Asia Pacific Journal of Developmental Differences
Vol. 4, No. 2, July 2017, pp 145—166
DOI: 10.3850/S2345734117000090

Investigation of cognitive factors related to Filipino and English reading literacy of third-grade Filipino children

Lhannie Estrera[1*] and Akira Uno[1]

1. *University of Tsukuba*

ABSTRACT

This study investigated the cognitive factors relating to the reading of a relatively transparent and an opaque script: Filipino and English. The characteristics of cognitive skills of good and poor readers of Filipino and English were also examined. A total of 98 Filipino third-grade children studying in Manila were assessed for their phonological skills, visual processing skills, receptive vocabulary, nonverbal intelligence and reading literacy skills in Filipino and English. Results of multiple regression analyses revealed that phonological awareness and naming speed were significant predictors for both Filipino and English reading. However, receptive vocabulary significantly predicted English reading, but not Filipino reading. Comparison of readers showed similar results in which poor readers showed significantly poor performance in phonological processes and naming speed in both Filipino and English. A significant difference was also found for receptive vocabulary between poor and good readers in English, but not in Filipino. It is likely that the difference in orthographic depth affected the degree of contribution of vocabulary towards reading in Filipino and English. Current findings have implications on assessing children with reading difficulties. Further research is recommended to have more in-depth understanding of reading for Filipino children.

Keywords: cognitive skills, Filipino reading, English reading

**Correspondence to:*
Lhannie Estrera, Doctorate student under the Kansei, Behavioral and Brain Sciences Program in University of Tsukuba
E-mail: s1730386@s.tsukuba.ac.jp; lhannie.estrera@gmail.com

Introduction

Reading is a complex skill that seems simple and automatic when developed normally. However, research on reading acquisition has shown that reading requires cognitive prerequisites (Goswami, 2000) and that a deficit in one or more of such cognitive processing would lead to reading difficulty. Many researchers are in consensus that one of the core factors for reading is phonological awareness (Gough, et al., 1992; Rack, Snowling, & Olson, 1992; Snowling, 2001; Cornwall, 1992; Goswami, 2000; Muter, et al., 2004; Ziegler & Goswami, 2005).

Other cognitive abilities related to reading literacy include visual cognitive processes, vocabulary, naming speed and other phonological processing skills such as verbal short-term memory (McBride, 2016; Metsala, 2011; Dillon & Pisoni, 2006; Wolf & Bowers, 1999; Wolf, et al., 2002). However, it is important to note that these researches are usually focused on literacy in English. Increasing number of studies regarding other languages have shown that models of reading in English may not be generalized to other languages (e.g., Su, et al., 2010) and that contributions of underlying cognitive predictors of reading may differ among scripts and languages (McBride-Chang & Kail, 2002). For this reason, it is necessary to research not only about the English language, but other languages as well.

One of the less researched languages in the field is Filipino. Together with English, Filipino is one of the official languages of the Philippines. Filipino refers to the many different languages and dialects spoken in the country. Both Filipino and English are studied during the elementary schoolyears of children and are learned as early as the first grade. Both also use the same alphabet writing system (Aa, Bb, Cc); however the two languages differ in terms of letter-to-sound and sound-to-letter (grapheme-to-phoneme and phoneme-to-grapheme) correspondences. English is considered to have a highly opaque orthography because of its inconsistent grapheme-phoneme correspondences. According to Helmuth (2001), English has 1,120 ways to spell its 40 sounds. In contrast, Tagalog, one of the commonly spoken Filipino languages all over the country, is considered more transparent because of its nearly perfect relationship between sounds and letters (Ocampo, 2004).

The studies of Everatt and colleagues (2002; 2004; 2010) showed how a young Filipino reader may display different cognitive deficits depending on the language being observed. They demonstrated that there are issues and a need for appropriate assessment tools across language and bilingual context. However, they did not provide any concluding statements regarding what cognitive factors would have a significant role for Filipino and English reading.

With the lack of research regarding Filipino and English reading, it is the aim of the current study to determine the cognitive processes that would predict Filipino and English literacy attainment of Filipino children. In particular, Tagalog, the language mainly spoken in Manila, was the Filipino language used in the

study. The cognitive skills examined in this study are further discussed below.

Cognitive factors underlying reading

According to Ziegler and Goswami (2005), the process of phonological recoding or the mapping between letters and sounds is essential for reading. They explained in their review that the phonological system, representation of phonological structures that are used in mapping on symbols (graphemes, letters or characters), is highly important for reading and that difficulty in reading stems from an impaired phonological system.

The typical way of examining the phonological system is through experimental measures of phonological awareness skills which is the awareness of speech sounds with the ability to reflect on and manipulate such sounds (Stahl & Murray, 1994; Ziegler & Goswami, 2005). This ability is assessed with sound manipulation tasks such as phoneme deletion tasks and spoonerisms. Many studies have shown that phonological awareness strongly predicts reading acquisition across languages and that good phonological awareness skills are characteristics of good readers, while poor phonological awareness skills are characteristics of poor readers (Ziegler & Goswami, 2005; Snowling, 2001; Cornwall, 1992; Goswami, 2000; Muter, et al., 2004; Caravolas, et al., 2005; Batnini & Uno, 2014).

If mastery of mapping sounds to letters would lead to successful reading, then it should follow that there should not be any reading difficulty when reading transparent orthographies which has consistent grapheme-phoneme correspondence (GPC). However, previous studies of transparent scripts have already shown otherwise and though the prevalence is small compared with English counterparts, people with reading difficulty (people with dyslexia) are present within the population who use transparent orthography such as Italian, Finnish, vowelized Arabic, Czech, and Japanese Kana (Dulude, 2012; Barca, et al., 2006; Paulesu, et al., 2012; Caravolas, et al., 2012; Batnini & Uno, 2014; Uno, et al., 2009).

Wolf and Bowers (1999; 2002) proposed the double deficit hypothesis. They posit that in addition to phonological awareness, naming speed is another core factor related to reading and that there are children who would show no deficits in phonological awareness but would show deficits in naming speed. Naming speed or Rapid Automatized Naming (RAN) is the fluency to name aloud a series of letters, digits, objects, or colors.

