

Print Exposure of Taiwanese Fifth Graders: Measurement and Prediction

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Abstract Since Taiwanese readers have international and multicultural reading interests and habits, this study aims to develop a Chinese title recognition test, a translated title recognition test (TTRT), and a Chinese author recognition test as measures of print exposure for fifth graders in Taiwan, and to investigate the relative extent to which print-exposure scores, diary estimates of reading time, reading attitude, and activity preference help predict performance on number of Chinese characters recognized and reading comprehension score. The sample consisted of 318 (153 boys and 165 girls) fifth graders in 11 classes from three elementary schools in Northern Taiwan. Data analysis was performed by Pearson moments correlation and hierarchical regression analysis. We found that, TTRT and TRT composite scores had substantial prediction power for vocabulary size beyond the book-reading time estimates and print-disposition variables, and for reading comprehension beyond vocabulary size, the book-reading time estimates, and print-disposition variables. Our findings corroborate those of previous Western studies on the linkage between print exposure and reading abilities. At the same time, they invite more conversation about evaluating the various instruments used in the area of reading habits, reading disposition, and print exposure, and provide a

rationale for developing an instrument of print exposure for children from non-English speaking countries.

Keywords Print exposure · Reading performance · Instrument development · Primary school · Taiwan

Researchers have used a variety of methods to assess individual differences in out-of-school reading amount: self-reported questionnaires, daily activity diaries, and print-exposure checklists. A print-exposure checklist follows a quick-probe logic, in which names of best-selling authors or titles of popular books function as probes. Guessing is not an advantageous strategy, because it is easily detected and corrected by an examination of the number of foils checked. As a proxy of reading volume, the print-exposure checklist is based on an assumption that a person who reads frequently will know more about literature and therefore will recognize more correct items than a respondent who reads less often. According to Stanovich and West's (1989), a print-exposure checklist minimizes the complications associated with social desirability in self-reporting; it is also easier to administer and saves time as compared with diary estimates of absolute reading time.

Two print-exposure checklists, the author recognition test (ART) and the title recognition test (TRT), have been widely used and have consistently proved to be an effective measure for reflecting relative individual differences in out-of-school reading for any age group. Mol and Bus (2011) meta-analyzed 99 studies that investigated the association between print exposure and components of reading across preschoolers, students attending Grades 1–12, and college students. They found moderate to strong correlations between print exposure and many measures in the outcome domains. Their main findings are consistent

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with a developmental model of reading comprehension and technical reading and spelling, in which print exposure is considered to play an important role in shaping literacy.

Most research from the above review study was conducted in Western cultures, especially English-speaking countries. Among them, several have shared the procedure of developing print-exposure checklists for elementary-school students and focused on how print exposure helps predict children's size of vocabulary, reading comprehension, and listening comprehension. First, in an effort to extend the findings of Stanovich and West's (1989) initial creation of the ART for college students to children's reading performance, Cunningham and Stanovich (1990) demonstrated the utility of an analogous measure, the TRT, by employing children's book titles, rather than authors, as items. This TRT consisted of a total of 39 items: 25 actual children's book titles (that were not prominent in classroom reading activities) and 14 foils for book names. Later, Allen et al. (1992) revised the TRT from the previous study and developed an ART for fifth graders. They examined whether more indirect indicators of reading habits and print disposition, such as print-exposure checklists, the elementary reading attitude survey (ERAS) developed by McKenna and Kear (1990), and an activity preference survey (APS) in which "reading a book" was pitted against six other activities, converged with more direct measures, such as diary estimates of absolute reading time (Anderson et al. 1988). At the same time, Allen et al. assessed criterion validity for all measures of print habits and attitudes with several indicators of verbal ability and knowledge. The results confirmed the convergent and discriminant validity of a construct conceived as "non-school print exposure" that appears to be measured equally well by the checklists as by daily activity diaries. Then, using the TRT and ART as instruments, several studies have documented relationships between children's print exposure and their vocabulary knowledge (Cunningham and Stanovich 1991, 1997; Ecalle and Magnan 2008) and reading comprehension (Cipielewski and Stanovich 1992; Cunningham and Stanovich 1997; Echols et al. 1996; Spear-Swerling et al. 2010).

