Reading in a Foreign Language October 2012, Volume 24, No. 2
ISSN 1539-0578 pp. 186–208

Oral reading fluency in second language reading

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Abstract

This study investigated the role of oral reading fluency in second language reading. Two hundred and fifty-five high school students in South Korea were assessed on three oral reading fluency (ORF) variables and six other reading predictors. The relationship between ORF and other reading predictors was examined through an exploratory factor analysis (EFA). Next, the contribution of ORF to silent reading comprehension was investigated through multiple regression analyses (MRA) with ORF variables as predictors of reading comprehension. EFA identified two factors (fluency and comprehension) and showed that passage reading fluency crossloaded with both factors. MRA results indicated that the three ORF variables collectively explained 21.2% of variance in silent reading comprehension. Oral passage reading fluency alone explained 20.9% of variance in silent reading comprehension. After controlling for pseudoword reading and word reading fluency, oral passage reading fluency still accounted for an additional 12.4% of the remaining reading variance.

Keywords: oral reading fluency, second language reading, reading components, reading comprehension, reading variance

The purpose of this study is to examine the role of oral reading fluency in second language (L2) reading among high school students in South Korea whose first language (L1) is Korean and whose L2 is English. Although the definition of reading fluency varies across researchers, most agree that it includes components of speed, accuracy, and in reading a connected text, “prosodic phrasing and contours of the text” (Grabe, 2009, p. 292; Rasinski & Samuels, 2011). Whether oral or silent, the significance of reading fluency in reading is that it marks successful orchestration of certain subskills (e.g., decoding, word recognition, syntactic processing) necessary for comprehension (Fuchs, Fuchs, Hosp, & Jenkins, 2001; Grabe, 2009, 2010; Grabe & Stoller, 2002, 2011; Koda, 2005; Potter & Wamre, 1990; Rasinski, Reutzel, Chard, & Linan-Thompson, 2011). Furthermore, reading fluency is a reliable trait that a skilled reader exhibits across various types of texts. Although reading rates do vary to a certain degree as a function of reading purpose (Carver, 1992, 1997), in the case of silent reading for comprehension and learning, a skilled reader typically reads most texts at a rate of 250-300 words per minute (Grabe, 2009).

Although the investigation of reading fluency has been scarce in L2 reading research, the research interest in this topic has clearly been on the rise in recent years (e.g., Gorsuch & Taguchi, 2008; Jiang, Sawaki, & Sabatini, 2012; Jeon, 2009; Lems, 2003, 2006, 2012; McTague, Lems, Butler, & Carmona, 2012; Taguchi, 1997; Taguchi & Gorsuch, 2002; Taguchi, Takayasu-Maass, & Gorsuch, 2004). Undoubtedly the most significant contributor to L2 reading fluency research to date, Taguchi and his colleagues, in a series of studies, investigated the training effects of fluency instruction on reading rate and comprehension development. The more recent studies such as Lems (2003, 2006, 2012), Jiang et al. (2012), and McTague et al. (2012), on the other hand, examined the relationship between different aspects of oral reading fluency (e.g., rate, accuracy, prosody, word reading fluency) and reading comprehension among adult second language readers or English Language Learners (e.g., Spanish-English bilingual students) in the US. None of these studies, however, investigated reading fluency in the larger context of other reading predictors, an endeavor which would help us refine the construct of reading fluency. The present study therefore aims to (a) expand the current understanding of L2 oral reading fluency by identifying its relationship with other key reading predictors (e.g., decoding, vocabulary knowledge, grammar knowledge, and metacognition), and (b) to examine the predictive power of oral reading fluency on L2 reading comprehension, thereby examining the potential of reading fluency as the proxy of L2 reading comprehension.

