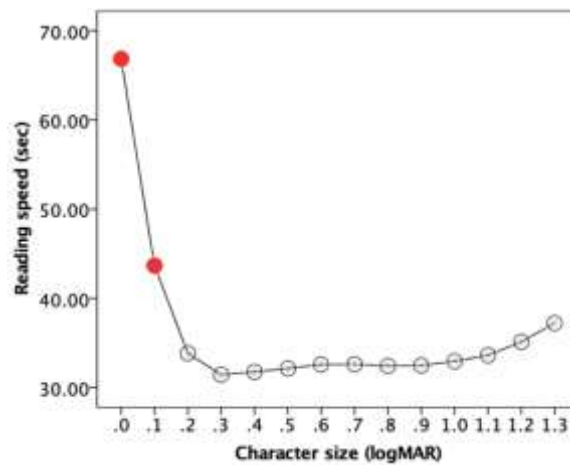
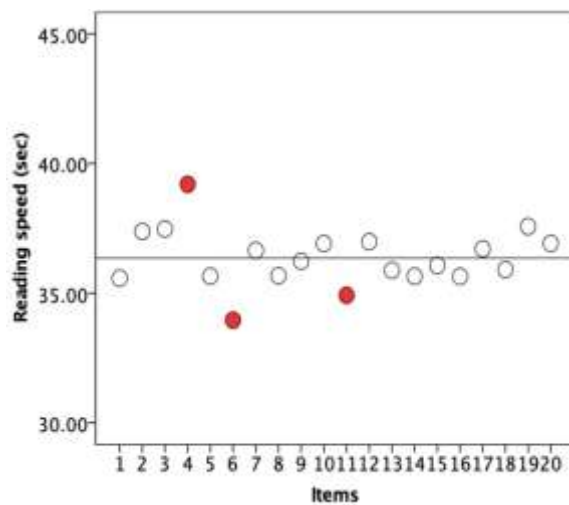


Figure 3. The average reading time on various reading items



Discussion(s)

From the relationship between the character size and the reading speed, it was found that both larger and smaller character size have lower reading speed. However, when compared with the larger character size, the reading speed corresponding to the small character size is significantly reduced. This is consistent with previous study (Legge, Pelli, Rubin, & Schleske, 1985). In addition, the reading speed of all the participants was significantly reduced from the corresponding character size and visual acuity size (0.0 logMAR) and the character size which visual acuity plus 0.1 logMAR. As the character size from the character size which visual acuity plus 0.1 logMAR, reading speed increases to the maximum speed plateaus. However, there is a difference between this result and the study of Simplified Chinese characters (Wang, Li, & Guo).

In this study, we developed a chart of Traditional Chinese version with reference to IReST, but deleted 2 IReST items according to the result. In terms of reading speed, item No.4 took longer to read and article No.6 completed it shorter. Traditional Chinese character is generally explicitly have more strokes, more complex spatial structure and take longer time to read (Chi, Cai, & You, 2001; Ma & Chuang, 2015). The result just like in item No.6 is currently remain unexplainable, and we will be analyzed in the future.

CONCLUSION

In the first step, we developed and validated a Traditional Chinese chart for measuring the reading performance of Taiwanese. 12 characters size and 17 items were confirmed to be reproducible. The present results encourage to research on the validity of this chart for assessing the Traditional Chinese reading performance in Taiwan students with low vision.

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