A study regarding Finnish, a highly transparent orthography, has shown that phonological awareness failed to predict the delayed learning process of late readers and that naming speed is one of the factors that explained the variance between late readers and early readers (Holopainen, et al., 2001). It has been suggested that more than phonological awareness, naming speed may be a better predictor for transparent orthographies particularly in later stages of reading development (Lyytinen, et al., 2006; Landerl & Wimmer, 2008). There is no clear explanation for the role of RAN

in reading, however, it has been suggested that RAN involves many processes related to reading. An example would be the access and retrieval of phonological information, a lexical process related to reading (Wolf, et.al, 2002).

Verbal short-term memory (STM), a component of phonological processing usually measured through non-word repetition, and vocabulary size have also been found to contribute unique variance for reading. Both are used in distinguishing children with reading difficulties (Metsala, 2011; Dillon & Pisoni, 2006; Scarborough, 1990). However, phonological awareness and naming speed are recommended to have more predicting power, as there were also studies which reported that verbal STM (Parrila, et al., 2004) and vocabulary (Ziegler, et al., 2010) as not significant predictors for reading.

Another underlying cognitive factor for reading literacy is visual processing. However, this ability may be more important in non-alphabetic scripts like Chinese characters than alphabetic scripts like English (McBride, 2016). Nonetheless, these abilities were also examined in the current study.

To determine the cognitive predictors for Filipino and English reading, phonological processing skills, naming speed, visual processing skills, receptive vocabulary and reading literacy skills of third-grade Filipino children were assessed.

Method

Participants

A total of 102 Filipino children in the third grade of a public elementary school in Manila initially participated in the study. A general intelligence test, i.e., Raven's Coloured Progressive Matrices test (RCPM), was administered to the participants. Children whose scores showed 'normal' performance (greater than –2SD of the mean) were included in the study for a total of 98 participants. The children were aged between 7 and 10 years old.

A permit from the Department of Education of the Philippines to conduct the study was obtained. Informed consent and approval were received from the school principal, teachers, parents and children. All of the participants were recruited through the school and their cooperation was voluntary. There were no known risks for the participants and they were free to withdraw from the study at any time without explanation. This study was approved by the Research Ethics Committee of the Human Sciences at the University of Tsukuba (ID NO. 27-89).

Procedure

The tests were conducted from November 2015 to January 2016 which was the third quarter of the academic schoolyear. There were two test sessions throughout the study which were conducted in the classrooms: a group session and an individual session. In the group session, RCPM, Rey-Osterrieth Complex Figure Test

(ROCFT), and receptive one-word picture vocabulary test in Filipino and English were administered. In the individual session, Rapid Automatized Naming task (RAN), phonological processing tasks and reading tasks for both Filipino and English were administered. To control for the order effect of the language, the participants were randomly assigned to either a session of Filipino tests were first administered or English tests were first administered.

Tests and Materials

Cognitive tests

Nonverbal intelligence test

The Raven's Coloured Progressive Matrices (RCPM) was used as a nonverbal intelligence test which included 36 items. The test was divided into three sets, 12 items each. The items were ordered in increasing difficulty. In each item, a coloured pattern with a missing part was presented to the participants. They were then asked to select the correct missing part out of six choices. The score of the participants for this test was their total number of correct answers for the three sets (Cronbach alpha reliability score was .87).

Visual cognitive processing test

The Rey-Osterrieth Complex Figure Test (ROCFT) was used to assess visual perception and memory which included three conditions: copy drawing, immediate recall and delayed recall. In the copy condition, the participants were first asked to copy a complex figure. After completing the drawing, the copy was removed and the participants moved on to the immediate recall condition. The participants were asked to reproduce the drawing without having a copy. In the delayed recall condition, the participants were asked to reproduce the drawing once again after 30 minutes. (Cronbach alpha reliability for the copy, immediate and delayed were .71, .82, and .80, respectively.)

Receptive vocabulary

Filipino and English receptive vocabulary tests (RVT) were derived from the One-word Picture Vocabulary Test (Martin & Brownell, 2011). Each test had 15 items. In each item, a set of four pictures was presented. The participants were then asked to listen to a target word and select from the four pictures that corresponded to the target word. Since the test was originally in English, the target word was translated for the Filipino version. All items in English were completely different from the Filipino version. The score for the tests were the total number of correct answers. (Cronbach alpha reliability for Filipino and English RVT were .45 and .58, respectively)

Automatization

The Rapid Automatized Naming (RAN) task by Kaneko and colleagues (2004) was used as a rapid naming task. On an A4 size sheet of paper, 20 stimuli arranged in four rows, five stimuli in each row, was presented to the participants. The participants were required to name aloud each stimulus as quickly as

possible. The stimulus was either a drawing of an object (cat, sheep, feet, hat, pencil, dog, banana, chair, scissors and umbrella) or a digit (one to nine). The RAN task had one practice and three trials. The RAN was conducted in both English and Filipino at different times. The duration of naming all stimuli was measured in each trial. The average duration for the three trials was used as the RAN speed. (Cronbach alpha reliability for Filipino and English RAN were .88 and .82, respectively).

Phonological processing task

Non-word repetition task

In both Filipino and English tasks, a total of 5 non-words were verbally presented to the participants. The participants were asked to listen carefully and to repeat the non-word. The task had at least one practice trial. The English non-word repetition task was derived from the non-words in Woodcock Reading Mastery Tests – Revised (Woodcock, 1998). For the Filipino non-word repetition task, real words were manipulated by changing a letter, a syllable, or the order of the syllables of the original word. The words were derived from the most frequently used words in the textbooks used in English and Filipino classes. The score of the participants was the total number of correctly pronounced non-words out of the 5 items. (Cronbach alpha reliability for Filipino and English tasks were .65 and .48 respectively).

Phoneme deletion task

In both English and Filipino versions, initial and final phoneme deletion subtasks were administered. There were five items for each subtask for a total of 10 words. Each word was verbally presented to the participants and they were asked to repeat the word. They were then asked to repeat the word again but this time omitting a target sound which was either the initial or final phoneme of the word. The task had at least one practice trial. The words were derived from the most frequently used words in the textbooks used in English and Filipino classes. The score of the participants was the total number of correct answers out of the 10 items. (Cronbach alpha reliability for Filipino and English tasks were .80 and .75, respectively)

Syllable repetition in reverse order task

This task was only done in Filipino, since the Filipino words are usually CVC, CVCVC or CVCCVC in which the words can be easily broken down in syllables. A total of 10 words were verbally presented to the participants. They were first asked to listen carefully and repeat the word before repeating the word in reverse order syllabically. For example, the Filipino word baboy should be repeated in reverse order as boyba. The task had at least two practice trials. The score of the participants was the total number of correct answers out of the 10 items. (Cronbach alpha reliability was .59)

Reading tasks

The reading task had three subtasks: non-word reading, word reading and paragraph reading tasks. The stimuli for the Filipino non-word, and English and

Filipino word reading tasks were derived from the most frequently used words in the textbooks used in the English and Filipino classes. For the Filipino non-words, real words were manipulated by changing a letter, a syllable, or the order of the syllables of the original word. The English non-word reading task was derived from the non-words Woodcock Reading Mastery Test. The paragraphs used for both English and Filipino paragraph reading tasks were original text of the study, again using the textbooks as reference for the words to include in the paragraph.