Literature Review

The theoretical support for reading fluency as a prerequisite for comprehension can be found in Automaticity Theory (DeKeyser, 2001; LaBerge & Samuels, 1974; Rasinski & Samuels, 2011; Segalowitz, 2003; Segalowitz & Segalowitz, 1993) and Verbal Efficiency Theory (Perfetti, 1985, 1988, 1994; Perfetti & Lesgold, 1979). Both theories assume that attention and working memory, the two mental resources necessary for reading, are limited in capacity. Because all unautomatized mental processes compete for these limited resources, an unskilled reader who is still struggling with decoding, word recognition, and syntactic parsing, for example, will have fewer attentional resources available for higher-level comprehension processes (e.g., inference, and comprehension monitoring), and is likely to experience comprehension failure. Reading fluency, a marker of automatized and well-coordinated sub-processes (e.g., phonological decoding, word recognition, and syntactic parsing) of reading, therefore, can be seen as a prerequisite for comprehension.

These theoretical claims are empirically well supported in first language (L1) research (e.g., Fuchs, Fuchs, & Maxwell, 1988; National Reading Panel, 2000; Samuels, 2006). Studies on young, nondisabled L1 readers (Grades 4 through 6) reported that oral reading fluency correlates highly with standardized reading comprehension measures. The reported correlation coefficients ranged from .65 to .83 for passage reading, and .53 to .75 for word reading (Fuchs et al., 1983a; Fuchs et al., 1983b; Jenkins, Fuchs, Espin, van den Broek, & Deno, 2003; Klauda & Guthrie, 2008; Marston, 1989; Tindal et al., 1983a; Tindal et al., 1983b). From their extensive review of

L1 reading fluency studies, Fuchs et al. (2001) also reported that the correlations between oral passage reading fluency and comprehension were high: r = .81 to .90.

Although reading fluency has started receiving attention from L2 reading researchers in recent years (e.g., Grabe, 2010; Gorsuch & Taguchi, 2008; Jiang et al., 2012; Taguchi et al., 2004; Yamashita & Ichigawa, 2010), the body of empirical research on the role of reading fluency, and especially on passage reading fluency in L2 reading, is still very limited and the findings are inconclusive. To my knowledge, Lems' (2003) unpublished doctoral dissertation was the first study to report the correlation between passage-level oral reading fluency and reading comprehension. The study involved 232 adult-education L2 students of six different L1 backgrounds (Polish, Ukrainian, Chinese, Spanish, Bulgarian, and other unidentified languages). By adopting multiple fluency measures that assessed accuracy, speed, efficiency (accuracy and speed), and prosody of oral passage reading, Lems (2003) reported a series of correlations between different aspects of oral reading fluency and reading comprehension. The key findings of this study were as follows: (a) the correlations between oral reading fluency (number of words correctly read per minute) and comprehension varied widely from weak (r = .04, *ns*) to strong (r = .76, p < .01); (b) the correlation between oral reading fluency and comprehension was higher among learners with higher overall L2 proficiency; and (c) the correlation between oral reading fluency and comprehension was highest in the L1-Spanish group and lowest (and statistically insignificant) in the L1-Chinese group, suggesting the influence of L1-L2 orthographic distance on the relationship between oral reading fluency and comprehension. Lastly, the study reported that prosody did not have significant explanatory power on reading comprehension possibly due to the low interrater reliability, a finding that resonates with Fuchs, Fuchs, Hosp, and Jenkins (2001).

Most recently, Jiang et al. (2012) investigated the relationship between oral reading fluency and reading comprehension among 200 adult L1-Chinese L2-English learners who were also test-takers of TOEFL. Among the variables examined were oral word reading, oral nonword reading, oral passage reading, and silent reading comprehension. In contrast with Lems' (2003) findings on the L1-Chinese group, the results showed that oral passage reading fluency correlated significantly with comprehension (r = .51, p < .01). Although lower in extent, the correlation between word reading fluency and comprehension was also significant (r = .27, p < .01). The correlation between nonword reading efficiency and reading comprehension was, however, not significant (r = .01, *ns*). As a result, the contribution made to reading comprehension was much larger for passage reading fluency than for word reading fluency, a finding that is consistent with L1 research (e.g., Fuchs et al., 1983a, 1983b; Jenkins et al., 2003; Klauda & Guthrie, 2008; Tindal et al., 1983a, 1983b). Referring to Fuchs et al.'s (2001) conjecture, Jiang et al. interpreted this result to suggest that word reading and passage reading may be substantially different processes with the former tapping primarily lower-level processes (e.g., phonemic decoding and word recognition) and the latter involving both lower- and higher-level comprehension processes. This conjecture, however, remains untested because neither Lems nor Jiang et al. simultaneously examined other key reading predictors (e.g., morphology, vocabulary, and grammar) along with oral reading fluency and silent reading comprehension. In response, the present study provides a direct and empirical appraisal of this conjecture.