Regarding the Chinese version of the print-exposure checklist, McBride-Chang and Chang (1995) used a TRT to investigate the relationship between print exposure and reading comprehension with 100 fifth graders in Tianjin, China. They found that print exposure was substantially associated with reading comprehension, but did not significantly help predict additional variance in the reading-comprehension measure once vocabulary was added into a hierarchical regression, while memory abilities did. This study explained neither the procedure for development nor the content of the instrument. Most recently, Chen and Fang (2013, online first) presented the process of

constructing a Chinese version of the ART (CART) for college students in Taiwan and established relationships between print exposure and vocabulary size, reading comprehension, as well as scores on two general reading achievement tests (i.e., the "General Scholastic Ability Test-Chinese" and the "Departmental Required Test-Chinese"). With no uniform system of translating the names of foreign authors, however, this version of the ART consisted only of Chinese authors. The authors pinpointed this as a research limitation, since, unlike in English-speaking countries, where books originally written in English might fairly well represent most readers' relative levels of print exposure, in Taiwan, many individuals' reading experiences consist not only of works written in Chinese but also of those translated from many other languages. For example, according to eight top-ranked library loan titles and bookstore best-selling lists in 2010, 60 % of titles were translated works. Therefore, the present study aimed to develop a TRT composed of both Chinese titles and translated titles, in addition to a Chinese version of ART, for Taiwanese fifth graders, and to investigate their associations with vocabulary size and reading comprehension.

Based on the above studies, the goal of this research is fourfold: (a) to develop two versions of TRT for fifth graders in Taiwan: one a translated title recognition test (TTRT) that consists of popular children's books by writers from other languages, and, the other, a Chinese title recognition test (CTRT) that consists of popular children's books by Mandarin writers; (b) to develop a Chinese version of an author recognition test (CART) for fifth graders in Taiwan; (c) to examine the overall correlations among the print-exposure checklists (i.e., TTRT, CTRT, TRT-composite, CART), and three other types of reading habits and print disposition (i.e., diary estimates of absolute reading time, an elementary reading-attitude survey, and activity preference), as well as two criterion measures of reading performance (i.e., number of Chinese characters recognized and reading comprehension score), in order to provide preliminary evidence for the ART and TRT's construct validity; and (d) to investigate the relative extent to which print-exposure scores, diary estimates of reading time, reading attitude, and activity preference help predict performance on number of Chinese characters recognized and reading comprehension score.

Method

Developing the TRT and CART for Fifth Graders in Taiwan

Following the general principle of developing print-exposure checklists established by the Western studies, as well

as the suggestions provided by Chen and Fang (2013, online first) while constructing the CART for college students in Taiwan, we gathered initial book titles from six sources, including top-ranked lists from the three most-popular book stores, recommended reading lists from the two largest libraries in Taiwan, and books recommended by elementary school teachers.

Only books that were mentioned in multiple sources and are considered to be appropriate for fifth graders were included in the instrument for TRT pilot study. Among the 145 titles, 90 were translated works and 55 were written in Mandarin; 122 were fiction, while 23 were non-fiction. We added four “foils” to the list to identify and weed out any random responses, yielding a total of 149 titles for the TRT. From the initial book titles, we also came up with 51 Chinese authors for the children’s books, since it is rather unfeasible to include translated names of authors from other languages. Similarly, three “foils” were included, yielding a total of 54 Chinese authors for the CART.

We collected data for the pilot test on both checklists in November 2012 from 1184 fifth graders at 18 schools from Northern, Central, Southern, and Eastern Taiwan. On both the TRT and CART, we asked respondents to indicate whether or not they were familiar with the titles or the name of a particular author by putting a checkmark next to the name. To prevent respondents from marking carelessly and therefore contaminating our data, once a “foil” was checked, that particular respondent’s questionnaire was excluded from the data analysis. At the end, data from 1028 respondents were categorized as valid for the TRT, while 1135 were categorized as valid for the CART.

For the TRT, according to the 1028 fifth graders, the selection rate for each of the 145 “real” titles ranged from 0 to 914 (89 % of respondents), with a mean of 16.09 (SD = 8.783). The top two titles were removed because they are Chinese classics and some teachers reminded us that they are part of the school curriculum, which virtually all students could be expected to recognize. For the remaining 143 titles, we found that translated works not only accounted for a higher proportion (63 %), but also occupied higher rankings on the list. To be specific, the top-25 translated works on the ranking list selected to be included in the formal checklist of the Translated version of the TRT (TTRT) were ranked between 3rd and 36th, with recognition rates falling between 10 and 84 % of respondents. In contrast, the top-25 Chinese works on the ranking list selected to be included in the formal checklist of the Chinese version of the TRT (CTRT) were ranked between 9th and 91st, with recognition rates falling between 58 and 3 % of the respondents. Among the 25 translated titles, 9 were written by American authors, 9 by European authors, and 7 by Japanese and Korean authors.