Non-word reading task

In both Filipino and English versions, a total of 10 non-words printed in an A4 size sheet of paper was presented to the participants. They were then asked to read aloud each non-word. The score of the participants was the total number of correctly read non-words out of the 10 items. (Cronbach alpha reliability for Filipino and English tasks were .67 and .66, respectively).

Word reading task

In the English task, the word reading task was divided into two subtasks with 15 items each: regular and irregular words. Regular words consisted of words that could be easily read through consistent letter-sound rules. Irregular words were exception words that could not be easily read through consistent letter-sound rules. The Filipino task consisted of 25 words arranged in increasing number of syllables. All of the list of words were presented in an A4 size sheet of paper. The participants were asked to read aloud the words as accurately as possible. The total number of correctly read words was the score of the participants. (Cronbach alpha reliability for Filipino word reading was .86 while regular and irregular words in English reading tasks were .92 and .89, respectively).

Paragraph reading fluency task

In both English and Filipino tasks, a single paragraph consisting of 100 words was presented in an A4 size sheet of paper. The participants were asked to read the paragraph aloud as accurately and as quickly as possible. The score of the participants was the number of words correctly read in one minute. (Cronbach alpha reliability for Filipino and English tasks were .88 and .91, respectively).

Analyses

Pearson correlation analyses was done separately for English and Filipino variables to determine the correlation among the variables. Separate multiple regression analyses were performed on Filipino and English measures to determine which cognitive factors would predict Filipino and English reading. The reading measures (non-word reading, word reading, and paragraph reading fluency) were the dependent variables while the cognitive ability measures were the independent variables. In both Filipino and English variables, initial and final phoneme deletion were found to be highly correlated with each other, thus phoneme deletion was considered as a single independent variable by using the

sum of initial and final phoneme deletion scores. In addition, ROCFT immediate condition was excluded from the analyses to avoid multicollinearity since it was found to be highly correlated with ROCFT delayed condition. Thus, the following cognitive measures were considered as the independent variables in the analyses: RVT, ROCFT copy, ROCFT delay, RAN, non-word repetition, and phoneme deletion. The syllable repetition in reverse order was also included in the analyses for Filipino reading.

To have an understanding regarding the characteristics of children who have reading difficulty, the participants were divided into groups of poor and good readers. Participants who scored less than -1.5SD of the mean in the paragraph reading fluency task in Filipino were selected as poor readers in Filipino. Similarly, participants who scored less than -1.5SD of the mean in the paragraph reading fluency task in English were selected as poor readers in English. Those who scored greater than -1.5SD of the mean in the paragraph reading fluency tasks were classified as good readers. The scores of the poor and good readers in the cognitive tasks were then compared through the Mann-Whitney U test.

Results

Descriptive statistics for each measure for the 98 children are shown in Table 1. The results showed that the participants tend to have high scores in all measures with the mean scores nearing the maximum score for the test except for paragraph reading in both Filipino and English. Though there was only a small difference, scores in the Filipino tasks tend to be higher than those of the English tasks.

Results of the correlation analyses are shown in Table 2 and Table 3. Correlation analysis among Filipino variables showed that cognitive measures of Rapid Automatized Naming (RAN), non-word repetition, phoneme deletion and its components, and syllable repetition in reverse order were significantly correlated with reading measures with moderate to high correlation coefficient (from $r = 0.34$ to $r = 0.68$). An exception to this was receptive vocabulary test (RVT), and Rey-Osterrieth Complex Figure Test (ROCFT) copy, immediate and delayed recall condition. ROCFT copy, immediate and delayed had low to moderate correlations to most of the other measures (from $r = 0.03$ to $r = 0.33$), and have high correlation among its components (from $r = 0.58$ to $r = 0.78$). RVT was also found to be significantly correlated only to ROCFT components and RAN with low to moderate correlations (from $r = 0.24$ to $r = 0.36$), but not with the other measures. The highest correlation in the analysis was found between phoneme deletion and its components (from $r = 0.6$ to $r = 0.91$), between non-word reading and word reading ($r = 0.84$) and between ROCFT immediate and delayed ($r = 0.79$).

Correlation analysis among the English variables showed a similar pattern where almost all measures of cognitive abilities and literacy measures were significantly correlated with each other with moderate to high correlation coefficient (from $r = 0.36$ to $r = 0.83$). Similar to the Filipino variables, ROCFT components did not

Table 1—Descriptive statistics on cognitive and literacy measures

Variable	Minimum	Maximum	Mean	SD
Age	7	10	8.32	0.64
Nonverbal intelligence				
RCPM (/36)	13	35	25.97	5.92
Visual cognitive processing				
ROCFT copy (/36)	17.0	35.0	27.27	3.95
ROCFT immediate (/36)	6.0	32.0	20.95	5.68
ROCFT delayed (/36)	9	31	20.31	5.28
Filipino tasks				
Receptive vocabulary test (/15)	6	15	11.63	1.96
RAN (sec)	14.61	63.70	24.98	8.99
Non-word repetition (/5)	0	5	4.52	0.90
Initial phoneme deletion (/5)	0	5	4.31	1.20
Final phoneme deletion (/5)	0	5	3.83	1.35
Sum of phoneme deletion (/10)	0	10	8.13	2.27
Reverse order syllable	0	9	4.66	1.95
Filipino literacy tasks				
Non-word reading	0	10	8.80	1.96
Word reading (/25)	1	25	22.55	4.01
Paragraph reading fluency (/100)	0	100	67.24	23.65
English tasks				
Receptive vocabulary test (/15)	3	15	11.35	2.47
RAN (seconds)	10.67	81.35	20.65	11.36
Non-word repetition (/5)	1	5	3.77	0.78
Initial phoneme deletion (/5)	0	5	4.16	1.35
Final phoneme deletion (/5)	0	5	3.84	1.29
Sum of phoneme deletion (/10)	0	10	8.00	2.44
English literacy tasks				
Non-word reading (/10)	0	9	5.50	2.14
Regular word reading (/15)	0	15	12.23	3.83
Irregular word reading (/15)	0	15	11.03	3.87
Paragraph reading fluency (/100)	0	99	66.61	28.02

Note: N=98. RCPM = Raven-coloured Progressive Matrices Test; ROCFT copy = Rey-Osterrieth Complex Figure Test copy; ROCFT immediate = Rey-Osterrieth Complex Figure Test immediate recall; ROCFT delayed = Rey-Osterrieth Complex Figure Test delayed recall; RAN = Rapid Automatized Naming.