Another important and practical question regarding oral reading fluency is whether it can be considered a proxy for reading comprehension. Fuchs and colleagues (1988, 2001) in their review of L1 fluency research have argued that there is sufficient evidence that oral reading fluency is a strong indicator of reading competence and therefore fluency needs to be included in reading assessments. If oral reading fluency correlates highly with L2 reading comprehension as it does in L1, it may be worth examining its potential as a formal or informal assessment tool.

As an assessment method, oral passage reading has many strengths (Fuchs et al., 1988); first, oral passage reading can be performed using almost any connected text and does not require extensive training to administer and score. With minimal training, teachers can easily develop testing tools based on their course materials and administer tests with a stopwatch (or a regular watch). If rate and accuracy are used as the main scoring criteria, scoring can also be done promptly and with a high interrater reliability (Lems, 2003; Jiang et al., 2012). Second, it is worth noting that, unlike silent reading where its construct validity may be questionable (e.g., students may be repeatedly making a decoding error of a certain word or in the worst case scenario, not reading at all), oral reading provides a transparent observation into the test taker’s performance.

If, on the other hand, reading fluency is not found to be a strong indicator of comprehension, it would be beneficial to limit the use of oral reading fluency to informal and low-stakes assessments. More empirical findings on L2 oral reading fluency and comprehension will help determine the usefulness of oral reading fluency as a measure of reading comprehension.

In sum, for language professionals interested in the role of oral reading fluency and L2 reading competence, and in the potential of oral reading fluency as a proxy of reading comprehension, many important questions remain unanswered. First, within the larger construct of L2 reading abilities comprised of multiple components (e.g., decoding, word recognition, syntactic processing, and metacognitive processing), how does oral reading fluency fit in? Are word reading fluency and passage reading fluency significantly different from each other? If so, why? Is oral reading fluency a good enough index of L2 reading comprehension?

To help answer these questions, the present study investigates the latent structure of L2 reading abilities using a range of reading-related variables (e.g., morphological awareness, vocabulary knowledge, grammar knowledge, metacognitive awareness of reading, listening comprehension, and reading comprehension). To investigate where in this latent structure fluency is situated, the study also includes three typical measures of oral reading fluency (i.e., pseudoword reading, word reading, and passage reading). More specifically, the present study investigates the following research questions:

1. How does oral reading fluency relate to other components of L2 reading?
2. Are word-level reading fluency and passage reading fluency substantially different from each other? If so, why?
3. Can oral passage reading fluency be considered a proxy for L2 reading comprehension among the present study participants?

Methods

Participants

The data are from a larger longitudinal project (Jeon, 2009) that investigated the effects of reading fluency training among South Korean high school students. The present study data were collected from 267 Grade 10 students at a high school in South Korea. After cases with missing values and outliers were removed from the data, 255 participants (135 boys and 120 girls) were included in the final data analysis. The average age of the participants was 15.83 years (*SD* = .38 years). The mean length of English studies of participants was 7 years and 7 months (*SD* = 1 year and 5 months) with the last 3.5 years of studies at the secondary level. None of the participants had resided in an English speaking country prior to the study and all participants had Korean as their L1.

Instruments

A total of nine tests including three oral reading fluency tests were used to assess nine variables in this study. Each test, along with its target construct (measured variables), is detailed below in two sections: three oral reading fluency tests and six non-oral reading fluency tests.

Three oral reading fluency tests. Pseudoword reading test (PRT), word reading test (WRT), and passage reading test (PASSRT) were used to assess participants' oral reading fluency. The descriptions of each test are provided below.