For the CART, according to the 1135 respondents, the selection rate for each of the 51 “real” Chinese authors ranged from 0 to 834 (73 % of respondents), with a mean of 4.58 (SD = 3.618). This low recognition rate was consistent with the general impression and empirically supported acknowledgement that, for children, TRT was a more sensitive instrument than ART, because children may read many books but not notice author information, while ART was the most sensitive instrument for college students (Cipielewski and Stanovich 1992; Echols et al. 1996). The top-25 authors on the ranking list selected to be included on the formal checklist of the Chinese version had recognition rates between 4 and 73 % of respondents.

Conducting the Formal Study

The formal study was conducted in February and March 2013. The sample consisted of 318 (153 boys and 165 girls) fifth graders in 11 classes from three elementary schools in Northern Taiwan. All students were invited (a) to record time spent reading in a daily activity diary for seven school days and three non-school days; (b) to report reading disposition with the elementary reading attitude survey and activity preference survey as instruments; (c) to take the CART and TRT developed by this study as indicators of print exposure; and (d) to take the Chinese character recognition test and Reading Comprehension test as two criterion measures of reading performance.

Reading Habits, Print Disposition, and Print Exposure Measures

Daily Activity Diaries

We developed our instrument for collecting daily activity data based on Anderson et al. (1988) and Allen et al. (1992) forms of diaries, which proposed including nearly exhaustive and mutually exclusive activity categories. The content of the original categories reflected cultural differences, however, and so we revised them for modern Taiwanese readers. We used a graphical layout, in which extended across each row were time lines ranging from 3:00 p.m. to 12 a.m. for school days, and from 6:00 a.m. to midnight for non-school days, divided into quarter hours. Students filled out activity sheets each school day, recording their previous day’s activities. We collected data across 2 weeks, including 7 school days, a two-day-weekend in between and a national holiday on Thursday, February, 28, as a total of seven school days and three non-school days. Respondents were instructed to date each sheet and to account for all time blocks. For the purpose of this study, three kinds of time amounts were calculated: average amount of minutes spent on print-based reading

fiction and non-fiction after school across seven school days (school-day book reading time-diary), ranging from 0 to 540 (9 h); average number of minutes spent across non-school days (non-school-day book-reading time diary), ranging from 0 to 1080 (18 h); and average number of minutes spent across seven school days and three non-school days (average book-reading time diary), ranging from 0 to 702 min.

Elementary Reading Attitude Survey (ERAS)

McKenna and Kear (1990) developed the ERAS as a public-domain instrument to estimate attitude levels efficiently and reliably. We translated the ERAS into a Chinese version, and the Cronbach's alpha for the recreational, academic, and overall reading attitudes were 0.92, 0.86, and 0.93, respectively.

Activity Preference Survey (APS)

Allen et al. (1992) used the Activity Preference Survey (APS) as a print disposition measure. With the probing question of "Below you will be given a choice between doing one of two activities. Please put a check next to the one you prefer", in the Chinese version of the activity preference questionnaire, "read a book of my choice" was pitted against each of the following four activities: play an outdoor sport, watch TV, talk to my friends, and surf the Net. The subject's score on the task was simply the number of times that reading was chosen over one of these four activities, with a possible range of scores from 0 to 4.

Print Exposure Checklists

Two kinds of instrument were developed in the present study as indicators of print exposure: CART and TRT. As described above, the CART included 25 real Chinese authors and 15 "foils" and asked respondents to indicate whether or not they were familiar with a particular author by putting a checkmark next to the name. The CART score, ranging from -15 to 25, was calculated by taking the number of correct items that were checked and subtracting the number of foils checked. The TTRT consisted of 25 "real" translated titles and yielded a score from 0 to 25. The CTRT also consisted of 25 "real" translated titles and yielded a score between 0 and 25. Finally, the TRT-composite consisted of 50 "real" titles and 30 "foils" and yielded a score between from -30 and 50. In other words, we generated four kinds of scores for relative level of print exposure: CART, TTRT, CTRT, and TRT-composite score, and their Cronbach's alpha values were 0.79, 0.83, 0.71, and 0.87, respectively.