Table 2- Pearson correlation analyses of all Filipino variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1) RVT	-	.258*	.236*	.283**	-.357**	.074	.031	.058	.050	-.022	-.033	.044	.120
2) ROCFT copy		-	.585**	.591**	-.292**	.227*	.222*	.309**	.300**	.059	.240*	.199*	.262**
3) ROCFT imm			-	.787**	-.245*	.077	.135	.173	.173	.088	.054	.123	.174
4) ROCFT del				-	-.331**	.027	.103	.204*	.175	.067	.084	.107	.177
5) RAN					-	-.178	-.253*	-.371**	-.353**	-.315**	-.387**	-.390**	-.588**
6) Non-word rep						-	.272**	.296**	.319**	.107	.277**	.342**	.284**
7) IP Del.							-	.596**	.880**	.341**	.593**	.647**	.621**
8) FP Del.								-	.906**	.465**	.598**	.563**	.589**
9) SP Del.									-	.455**	.667**	.674**	.676**
10) Rev.Ord. Sy.										-	.335**	.290**	.451**
11) NW Read.											-	.837**	.675**
12) W Reading												-	.676**
13) Par. Reading													-

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note: N=98 for all analyses. RVT = Receptive Vocabulary Test; ROCFT copy = Rey-Osterrieth Complex Figure Test copy; ROCFT imm. = Rey-Osterrieth Complex Figure Test immediate recall; ROCFT del. = Rey-Osterrieth Complex Figure Test delayed recall; RAN = Rapid Automatized Naming; Non-word rep. = Non-word repetition; IP Del. = Initial Phoneme Deletion; FP Del. = Final Phoneme Deletion; SP Del. = Sum of scores for phoneme deletion test; Rev. Ord. Sy. = Syllable repetition in reverse order; NW Read. = Non-word reading; W Reading = Word reading; Par. Reading = Paragraph reading.

Table 3– Pearson correlation analyses of all English variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1) RVT	-	.300**	.158	.170	-.476**	.125	.355**	.341**	.377**	.357**	.559**	.469**	.500**
2) ROCFT C		-	.585**	.591**	-.225*	.178	.267**	.286**	.299**	.203*	.323**	.307**	.265**
3) ROCFT I			-	.787**	-.121	.066	.146	.069	.117	.121	.143	.159	.084
4) ROCFT D				-	-.158	.044	.121	.126	.133	.060	.126	.155	.127
5) RAN					-	-.137	-.452**	-.350**	-.435**	-.426**	-.510**	-.529**	-.544**
6) NW Rep.						-	.224*	.259*	.260**	.190	.198	.122	.161
7) IP Del.							-	.711**	.928**	.663**	.760**	.802**	.673**
8) FP Del.								-	.922**	.624**	.679**	.724**	.612**
9) SP Del.									-	.696**	.779**	.826**	.695**
10) NW Read.										-	.730**	.786**	.759**
11) IW Read.											-	.903**	.846**
12) RW Read.												-	.835**
13) Par. Read.													-

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note: N=98 for all analyses. RVT = Receptive Vocabulary Test, ROCFT C = Rey-Osterrieth Complex Figure Test copy; ROCFT I = Rey-Osterrieth Complex Figure Test immediate recall; ROCFT D = Rey-Osterrieth Complex Figure Test delayed recall; RAN = Rapid Automatized Naming; NW Rep. = Non-word repetition; In. Phon. Del. = Initial Phoneme Deletion; Fin. Phon. Del. = Final Phoneme Deletion; Phon. Del. Sum = Sum of scores for phoneme deletion test; IW Read = Irregular Word Reading; RW Read. = Regular Word Reading; Par. Read. = Paragraph reading.

Table 4—Multiple regression analysis for cognitive predictors of reading in Filipino

Variables	β coefficient	t	p	Adjusted R^2
Non-word Reading				0.462
RVT	-0.144	-1.743	.085	
RAN	-0.241	-2.679**	.009	
Non-word repetition	0.046	0.574	.568	
Phoneme deletion	0.569	6.160***	.000	
RO syll	-0.006	-0.069	.945	
ROCFT copy	0.091	0.923	.358	
ROCFT delayed	-0.109	-1.137	.259	
Word Reading Accuracy				0.467
RVT	-0.055	-0.673	.503	
RAN	-0.214	-2.392*	.019	
Non-word repetition	0.132	1.644	.104	
Phoneme deletion	0.606	6.590***	.000	
RO syll	-0.064	-0.740	.461	
ROCFT copy	-0.040	-0.404	.687	
ROCFT delayed	-0.030	-0.314	.754	
Paragraph Reading				0.580
RVT	-0.042	-0.570	.570	
RAN	-0.403	-5.066***	.000	
Non-word repetition	0.048	0.677	.500	
Phoneme deletion	0.474	5.807***	.000	
RO syll	0.104	1.367	.175	
ROCFT copy	0.027	0.315	.754	
ROCFT delayed	-0.052	-0.615	.540	

Note: N = 98 for all analyses; RVT = Receptive vocabulary test; ROCFT copy = Rey-Osterrieth Complex Figure Test copy; ROCFT delayed = Rey-Osterrieth Complex Figure Test delayed recall; RAN = Rapid Automatized Naming; RO Syll = Syllable repetition in reverse order

*p< .05, **p< .01, ***p< .001

Table 5—Multiple regression analysis for cognitive predictors of reading in English