Pseudoword reading test. This test was used to measure phonemic decoding fluency, which was defined as the ability to quickly and accurately decode L2 graphemes into their corresponding phonemes. Forty English pseudowords from Wang and Koda (2005) and 20 English pseudowords from the Gates-McKillop Reading Diagnostic Test-Form II (Gates, 1962) were used for this test. The last 20 longer pseudowords were added because of the expectation that the individual variance in phonemic decoding may be very small among the present study participants due to their extended experience with an alphabetic L1 (see Wang & Koda, 2005 for further explanation on the positive crosslinguistic transfer between orthographically similar languages). Participants were asked to read the pseudowords quickly and accurately into a digital audio recorder.

Each pseudoword was scored either correct (1 point) or incorrect (0 points) by the researcher and an experienced English teacher. Following Wang and Koda's (2005) scoring system, all acceptable pronunciations were scored correct. For example, both /foɵ/ (analogy to the pronunciation of the orthographically irregular "both") and /fɑɵ/ (analogy to the pronunciation of the regular "moth") were scored correct. Because nonwords in Wang and Koda's "Materials for Naming Experiments" had been borrowed from Glushko (1979) and Plaut, McClelland, Seidenberg, and Patterson (1996), the accepted pronunciations provided in these two studies were used to score participants' pseudoword readings in the present study. In addition, pronunciations of seven native speakers of English were collected and used as additional accepted pronunciations. Among the seven native speakers (5 females and 2 males) who provided pseudoword pronunciations, three were from the East Coast of the US, two were from the Midwest of the US, and the remaining two were each from the Southwest and the West Coast of the US, yielding a reasonable variation in terms of regionality. All pronunciations of these native speakers were used inclusively as accepted pronunciations and were included in the final answer key.

For each participant, the number of correctly read pseudowords and total reading time were recorded. Reading time divided by the number of correctly read words was used as an index of phonemic decoding fluency. The interrater reliability (Pearson's *r*) of the test was .94.

Word reading test. This test was used to measure word reading fluency, which was defined as the ability to quickly and accurately read aloud real words. Eighty English words from Wang and Koda (2005) were used for this test. According to Wang and Koda, the eighty words were "(a) high frequency regular words (e.g., best), (b) low frequency regular words (e.g., slam), (c) high frequency exception words (e.g., both), and (d) low frequency exception words (e.g., swamp)" (p.81). It was anticipated that the inclusion of low frequency words and orthographically irregular words would contribute to increasing variance in test data; as a result, unlike the PRT, additional test items were deemed unnecessary. The administration and scoring method for this test were the same as the PRT. The interrater reliability (Pearson's *r*) of the test was .91.

Passage reading test. This test was used to measure passage reading fluency, which was defined as the ability to orally read a connected text fast and accurately. Prosody was not included in the target construct definition given the findings of Jiang et al. (2012) and Lems (2003); both studies reported that it was difficult to achieve an acceptable reliability with their prosody measures due to the subjective nature of judging desirable prosody, and that prosody failed to explain a significant amount of reading variance. For the PASSRT, a 117 word-long expository passage was imported from the reading comprehension section of a retired General Test of English Language Proficiency (G-TELP, 1996; see http://gtelp.co.kr/e_gtelp/gtelp/e_gtelp04.asp for more detailed information about the test) Level 4. The Flesch-Kincaid grade level of this passage was nine and this readability level was equivalent to the average readability of reading passages included in the Reading Comprehension Test of this study. The rationale for keeping the readability equivalent across the oral reading test and silent reading comprehension measure was based on Fuchs et al. (1988), which noted that correlations between fluency measure and silent reading measure tend to be high when the readability of the texts are equivalent. Participants were cued to pay attention to their reading accuracy, speed, and comprehension as they read the passage aloud into a digital recorder. The administration and scoring method of this test were the same as that of the PRT and the WRT. The interrater reliability (Pearson's *r*) of this test was .94.

Six non-oral reading fluency tests. Descriptions of the six non-oral reading fluency tests (morphological awareness test, word knowledge test, grammar knowledge test, reading comprehension test, listening comprehension test, and metacognitive awareness reading questionnaire) are provided in the following section.