Reading Ability Measures

Chinese Character Recognition Test

Participants completed the Chinese Character Recognition Test developed by Hung et al. (2006) for elementary- and junior-high-school students. For the purpose of this study, the version designed for 3rd through 9th graders was used. This test consisted of 40 Chinese characters, which belonged to three frequency levels: 19 words from level 1, which included those characters occupying ranks above 2000 in the National Institute for Compilation and Translation (NICT) character-frequency norm; 15 words from level 2, which included those characters occupying ranks 2000–3500, with 3 words for every 300 sub-level; and 6 words from level 3, which included those characters occupying ranks 3500 to 5021, with 3 words for every 700 sublevel (Wang et al. 2008). Participants were first asked to respond to each of the test characters by writing down both its pronunciation, using the Mandarin Phonetic Alphabet, and using the character to compose a word or phrase. Then the number of characters that the participants knew was estimated, based on a list provided by the test, with a score ranging from 0 to 5021. The Cronbach's alpha for fifth graders was 0.91, and the split-half reliability score was 0.93.

Reading Comprehension Test

Participants also completed the Reading Comprehension Test developed by Ko and Zhan (2006) for second through sixth graders, with a sample of 2712. For the purpose of this study, the 5-A version designed for fifth graders was used. Participants had 25 min to read an essay and complete 31 comprehension questions. Among them, 12 questions were related to the usage of polysemous words, 6 to proposition assembly, 4 to sentence-level comprehension, and 9 to passage-level comprehension. The score ranged from 0 to 31. The Cronbach's alpha for this specific version was 0.91.

Results

Table 1 presents the N, range of scores, means, and standard deviations (SDs) of the primary measures used in this study. According to their daily activity diaries, these Taiwanese fifth graders spent an average of 8.35 min/day on book reading during school days and 18.54 min/day during non-school days. For the measures of print exposure, these fifth graders, on average, recognized a higher proportion of translated titles (11.62 out of 25) than Chinese titles ($M = 3.79$ out of 25). There is a significant difference

Table 1 Mean scores (with SDs) of research variables

	N	Min. possible	Max. possible	Obtained range	Mean	SD
Diary-school-day book reading time	312	0	540	0–72	8.35	15.10
Diary-non-school-day book reading time	312	0	1080	0–205	18.54	34.5
Diary-average book reading time	312	0	702	0–140	14.62	23.72
ERAS -recreational reading attitude	319	10	40	10–40	29.25	6.86
ERAS-academic reading attitude	319	10	40	10–40	25.53	5.83
ERAS-reading attitude total	319	20	80	20–80	54.78	11.69
Activity preference—reading	320	0	4	0–4	1.79	1.451
CTRT	318	0	25	0–15	3.79	2.72
TTRT	318	0	25	1–22	11.62	4.22
TRT composite score	318	–30	50	2–33	14.59	5.51
CART	318	–15	25	–1–14	4.15	3.12
Number of Chinese characters recognized	321	0	5021	0–4941	3384.51	890.76
Reading comprehension score	321	0	31	7–31	22.38	4.73

Table 2 Correlations among research variables

Diary-book reading time			Print disposition measures				Print exposure checklists				Criterion tasks		
1	2	3	4	5	6	7	8	9	10	11	12	13	
1	1												
2	0.563**	1											
3	0.887**	0.881**	1										
4	0.242**	0.342**	0.330**	1									
5	0.138*	0.220**	0.202**	0.696**	1								
6	0.211**	0.310**	0.294**	0.934**	0.907**	1							
7	0.311**	0.444**	0.426**	0.708**	0.462**	0.646**	1						
8	0.095	0.137*	0.131*	0.276**	0.251**	0.287**	0.212**	1					
9	0.099	0.154**	0.143*	0.371**	0.269**	0.352**	0.267**	0.588**	1				
10	0.107	0.171**	0.157**	0.400**	0.290**	0.379**	0.325**	0.735**	0.926**	1			
11	0.129*	0.112	0.136*	0.317**	0.275**	0.323**	0.223**	0.435**	0.507**	0.554**	1		
12	0.220**	0.221**	0.250**	0.347**	0.275**	0.341**	0.354**	0.233**	0.375**	0.402**	0.419**	1	
13	0.178**	0.161**	0.192**	0.226**	0.130*	0.197**	0.278**	0.162**	0.304**	0.317**	0.270**	0.492**	1

* $p < .05$; ** $p < .01$; *** $p < .001$

1 Diary-school-day book reading time, 2 diary-non-school-day book reading time, 3 diary-average book reading time, 4 ERAS-recreational reading attitude, 5 ERAS-academic reading attitude, 6 ERAS-reading attitude total, 7 activity preference—reading, 8 CTRT, 9 TTRT, 10 TRT composite score, 11 CART, 12 number of Chinese characters recognized, 13 reading comprehension score

between numbers of translated and of Chinese titles recognized by the children ($t = 40.82, p < 0.001$). They also recognized a greater proportion of book titles (14.59 out of 50) than book authors (4.15 out of 25).