Variables	β coefficient	t	p	Adjusted R^2
Non-word Reading				0.478
RVT	0.070	0.804	.424	
RAN	-0.132	-1.498	.138	
Non-word Repetition	0.038	0.504	.615	
Phoneme Deletion	0.615	7.181***	.000	
ROCFT Copy	-0.003	-0.031	.976	
ROCFT Delayed	-0.053	-0.580	.563	
Regular Word Reading				0.716
RVT	0.120	1.872	.064	
RAN	-0.161	-2.475*	.015	
Non-word repetition	-0.059	-1.076	.285	
Phoneme deletion	0.711	11.255***	.000	
ROCFT copy	0.030	0.421	.675	
ROCFT delayed	-0.003	-0.048	.962	
Irregular Word Reading				0.680
RVT	0.262	3.857***	.000	
RAN	-0.110	-1.593	.115	
Non-word repetition	0.003	0.051	.960	
Phoneme deletion	0.619	9.242***	.000	
ROCFT copy	0.071	0.938	.351	
ROCFT delayed	-0.061	-0.847	.399	
Paragraph Reading				0.556
RVT	0.196	2.452*	.016	
RAN	-0.223	-2.748**	.007	
Non-word repetition	0.000	0.005	.996	
Phoneme deletion	0.523	6.630***	.000	
ROCFT copy	0.010	0.116	.908	
ROCFT delayed	-0.018	-0.208	.836	

Note: *N* = 98 for all analyses; RVT = Receptive vocabulary test; ROCFT copy = Rey-Osterrieth Complex Figure Test copy; RAN = Rapid Automatized Naming; ROCFT immediate = Rey-Osterrieth Complex Figure Test immediate recall; ROCFT delayed = Rey-Osterrieth Complex Figure Test delayed recall

*p< .05 , **p< .01, ***p< .001

show high correlations with reading and other cognitive measures. ROCFT copy was low to moderately correlated with other cognitive and reading measures (from r = 0.18 to r = 0.32) while ROCFT immediate and delayed were significantly correlated only among its components (from r = 0.59 to r = 0.79). In contrast with the Filipino results, the English RVT was found to be significantly correlated among all measures except for ROCFT immediate and delayed. The highest correlation was found between irregular word reading and regular word reading (r = 0.90), ROCFT immediate and delayed (r = 0.79), and phoneme deletion and among its components (from r = 0.71 to r = 0.92).

Table 6—Characteristics of the poor and good readers in Filipino

Measures	Mean (SD)		Poor and Good Readers	
Group	Poor (n=9)	Good (n=89)	U-value	p-value
Gender				
Male	3	43		
Female	6	46		
Reading tests				
Non-words (/10)	5.8 (3.4)	9.6 (0.6)		
Words (/25)	16.5 (8.4)	24.2 (0.9)		
Paragraph fluency (/100)	23.5 (15.4)	96.7 (2.6)		
Cognitive abilities test				
RVT (/15)	11.7 (1.6)	11.6 (2.0)	383.0	.827
RAN (s)	34.4 (8.5)	24.0 (8.5)	121.0**	.001
Non-word rep (/5)	3.8 (1.7)	4.6 (0.8)	278.0	.061
Phoneme del (/10)	3.2 (2.5)	8.6 (1.6)	22.0**	.000
RO syll (/10)	3.2 (1.2)	4.8 (2.0)	214.5*	.020
ROCFT copy (/36)	24.8 (2.8)	27.5 (4.0)	218.5*	.025
ROCFT imm (/36)	18.5 (4.0)	21.2 (5.8)	271.5	.112
ROCFT delayed (/36)	18.0 (4.5)	20.5 (5.3)	277.5	.130

Note: *N* = 98 for all analyses; RVT = Receptive vocabulary test; RAN = Rapid Automatized Naming; RO syll = Syllable repetition in reverse order ROCFT copy = Rey-Osterrieth Complex Figure Test copy; ROCFT imm = Rey-Osterrieth Complex Figure Test immediate recall; ROCFT delayed = Rey-Osterrieth Complex Figure Test delayed recall
*p< .05, **p< .01

Results of the multiple regression analyses for Filipino reading attainment are shown in Table 4 while results of the analyses for English reading attainment are shown in Table 5.

Results revealed that non-word reading, word reading and paragraph reading fluency ($F(7,90) = 12.90$, 13.13, and 20.12, respectively) were significantly predicted by RAN ($\beta = -0.24$, $p<.05$, $\beta = -0.21$, $p<.05$, and $\beta = -0.41$, $p<.001$, respectively) and phoneme deletion ($\beta = 0.57$, $p<.001$; $\beta = 0.61$, $p<.001$; $\beta = 0.48$, $p<.001$, respectively). RVT, non-word repetition, ROCFT measures and repetition of syllable in reverse order were not significant predictors of Filipino reading.

Table 7—Characteristics of the poor and good readers in English

Measures	Mean (SD)		Poor and Good Readers	
Group	Poor (n=10)	Good (n=88)	U-value	p-value
Gender				
Male	3	43		
Female	7	45		
Reading tests				
Non-words (/10)	1.6 (1.1)	5.9 (1.8)		
Regular words (/15)	2.9 (2.6)	13.2 (2.4)		
Irregular words (/15)	2.2 (1.7)	11.9 (2.7)		
Paragraph fluency (/100)	7.7 (7.5)	72.6 (21.7)		
Cognitive abilities test				
RVT (/15)	8.9 (2.3)	11.6 (2.4)	163.0**	.001
Non-word rep (/5)	3.7 (0.7)	3.8 (0.8)	344.5	.185
Phoneme del (/10)	3.0 (3.2)	8.5 (1.7)	72.0**	.000
RAN (s)	34.4 (17.9)	19.3 (9.6)	80.0**	.000
ROCFT copy (/36)	24.8 (2.8)	27.5 (4.0)	229.5*	.013
ROCFT imm (/36)	18.5 (3.9)	21.2 (5.8)	278.5	.058
ROCFT delayed (/36)	18.0 (4.5)	20.5 (5.3)	300.0	.100

Note: *N* = 98 for all analyses; RVT = Receptive vocabulary test; ROCFT copy = Rey-Osterrieth Complex Figure Test copy; ROCFT imm = Rey-Osterrieth Complex Figure Test immediate recall; ROCFT delayed = Rey-Osterrieth Complex Figure Test delayed recall; RAN = Rapid Automatized Naming
*p< .05, **p< .01

This shows that the predictors for Filipino reading were naming speed and phoneme awareness.