Morphological awareness test. The composite score of the Test of Morphological Structure-Revised (TMS-R) and the Verbal Suffix Knowledge Test-Revised (VSKT-R) was used to measure morphological awareness of study participants. Adapted from Carlisle's (2000) Test of Morphological Structure, TMS-R measured the knowledge of derivational morphemes, compounding rules and the ability to infer the meaning of a newly derived word. VSKT–R, adapted from Schmitt and Meara's (1997) Verbal Suffix Knowledge Test, measured the ability to identify morphemes in a morphologically complex word. The researcher and an experienced English teacher scored this test. The interrater reliability (Pearson's *r*) and the internal consistency (KR–20) were .99 and .88 for TMS-R. The KR-20 was .90 for VSKT-R. Interrater consistency was not applicable to VSKT-R. Detailed descriptions of TMS-R and VSKT-R can be found in Jeon (2011).

Word knowledge test. This test was used to measure the knowledge of English words. Fifty words were randomly selected from a list of 2,067 words in the Seventh National Curriculum Revision (South Korean Ministry of Education, 1997) to create this test. For each English word, participants were asked to provide one L1 equivalent. When there were multiple equivalents, participants were asked to provide one answer about which they were most certain. Following the answer key created using the Si-Sa Elite English–Korean Dictionary (2001), all responses within an acceptable range received credit (e.g., both "firm" and "difficult" were considered as an acceptable equivalent for "hard"). If the answer was semantically acceptable but showed an incorrect part of speech, the answer received 0.5 points. If the answer was out of an acceptable meaning range, however, it received 0 points even if the part of speech was correct. This decision was made because in reading a text, the knowledge of a word's meaning was deemed more important than the knowledge of its part of speech. The researcher and an experienced English teacher trained in the scoring procedure graded the tests. The interrater reliability (Pearson's *r*) of this test was .98.

Grammar knowledge test. This test was used to measure participants' grammar knowledge of English. The grammar subsection of a retired G-TELP Level 4 was used for this test. The test included 20 multiple-choice questions. For each test item, participants were asked to read one or two incomplete sentences (the incomplete part had an underscore) and complete the sentence (or sentences) by choosing the best option (word or word phrase) from four choices. Participants' responses were machine scored either as correct (5 points) or incorrect (0 points). The internal consistency (KR-20) of this test was .84.

Reading comprehension test. This test was used to measure participants' silent reading comprehension ability of English text. The reading subtest of a retired G–TELP Level 4 was used for this test. The test included four short (less than 120 words in length) reading passages of an average readability level of nine (Flesch-Kincaid), each of which was followed by five multiple-choice comprehension questions. Participants' responses were machine scored either as correct (5 points) or incorrect (0 points). The internal consistency (KR-20) of this test was .87.

Listening comprehension test. This test was used to measure participants' general linguistic comprehension ability of English discourse. Although a person's listening comprehension ability is not a direct measure of his reading ability, many L1 and L2 reading componential analysis studies (e.g., Droop & Verhoeven, 2003; Hoover & Gough, 1990; Proctor, Carlo, August, & Snow, 2005) have reported that listening comprehension is a strong predictor of reading comprehension (e.g., path coefficient of .44 in Proctor et al., 2005). Gernsbacher and colleagues (1990, 1991) have even suggested that there may be a latent construct, which oversees comprehension across input modalities. LCT was therefore included in the present test battery.

The listening subtest of a retired G–TELP Level 4 was used for this test. The test had 20 multiple-choice items and for each item, participants were asked to listen to audio input and respond by selecting the best option. Because participants were allowed to take notes as they listened to the audio input, individual variance in short-term memory was not deemed to pose a threat to the construct validity of the test. Participants' responses were machine scored either as correct (5 points) or incorrect (0 points). The internal consistency (KR-20) of this test was .84.

Metacognitive awareness reading questionnaire. This questionnaire was used to measure reading-related metacognition. Due to the paucity of published metacognition measures, Vandergrift, Goh, Mareschal, and Tafaghodtari's (2006) Metacognitive Awareness Listening Questionnaire (MALQ) was adapted to create this questionnaire. Although originally made to assess listening-related metacognition in L2, the authors reported that the MALQ was developed based on the premise that there are many similarities between listening and reading comprehension processes. The authors thus noted that they had referred to existing reading questionnaires to develop this instrument. Upon reviewing the MALQ with two other applied linguists, all 21 items were considered suitable for assessing reading-related metacognition. Subsequently, "listening" in the MALQ was replaced with "reading" in the present questionnaire to make the Metacognitive Awareness Reading Questionnaire (MARQ). The 21 items on this measure inquired about participants' reading strategy use and level of metacogntive awareness when they read. Participants were asked to respond by using a 6-point Likert scale (6 being "strongly agree" and 1 being "strongly disagree"). The internal consistency (Cronbach's α) of the MARQ was .77.