Table 2 presents a matrix displaying correlations among all the variables investigated. All four print-exposure checklist scores were significantly correlated with most of the book-reading time, print disposition, and criterion variables, with CTRT showing weaker associations with the four variables, indicating that it is a weaker indicator of print exposure.

Tables 3, 4, 5, and 6 present four sets of hierarchical regression analyses examining the relative extent to which

print-exposure scores, as opposed to the book-reading time estimates and print-disposition variables, predict Taiwanese fifth graders' number of Chinese characters recognized and reading comprehension. For the purpose of the study, average book reading time was selected as the indicator for the direct measure of absolute reading time. Reading attitude total and activity-preference-for-reading were selected to represent two kinds of reading disposition. In Tables 3 and 4, average book-reading time, reading attitude total, and activity-preference-for-reading were entered first into the regression, and followed by each of the four print-exposure scores (i.e., CTRT, TTRT, TRT composite, and CART) to investigate the relative extent to

Table 3 Hierarchical regressions on number of Chinese characters recognized by entering reading habits and reading disposition first, followed by print exposure variables

	Model 1	Model 2	Model 3	Model 4	Model 5
Diary-average book reading time	68.911*	65.325*	64.197*	65.857*	56.842
ERAS-reading attitude total	15.035**	12.499*	8.357	8.562	7.359
Activity preference—reading	99.676*	98.648*	95.044*	81.493	104.022*
CTRTR		40.880*			
TTRTR			55.344***		
TRT composite score				44.302***	
CART					93.401***
R ²	0.156	0.171	0.215	0.219	0.253
R ² change		0.015*	0.059***	0.063***	0.097***
F	18.56***	15.46***	20.58***	20.99***	25.44***

* $p < .05$; ** $p < .01$; *** $p < .001$ **Table 4** Hierarchical regressions on reading comprehension score by entering reading habits and reading disposition first, followed by print exposure variables

	Model 1	Model 2	Model 3	Model 4	Model 5
Diary-average book reading time	0.269	0.256	0.243	0.252	0.228
ERAS-reading attitude total	0.005	-0.006	-0.030	-0.028	-0.021
Activity preference—reading	0.748**	0.745**	0.722**	0.659**	0.762**
CTRTR		0.178			
TTRTR			0.288***		
TRT composite score				0.221***	
CART					0.321***
R ²	0.088	0.098	0.147	0.145	0.130
R ² change		0.010	0.059***	0.057***	0.042***
F	9.66***	8.155***	12.92***	12.74***	11.19***

* $p < .05$; ** $p < .01$; *** $p < .001$ **Table 5** Hierarchical regressions on number of Chinese characters recognized by entering print exposure variables first, followed by reading habits and reading disposition

	Model 1	Model 2	Model 3	Model 4
TRT composite score	35.644***	32.317**	28.280**	25.626**
CART	81.826***	78.018***	74.126***	78.216***
Diary-average book reading time		99.238***		
ERAS-reading attitude total			13.899***	
Activity preference—reading				146.329***
R ²	0.202	0.234	0.242	0.266
R ² change		0.032***	0.029***	0.052***
F	38.52***	30.80***	33.06***	37.62***

* $p < .05$; ** $p < .01$; *** $p < .001$

which they predicted number of Chinese characters recognized and reading comprehension in addition to the three reading-habit and disposition variables. In contrast, in Tables 5 and 6, two print-exposure scores, TRT composite and CART, were entered first. CTRTR and TTRTR were

omitted from the regression models of Tables 5 and 6 at the first step, because they shared a substantial amount of information with the TRT composite score. Finally, in Table 7, we added number of Chinese characters in the model as an extended version of Table 4 to examine the

Table 6 Hierarchical regressions on reading comprehension score by entering print exposure variables first, followed by reading habits and reading disposition