In English measures, multiple regression analyses showed that phoneme deletion ($\beta = 0.62$, p<.001) significantly predicted non-word reading (F(6,91) = 15.80). In addition, RAN ($\beta = -0.16$, p<.05), and phoneme deletion ($\beta = 0.71$, p<.001) significantly predicted regular word reading (F(6,91) = 41.73) while RVT ($\beta = 0.26$, p<.001) and phoneme deletion ($\beta = 0.62$, p<.001) significantly predicted irregular word reading (F(6,91) = 35.42). Lastly, RVT ($\beta = 0.20$, p<.05), RAN ($\beta = -0.22$, p<.05), and phoneme deletion ($\beta = 0.52$, p<.001) significantly predicted English paragraph reading fluency (F (6,91) = 21.27). ROCFT measures and non -word repetition were not significant predictors of English reading. This shows that the predictors for English reading were naming speed, phoneme awareness, and receptive vocabulary.

In the Mann-Whitney U-test comparing poor and good readers, there were nine poor readers in Filipino and 10 poor readers in English. Results of the analyses are shown in Table 6 and Table 7. Results for the poor and good readers in Filipino showed that there were significant difference between their scores in RAN (U = 121.0, p = .001), phoneme deletion (U = 22.0, p = .000), syllable repetition in reverse order (U = 214.5, p = .020), and ROCFT copy condition (U = 218.5, p = .025). This indicates that poor readers in Filipino have significantly slower reading duration for naming speeds and significantly lower scores in phoneme deletion, syllable repetition in reverse order, and ROCFT copy condition.

On the other hand, results between poor and good readers in English revealed that there were significant difference between their scores in RVT (U = 163.0, p = .001), phoneme deletion (U = 72.0, p = .000), RAN (U = 80.0, p = .000), and ROCFT copy (U = 121.0, p = .001). This is an indication that poor readers in English have significantly slower reading duration in naming speed and significantly lower scores in RVT, phoneme deletion, RAN and ROCFT copy.

Discussion

Cognitive predictors for reading in Filipino

Results of the analyses revealed that both naming speed and phoneme awareness generally predicted reading in Filipino. The results are consistent with previous studies that are in consensus in asserting the importance of phonological awareness and rapid naming in reading (Cornwall, 1992; Snowling, 2001; Caravolas, et al., 2011). This is also in agreement with studies regarding reading in transparent scripts such as vowelized Arabic, Japanese Hiragana, and Korean Hangul, in which phonological awareness and naming speed were unique predictors of word and paragraph reading abilities (Batnini & Uno, 2014; Inomata, et al., 2013; Park & Uno, 2012). In particular, the current findings is consistent with the double deficit hypothesis which proposes that the two essential cognitive abilities related to reading are phonological awareness and naming speed (Wolf & Bowers, 1999,

2000; Wolf, et al., 2002). This hypothesis also states that children with reading difficulty may have deficits in naming speed or phonological awareness, or in both cognitive skills. Such statement may also be applicable to reading in Filipino in which a child who has difficulty in Filipino may have deficits in naming speed, phonological awareness, or both cognitive abilities.

According to the analyses, receptive vocabulary was not a significant predictor for reading in Filipino. There are varying findings with regards to the role of vocabulary in transparent languages. Park and Uno (2012, 2015) reported that receptive vocabulary was a significant predictor for reading accuracy and fluency in Korean Hangul, a relatively transparent language. An explanation for this is not because of the relative transparency of Korean Hangul, but because of its characteristic as a writing system in which phonological alterations occur in many word units from more than two syllables. The authors explained that there are irregular and exception words in Korean Hangul that may be read through vocabulary.

This is a characteristic not present in the Filipino language in which there are hardly any irregular or exception words. Findings of Park and Uno are in contrast with other studies of transparent scripts, Finnish and vowelized Arabic, which showed that vocabulary did not have a significant role for reading (Lyytinen, 2004; Batnini & Uno, 2014). However, results of the current study are consistent with these findings in which receptive vocabulary was not a significant predictor for reading in Filipino. This shows that once the child has fully learned the rule of mapping sounds to letters, the child will be able to accurately read a Filipino word even without prior knowledge of the word. This is due to the relatively transparent characteristic of Filipino script which has almost one-to-one correspondence between graphemes and phonemes (Ocampo, 2004) and the lack of presence of irregular and exception words.

Cognitive predictors for reading in English

Results of the analyses showed that phoneme awareness generally predicted reading in English in which it was a significant predictor for all reading measures: non-word reading, regular and irregular word reading, and paragraph reading fluency in English. Along with phoneme awareness, naming speed was also a significant predictor in which it predicted regular word reading and paragraph reading fluency. These findings are consistent with studies asserting the importance of phonological awareness and naming speed for reading in English (Cornwall, 1992; Snowling, 2001; Caravolas, et al., 2011; Bowers, 1993; Wolf & Bowers, 2000; Wolf, et al., 2002).

Likewise, receptive vocabulary was also a significant predictor in which it predicted irregular word reading in English. This is consistent with studies showing the importance of vocabulary in reading in English (Oulette, 2006; Ziegler & Goswami, 2005). This is also consistent with the study regarding Kanji, an opaque script, which showed that the most potent predictor for Kanji reading was

vocabulary size (Uno, et al., 2009). Due to the characteristic of inconsistent relationship between grapheme and phoneme in English, applying regular letter-to-sound rules is not always effective and that vocabulary knowledge is required in reading irregular and exception words.

General Discussion

In general, phoneme awareness predicted reading in both Filipino and English. This is consistent with previous studies which reported that phoneme awareness is a core component of alphabetic literacy across consistent (transparent) and inconsistent (opaque) orthographies (Caravolas, et al., 2005; Caravolas, et al., 2012; Moll, et al., 2014; Furnes & Samuellson, 2011). It is consistent with the notion that the representation of phonological structures, as measured by phonological awareness, is important in reading, particularly mapping sounds to letters, in reading (Ziegler & Goswami, 2005).

Moreover, naming speed was also a significant predictor for both Filipino and English reading. This is consistent with previous studies that not only phonological awareness, but also naming speed is an independent predictor for reading (Cornwall, 1992; Snowling, 2001; Caravolas, et al., 2011; Bowers, 1993; Wolf & Bowers, 2000; Wolf, et al., 2002). This shows that despite the mastery of mapping sounds and letters and a good performance in phonological awareness, a child may show reading difficulty which could be assessed through naming speed (Wolf & Bowers, 2000; Wolf, et al., 2002). The findings are also consistent with studies which reported that predictors of reading performance are relatively universal in alphabetical languages despite the transparency of script showing that both phonological awareness and naming speed are significant predictors for reading performance (Zieglar, et al., 2010; Caravolas, et al., 2005; Caravolas, et al., 2012).