Procedures. All but the three oral reading fluency tests were administered on the same day. For the three oral reading fluency tests, a group of 20 to 25 participants were taken to a room equipped with partitioned desks and were provided a test booklet, a digital audio recorder, and a pair of earplugs to cancel out background noise. They were then given directions for the three tests and recorded their responses. To minimize distraction, participants were asked to remain seated until the last person in the room finished the tests. The entire test administration was supervised by the researcher.

Data Analysis

In order to address the research questions, study data were analyzed using three statistical methods. First, to gain an overview of the relationship among the nine variables included in the study, a zero-order correlation was run. Next, an exploratory factor analysis was carried out to answer the first research question. Through the factor analysis, the study aimed to identify the latent structure of L2 reading abilities, and more importantly, to examine the relationship between oral reading fluency variables and other L2 reading predictors. Although the use of confirmatory techniques such as confirmatory factor analysis, path analysis, and structural equation modeling (e.g., Droop & Verhoeven, 2003; Proctor et al., 2005; Shiotsu 2010; van Gelderen et al., 2004; van Gelderen, Schoonen, Stoel, de Glopper, & Hulstijn, 2007; Verhoeven, 2000) has been the more popular approach in L2 reading componential analysis research, the present study adopted an exploratory technique for the following reasons.

Recently, experts of quantitative research methods have expressed concerns about using confirmatory methods in an exploratory fashion (Asparouhov & Muthén, 2009; Browne, 2001). Unlike exploratory methods that are data-driven, confirmatory methods are theory-driven, that is, they test whether the data yield an acceptable fit with a hypothetical model which was developed based on the researcher's hypothesis or previous findings. For this reason, mathematically, confirmatory methods place strict constraints on parameters (e.g., the requirement of zero-cross loadings), which often result in the rejection of the first hypothetical model. In such a case, researchers frequently respecify their model until they come upon an acceptable fit. In short, confirmatory methods rely on the "rule-out" approach in their pursuit for a fitting model. The problem arises, however, when the initial hypothetical model significantly lacks plausibility for some reason (e.g., insufficient previous research to guide model specification) and is extensively modified in an exploratory manner, sometimes to the point where the theoretical integrity of the model is compromised (e.g., eliminating key variables or factors) (Kline, 2005). When the research domain is young such as that of L2 oral reading fluency, and has yet to establish consistent findings or a reliable theory to guide a plausible model, solely depending on the elimination approach of the confirmatory methods may be neither effective nor appropriate.

Furthermore, it is important to note that because confirmatory methods do not allow cross loadings unless specified to do so (i.e., the researcher specifies the model so that an indicator loads on multiple factors), solely relying on confirmatory methods can make it possible for a researcher to miss unexpected crossloading patterns, which may offer important information for better understanding constructs of interest. It is therefore important for researchers working in a young domain to first garner sufficient findings using an exploratory technique.

The second and third research question more directly investigated the collective and individual contribution of oral reading fluency variables to explaining variance in silent reading comprehension. In order to answer these questions, four sequential regression analyses were carried out with silent reading comprehension as the criterion variable. The order in which the predictor variables were entered in each sequential regression analyses was as follows:

Regression 1: Passage Reading Test => Pseudoword Reading Test => Word Reading Test
Regression 2: Passage Reading Test => Word Reading Test => Pseudoword Reading Test
Regression 3: Pseudoword Reading Test => Word Reading Test => Passage Reading Test
Regression 4: Word Reading Test => Pseudoword Reading Test => Passage Reading Test