	Model 1	Model 2	Model 3	Model 4
TRT composite score	0.200***	0.186***	0.197***	0.155**
CART	0.201*	0.186	0.173	0.181
Diary-average book reading time		0.401*		
ERAS-reading attitude total			0.021	
Activity preference—reading				0.622***
R ²	0.109	0.128	0.116	0.147
R ² change		0.019*	0.002	0.034***
F	18.68***	14.848***	13.60***	17.80***

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 7 Hierarchical regressions on reading comprehension score, by controlling vocabulary, then entering reading habits and reading disposition, followed by print exposure variables

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Number of Chinese characters	0.003***	0.002***	0.002***	0.002***	0.002***	0.002***
Diary-average book reading time		0.104	0.105	0.110	0.115	0.104
ERAS-reading attitude total		-0.023	-0.035	-0.047	-0.045	-0.038
Activity preference—reading		0.517*	0.526*	0.531*	0.494*	0.545*
CTRT			0.082			
TTRT				0.169**		
TRT composite score					0.126**	
CART						0.130
R ²	0.225	0.245	0.248	0.264	0.263	0.252
R ² change		0.020*	0.002	0.019**	0.017**	0.006
F	87.65***	24.31***	19.61***	21.43***	21.25***	20.03***

* $p < .05$; ** $p < .01$; *** $p < .001$

relationship between vocabulary, print exposure and reading comprehension.

In Table 3, Model 1 reveals that the average book-reading time collected by the daily activity diaries, reading attitude total, and activity-preference-for-reading scores altogether helped predict 15.6 % of the variance in performance on number of Chinese characters recognized. Models 2, 3, 4, and 5 show that, in addition to the direct measure of absolute reading time and the two reading disposition variables, when CTRT, TTRT, TRT composite, and CART were each entered as the second step in these hierarchical models, all four contributed to a significant increase in the overall model fit, adding 1.5, 5.9, 6.3, and 9.7 % of the variance, respectively.

In Table 4, Model 1 reveals that average book-reading time, reading attitude total and activity-preference-for-reading scores altogether helped predict 8.8 % of the variance in performance on reading comprehension, with the activity-preference-for-reading score found to be the only significant predictor. Models 2, 3, 4, and 5 showed that in addition to the three reading habits and reading

disposition variables, when CTRT, TTRT, TRT composite, and CART were each entered as the second step in these hierarchical models, TTRT, TRT composite, and CART all contributed to a significant increase, explaining 5.9, 5.7, and 4.2 % of the variance, respectively. CTRT was the only exception.

In Table 5, Model 1 reveals that TRT composite score and CART altogether helped predict 20.2 % of the variance in performance on number of Chinese characters recognized. Models 2, 3, and 4 showed that in addition to the two print-exposure scores, when average book reading time, reading attitude total, and activity preference-reading scores were each entered as the second step in these models, they all contributed to a significant increase, explaining 3.2, 2.9, and 5.2 % of the variance, respectively.

In Table 6, Model 1 reveals that TRT composite score and CART altogether helped predict 10.9 % of the variance in performance on reading comprehension. Models 2, 3, and 4 showed that in addition to the two print-exposure scores, when average book-reading time, reading attitude total, and activity-preference-for-reading scores were

entered as the second step in these hierarchical models, average book-reading time and activity-preference-for-reading scores both contributed to a significant increase, explaining 1.9 and 3.4 % of the variance, respectively.

In Table 7, we added number of Chinese characters in the model, and found that, TTRT and TRT composite in Models 4 and 5 still contributed to a significant increase for reading comprehension in addition to the three reading habits and reading disposition variables, after controlling for vocabulary; but CART did not contribute to a significant increase.

To sum, our results suggested that, for number of Chinese characters recognized, average book-reading time, reading attitude total, and activity-preference-for-reading altogether accounted for 15.6 % of the variance, but TRT composite score and CART altogether accounted for 20.2 % of the variance, according to Tables 3 and 5. Furthermore, in addition to the three reading habit and disposition scores, TTRT, TRT composite and CART scores each contributed to a strong significant increase, ranging 5.9–9.7 % of the variance in performance on number of Chinese characters recognized, but in addition to the two print-exposure scores, the three reading habit and disposition scores each contributed to a significant increase, ranging from 2.9 to 5.2 %. In other words, print-exposure scores, with the exception of CTRT, were found to be better predictors for performance on number of Chinese characters recognized than the three reading habit and disposition scores.