The results of the Mann Whitney U-tests between poor and good readers confirmed the findings in multiple regression analyses. Poor readers in both Filipino and English performed significantly poorly in naming speed and phonological awareness, as measured by RAN, phoneme deletion task, and syllable -repetition in reverse order. It may be inferred that a lack in these cognitive skills may lead to a difficulty in reading for Filipino and English. It can also be assumed that phonological awareness and naming speed are good predictors for both Filipino and English reading.

A core difference found between reading in Filipino and English is that receptive vocabulary was a significant predictor for reading in English, particularly for irregular word reading and paragraph reading fluency, but not for reading in Filipino. Regular word reading in English is the same as word reading in Filipino in the aspect that these words follow a consistent grapheme to phoneme correspondence. It is for this reason why the same significant underlying cognitive factors, phoneme awareness and naming speed, were found for regular word reading in English and word reading in Filipino. On the other hand, irregular

words are exception words that do not follow the regular letter to sound mapping rule, a characteristic that is not found in Filipino words. Irregular word in English is a manifestation of its opaqueness. This opaqueness could be the reason why receptive vocabulary was a significant predictor for English irregular word reading but not in Filipino word reading. The comparison between the poor and good readers were similar to the results of the multiple regression analyses. Poor readers in English significantly performed poorly in the vocabulary task while there was no significant difference found between the performance of poor and good readers in Filipino. The significance of vocabulary in English reading is consistent with the notion of Ziegler and Goswami (2005) which explains that vocabulary knowledge, along with phonological awareness, is more important for reading development of inconsistent orthographies. Particularly for irregular words in English, vocabulary knowledge is necessary to successfully read the word. In contrast, a child could read a word in Filipino without knowing the meaning of a word.

Furthermore, visual cognitive processes were not significant predictors for both Filipino and English reading, although a significant difference was found between good and poor readers with regards to visual copying. This finding is consistent with McBride's explanation of the role of visual skill in the literacy development of children, particularly for English (2016). She noted that previous studies have failed to link a causation between visual skills and reading; however, differences in visual skills were found to be related with reading ability. This shows that visual cognitive processing may not be a good predictor for Filipino and English reading. On the other hand, it could be an indicator for distinguishing poor readers from good readers.

Conclusion

The main underlying cognitive abilities found to be related to reading in both Filipino and English were phonological awareness and naming speed. Receptive vocabulary was also a significant predictor for English, but not in Filipino. Studies regarding children who are bilingual in Filipino and English are quite limited. Findings of the current study are basic attempts to understand more about reading in Filipino and English for Filipino children. The results of this study have implications on which tasks should be focused on when assessing children with reading difficulties.

A limitation of the current study, however, is that it is focused only on third-grade Filipino children. Different results may be found if this study was conducted among older and/or younger children. Studies such as cross-sectional or longitudinal studies among children in the different levels of elementary school are recommended. More sensitive tasks for assessing cognitive skills are also recommended to gain more accurate findings. Further studies would help in discovering more about the underlying skills and also the development of reading literacy among Filipino children.

Acknowledgemetnt

The authors would like to thank the principal, teachers and children of the elementary school in Manila who participated in the study. Without their cooperation, the completion of this study would have been impossible. The authors would also like to express their gratitude to the Department of Education in the Philippines for granting the permission to conduct the study in Manila.

References

Barca, L., Burani, C., Di Filippo, G., & Zoccolotti, P. (2006). Italian developmental dyslexic and proficient readers: where are the differences? *Brain and Language, 98*, 347-351.

Batnini, S., & Uno, A. (2014). Investigation of basic cognitive predictors of reading and spelling abilities in Tunisian third-grade primary school. *Brain and Development, 37*(6), 579-591.

Bowers, P. (1993). Text reading and rereading: determinants of fluency beyond word recognition. *Journal of Reading Behavior, 25*(2), 133-153.

Caravolas, M., Lervag, A., Mousiku, P., Efrim, C., Litavsky, M., Onochie-Quintalla, E., . . . Hulme, C. (2012). Common patterns of prediction of literacy development in different alphabetic orthographies. *Psychological Science, 23*(6), 678-686.

Caravolas, M., Volin, J., & Hulme, C. (2005). Phoneme awareness is a key component of alphabetic literacy skills in consistent and inconsistent orthographies: Evidence from Czech and English children. *Journal of Experimental Child Psychology, 92*, 107-139.

Cornwall, A. (1992). Cornwall A. The relationship of phonological awareness, rapid naming, and verbal memory to severe reading and spelling disability. *Journal of Learning Disabilities, 25*(8), 532-538.

Corwin J, Bylsma F. W. (1993). Psychological examination of traumatic encephalopathy. *TCN 7*:21–34.

Dulude, L. (2012). Writing systems, phonemic awareness, and bilingualism: cross-linguistic issues in dyslexia. *Indiana University Undergraduate Journal of Cognitive Science, 7*, 22-30.

Everatt, J., Ocampo, D., Veii, K., Nenopoulou, S., Smythe, I., Mannai, H. A., & Elbeheri, G. (2010). Dyslexia in biscriptal readers. In N. Brunswic, S. McDougall, & P. D. Davies, *Reading and Dyslexia in Different Orthographies* (pp. 221-245). East Sussex: Psychology Press.

Everatt, J., Smythe, I., Ocampo, D., & Gyamarthy, E. (2004). Issues in the assessment of literacy related difficulties across language backgrounds: a cross-linguistic comparison. *Journal of Research in Reading, 27*(2), 141-151.

Everatt, J., Smythe, I., Ocampo, D., & Veii, K. (2002, November). Dyslexia Assessment of the Biscriptal Reader. *Topics in Language Disorder, 22*(5), 32-45.

Furnes, B., & Samuelsson, S. (2011). Phonological awareness and rapid automatized naming predicting early development in reading and spelling: Results from a cross-linguistic longitudinal study. *Learning and Individual Differences, 21,* 85-95.

Goswami, U. (2000). Phonological representations, reading development and dyslexia: towards a cross-linguistic theoretical framework. *Dyslexia, 6*, 133-151.