Similarly, our results indicated that, for reading comprehension, average book-reading time, reading attitude total, and activity preference-reading altogether accounted for 8.8 % of the variance, but TRT composite score and CART altogether accounted for 10.9 % of the variance, according to Tables 4 and 6. However, it is important to note, even though CART has higher explanatory power than TTRT and TRT composite on the vocabulary size, as shown in Table 3, when we added vocabulary size as the control variable in Table 7, the effect of CART on reading comprehension became non-significant. The results suggested that CART just correlated with number of Chinese character recognized, and it might not be a valid instrument for measuring print exposure, like TTRT and TRT composite scores.

Discussion

Even though using recognition checklists as the instrument for determining the relative levels of print exposure for children has been well recognized as being an effective method, and the linkage between print exposure and reading-related performance has been well established, the

role of translated books in the composition of a checklist developed for non-English speaking countries has never before been explored in the literature. Since Taiwanese readers have international and multicultural reading interests and habits, in this study, we constructed a version of a translated title recognition test (TTRT), which consisted of popular children's books by writers from other languages; a version of the Chinese title recognition test (CTRT), which consisted of popular children's books by Mandarin writers; and a version of the Chinese author recognition test (CART) for Taiwanese fifth graders, based on previous studies from Western cultures and on a study about developing a Chinese author recognition test for college students in Taiwan (Chen and Fang 2013, online first). In total, four kinds of scores were calculated for the purpose of this study: TTRT, CTRT, TRT composite score, and CART score.

This study found that, among the four instruments, TTRT and TRT composite scores not only had higher correlations with performance on number of Chinese characters recognized and on reading comprehension than average-book reading time collected by the diaries, reading attitude total, and activity preference-reading, but they also had substantial prediction power for vocabulary size beyond the book-reading time estimates and print-disposition variables, and for reading comprehension beyond vocabulary size, the book-reading time estimates, and print-disposition variables. On the other hand, CART was found to have relatively higher predictive power on vocabulary size than TTRT and TRT composite beyond the book-reading time estimates and print-disposition variables, but the effect on reading comprehension was non-significant beyond vocabulary size, the book-reading time estimates, and print-disposition variables. These results seemed to corroborate with findings from a couple of previous studies that TRT was a more sensitive instrument than ART for elementary-school children (e.g. Cipielewski and Stanovich 1992; Echols et al. 1996). Furthermore, the results that CTRT, the version of Chinese Title Recognition Test alone, was unable to predict reading comprehension beyond time spent book reading, reading attitude total and activity-preference-for-reading were not surprising, considering that both in pilot study and in formal study, fifth graders were not very familiar with Chinese titles. For example, the mean score for recognizing Chinese title in formal study was only 3.79 out of 25, and the highest score obtained was only 15, compared to a mean score of 11.62 on TTRT, indicating CTRT score might not be an ideal indicator for actual degree of print exposure, rather, TTRT score would provide more accurate estimation. Since Taiwanese children were found to read a lot more books by foreign writers than those by domestic ones, future studies are recommended to explore whether this is the unique

characteristic of Taiwanese children, or it is a common phenomenon across Asia–Pacific regions because of the globalization. Overall, with TTRT and TRT composite as proxies of reading volume, this study established there was a linkage between print exposure and reading performance for Taiwanese fifth graders, results generally consistent with findings from numerous previous studies (Cipielewski and Stanovich 1992; Cunningham and Stanovich 1991, 1997; Ecalle and Magnan 2008; Spear-Swerling et al. 2010).

In addition to results consistent with those in the extant literature, some of our findings add dimensions to understanding the relative extent to which various instruments used in the area of reading habits, reading attitudes, and print exposure are associated with performance on both number of Chinese characters recognized and reading comprehension. First, while Allen et al. (1992) suggested that their results provided evidence to support a construct argued to be best conceived of as non-school print exposure that appears to be measured equally well by the checklist tasks and by the activity-diary method, our findings suggested that recognition test scores are better predictors for both performances on numbers of Chinese characters and on reading comprehension than the direct measure of absolute time spent on reading. A reasonable explanation is that spending more time on extracurricular book reading does not necessarily equal more reading volume, because the factor of reading ability might play an important role. Our findings suggest that, rather than being a substitute for activity diaries, which collect absolute reading time for the sake of convenience, checklists that provide information on relative reading volume may serve as better indicators for actual reading amount than reading time collected by activity diaries. Second, between the two reading disposition variables, we found that the easy-to-administer activity preference survey on reading appeared to be a better predictor for reading performance, especially for reading comprehension, than the widely used reading-attitude survey. These findings provided insights into selecting instruments to assess reading behaviors and invite future research for in-depth investigation.

Finally, this study has at least two limitations. First, even though in pilot study we collected data from children of various regions in Taiwan to develop the instrument for print exposure, in formal study, all of our subjects were from Northern Taiwan with higher SES. For example, while Wang et al. (2008) that adopted a probability proportional to size (PPS) sampling techniques, obtained a mean score of 3142.08 (SD = 996.16) on number of Chinese characters recognized for fifth graders, we obtained a higher mean score of 3384 (SD = 890.76). Secondly, we are unable to get the SES information from our subjects in

the formal study. Therefore, the impact of SES factors was unexamined in this present study. Overall, our findings corroborate those from previous Western studies on the linkage between print exposure and reading abilities, number of Chinese characters recognized and reading comprehension. A unique feature and a major contribution of the present study lies in taking translated book titles into consideration when developing a TRT for Taiwanese fifth graders and providing empirical evidence to support the significance of making this decision for the first time in the literature. We hope the above findings shed light on the process of developing measures for print exposure for researchers from other non-English speaking countries.

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References

- Allen, L., Cipielweski, J., & Stanovich, K. E. (1992). Multiple indicators of children's reading habits and attitudes: Construct validity and cognitive correlates. *Journal of Educational Psychology, 84*(4), 489–503.
- Anderson, R. C., Wilson, P. T., & Fielding, L. G. (1988). Growth in reading and how children spend their time outside of school. *Reading Research Quarterly, 23*, 285–303.
- Chen, S. Y., & Fang, S. P. (2013). Developing Chinese version of an author recognition test for college students in Taiwan. *Journal of Research in Reading*. doi:10.1111/1467-9817.12018.
- Cipielewski, J., & Stanovich, K. E. (1992). Predicting growth in reading ability from children's exposure to print. *Journal of Experimental Child Psychology, 54*, 74–89.
- Cunningham, A. E., & Stanovich, K. E. (1990). Assessing print exposure and orthographic processing skill in children: A quick measure of reading experience. *Journal of Educational Psychology, 82*(4), 733–740.
- Cunningham, A. E., & Stanovich, K. E. (1991). Tracking the unique effects of print exposure in children: Associations with vocabulary, general knowledge, and spelling. *Journal of Educational Psychology, 83*(2), 264–274.
- Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology, 33*(6), 934–945.
- Ecalles, J., & Magnan, A. (2008). Relations between print exposure and literacy skills: New evidence from Grade 1-5. *British Journal of Developmental Psychology, 26*(4), 525–544.
- Echols, L. D., West, R. F., Stanovich, K. E., & Zehr, K. S. (1996). Using children's literacy activities to predict growth in verbal cognitive skills: A longitudinal investigation. *Journal of Educational Psychology, 88*(2), 296–304.
- Hung, L. Y., Wang, C. C., Chang, Y. W., Chen, H. F., & Chen, Q. S. (2006). *Size of Chinese characters test for elementary and junior high school students*. Taipei: Ministry of Education in Taiwan.
- Ko, H. W., & Zhan, Y. L. (2006). *Reading comprehension test for elementary school students*. Taipei: Ministry of Education in Taiwan.
- McBride-Chang, C., & Chang, L. (1995). Memory, print exposure, and metacognition—Components of reading in Chinese. *International Journal of Psychology, 30*(5), 607–616.

- McKenna, M. C., & Kear, D. J. (1990). Measuring attitude toward reading: A new tool for teachers. *The Reading Teacher*, *43*, 626–639.
- Mol, S., & Bus, A. (2011). To read or not to read: A meta-analysis of print exposure from infancy to early adulthoods. *Psychological Bulletin*, *137*(2), 267–296.
- Spear-Swerling, L., Brucker, P. O., & Alfano, M. P. (2010). Relationships between sixth-graders' reading comprehension and two different measures of print exposure. *Reading and Writing*, *23*(1), 73–96.
- Stanovich, K. E., & West, R. F. (1989). Exposure to print and orthographic processing. *Reading Research Quarterly*, *24*, 402–433.
- Wang, C. C., Hung, L. Y., Chang, Y. W., & Chen, H. F. (2008). Number of characters school students know from Grade 1 to G9. *Bulletin of Educational Psychology*, *39*(4), 555–568.