Gough, B. (ed)., Ehri, L. (ed)., & Treiman, R. (ed). (1992). *Reading Acquisition*. Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc Reading acquisition.

Helmuth, L. (2001, March). Dyslexia: Same Brains, Different Language. *Science, 291* (5511), 2064-2065.

Holopainen, L., Ahonen, T., & Lyytinen, H. (2001). Predicting delay in reading achievement in a highly transparent language. *Journal of Learning Disability, 34*(5), 401-413.

Inomata, T., Uno, A., & Haruhara, N. (2013). Investigation of cognitive factors affecting reading and spelling abilities of hiragana characters in kindergarten children. *The Japan Journal of Logopedics and Phoniatrics, 54*(2), 122-128.

Kaneko, M., Uno, A., & Haruhara, N. (2004). Relationship between Rapid Automatized Naming and Kana Reading Tasks in Preschool Children. *The Japan Society of Logopedics and Phoniatrics, 45*(1), 30-34.

Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: an 8-year follow-up. *Journal of Educational Psychology, 100* (1), 150-161.

Lyytinen, H. (2004). Growth and predictive relations of vocabulary and inflectional morphology in children with and without familial risk for dyslexia. *Applied Psycholinguistics, 25*(3), 397-411.

Lyytinen, H., Aro, M., Holopainen, L., Leiwo, M., Lyytinen, P., & Tolvanen, A. (2006). Children's language development and reading acquisition in a highly transparent orthography. In R. Malatesha Joshi, & P. Aaron, *Handbook of orthography and literacy* (pp. 47-62). New Jersey: Lawrence Erlbaum Associates, Inc.

Martin, N., & Brownell, R . (2011). *Receptive One-Word Picture Vocabulary Test.* Novato, CA : Academic Therapy Publications .

McBride, C. (2016). *Children's Literacy Development: A Cross-cultural Perspective on Learning to Read and Write* (2nd ed.). New York: Routledge.

McBride-Chang, C., & Kail, R. V. (2002). Cross-Cultural Similarities in the Predictors of Reading Acquisition. *Child Development, 73*(5), 1392-1407. Retrieved from http://www.jstor.org/stable/3696388 .

Metsala, J. (2011). Repetition of Less Common Sound Patterns: A Unique Relationship to Young Children's Phonological Awareness and Word Reading. *International Journal of English Linguistics, 1*(2), 3-17.

Muter, V., Hulme, C., Snowling, M., & Stevenson, J. (2004). Phoneme, rimes, vocabulary, and grammatical skills as foundations of early reading development: Evidence from longitudinal study. *Developmental Psychology, 40*(5), 665-681. doi:10.1037/0012-1649

Ocampo, D. (2004). Dyslexia in the Philippines. In I. Smythe, J. Everatt, & R. Slater, *International book of dyslexia: A guide to practice and resources.* West Sussex, England: John Wiley.

Oulette, G. (2006). What's meaning got to do with it: the role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology, 98* (3), 554-566.

Park, H., & Uno, A. (2012). Investigation of cognitive abilities related to reading and spelling in korean: readers with high, average, and low skill levels. *Dyslexia, 18*(4), 199-215.

Park, H, & Uno, A. (2015). Cognitive abilities underlying reading accuracy, fluency and spelling acquisition in Korean Hangul learners from grade 1 to 4: a cross-sectional study. *Dyslexia, 21*, 235-253.

Parrila, R., Kirby, J., & McQuarrie, L. (2004). Articulation rate, naming speed, verbal short-term memory, and phonological awareness: longitudinal predictors of

early reading development? *Scientific Studies of Reading, 8*(1), 3-26.

Paulesu, E., Demonet, J., Fazio, F., McCory, E., Chanoine, V., Brunswick, N. ... Frith, U. (2001). Dyslexia: cultural diversity and biological unity. *Science, 291*, 2165-2167.

Rack, J., Snowling, M., & Olson, R. (1992). The nonword reading deficit in developmental dyslexia: a review. *International Reading Association, 27* (1), 29-53.

Raven, J. C. (1976). *Coloured progressive matrices: sets A, AB, B*. Oxford: Oxford Psychologists Press Ltd.

Scarborough, H. (1990). Very early language deficits in dyslexic children. *Child Development, 61(*6), 1728-1743.

Snowling, M. (2001). From Language to Reading and Dyslexia. *Dyslexia, 7*, 37-46.

Su, I.-F., Klingebiel, K., & Weekes, B. S. (2010). Dyslexia in Chinese: Implications for connectionist models of reading. In N. Brunswic, S. McDougall, & P. D. Davies, *Reading and Dyslexia in Different Orthographies* (pp. 199-216). East Sussex: Psychology Press.

Uno, A., Wydell, T., Hurahara, N., Kaneko, M., & Shinya, N. (2009). Relationship between reading/writing skills and cognitive abilities among Japanese primary-school children: normal readers versus poor readers (dyslexics). *Reading and Writing: An Interdisciplinary Journal, 22*(7), 755-789.

Wolf, M., & Bowers, P. (1999). The double-deficit hypothesis for the developmental dyslexias. *J Educ Psychol, 91*, 415-38.

Wolf, M., & Bowers, P. (2000). Naming-speed processes and developmental reading disabilities: an introduction to the special issue on the double-deficit hypothesis. *Journal of Learning Disabilities, 33*(4), 322-324.

Wolf, M., O'Rourke, A., Gidney, C., Lovett, M., Cirino, P., & Morris, R. (2002). The second deficit: an investigation of the independence of phonological and naming-speed deficits in developmental dyslexia. *Reading and Writing: An Interdisciplinary Journal, 15*, 43-72.

Woodcock, R. (1998). *Woodcock Reading Mastery Tests—Revised: Examiner's Manual.* Circle Pines, MN: American Guidance Service, Inc; 1998.

Ziegler, J. C., & Goswami, U. (2005). Reading Acquisition, Developmental Dyslexia, and Skilled Reading Across Languages: A Psycholinguistic Grain Size Theory. *Psychological Bulletin, 131*(1), 3-29. doi:10.1037/0033-2909.131.1.3

Ziegler, J., Bertrand, D., Toth, D., Csepe, V., Reis, A., Faisca, L., ... Blomert, L. (2010). Orthographic depth and its impact on universal predictors of reading: a cross-language investigation. *Psychological Science, 21*(4), 551-559.