Results

Descriptive Statistics

Table1 summarizes the descriptive statistics of the nine tests (each measuring the nine variables under investigation) used in this study. Because the primary interest of this study concerns oral reading fluency, accuracy scores of the three oral reading fluency tests (Pseudoword Reading Test, Word Reading Test, Passage Reading Test) were not used for main data analyses. However, descriptive statistics of accuracy scores of these tests are also provided to offer useful additional information. For the three oral reading fluency tests, descriptive statistics of accuracy scores were the number of correctly read words and fluency scores represented total time taken to read words divided by the number of correctly read words. In Table 1, full scores of each test are also provided. It must be noted that although this table presents untransformed data for readers' ease of interpretation (e.g., mean score in relation with the full score), in subsequent data-analyses (i.e., zero-order correlation, exploratory factor analysis, sequential regression analyses), data of the three oral reading fluency tests and of the Word Knowledge Test were transformed due to severe to moderate skewness; fluency data from the Pseudoword Reading Test, Word Reading Test, and Passage Reading Test were inversely transformed and data from the Word Knowledge Test were logarithmically transformed.

Table 1. *Descriptive statistics of tests*

Test	Full score	*M*	*SD*
Pseudoword Reading Test-Fluency	NA	1.82	0.66
Pseudoword Reading Test-Accuracy	60	51.04	6.52
Word Reading Test-Fluency	NA	1.21	0.39
Word Reading Test-Accuracy	80	66.66	5.55
Passage Reading Test-Fluency	NA	0.96	0.29
Passage Reading Test-Accuracy	117	104.51	8.35
Morphological Awareness Test	113	33.3	14.07
Word Knowledge Test	50	14.01	8.47
Grammar Knowledge Test	100	62.64	18.36
Metacognitive Awareness Reading Questionnaire	126	73.06	11.31
Listening Comprehension Test	100	56.12	17.57
Reading Comprehension Test	100	56.16	14.94

Note. The mean fluency scores of the Pseudoword Reading Test, Word Reading Test, and Passage Reading Test are time taken (seconds) to read one correct word; therefore, unlike other measures listed in this table, a lower value of these tests signifies a higher performance level.

As can be seen in Table 1, the mean fluency scores of the Pseudoword Reading Test, Word Reading Test, and Passage Reading Test were strikingly low. On average, study participants were reading a connected text at the rate of 62.5 words per minute. Participants' reading rates of real word-level reading were even lower with approximately 33 words per minute for pseudowords and 50 words per minute for real words. An interesting fact to note, however, is that participants' accuracy performance was much higher with an average of 86% (Pseudoword Reading Test), 83% (Word Reading Test), and 89% (Passage Reading Test) accuracy level.

As for the six non-fluency-related tests, participants' performance level was the highest in the Grammar Knowledge Test (62.64% accuracy) and lowest in the Morphological Awareness Test (30% accuracy) and Word Knowledge Test (35.7% accuracy).

Zero-order Correlations of Nine Variables

A summary of intercorrelations of all included variables (as measured by the nine tests listed in Table 1) is provided in Table 2. All 36 correlations but one (between the Word Reading Test and the Metacognitive Awareness Reading Questionnaire) were statistically significant either at the .01 significance level (34 correlations) or at the .05 significance level (1 correlation). The three highest correlations were found between oral reading fluency variables (.794 between Word Reading Test and Pseudoword Reading Test,.706 between Pseudoword Reading Test and Passage Reading Test, and .674 between Word Reading Test and Passage Reading Test). It is also worth noting that the next highest correlations both involved the Grammar Knowledge Test (.589 between Grammar Knowledge Test and Reading Comprehension Test and .585 between Grammar Knowledge Test and Morphological Awareness Test).

Table 2. *Intercorrelations among pseudoword reading test, word reading test, passage reading test, morphological awareness test, word knowledge test, grammar knowledge test, metacognitive awareness reading questionnaire, listening comprehension test, and reading comprehension test (n = 255)*

	PRT[a]	WRT[a]	PASSRT[a]	MAT	WKT[b]	GKT	MARQ	LCT	RCT
PRT[a]	-	0.794**	0.706**	0.350**	0.362**	0.316**	0.144*	0.383**	0.280**
WRT[a]		-	0.674**	0.351**	0.324**	0.324**	0.094	0.397**	0.282**
PASSRT[a]			-	0.566**	0.573**	0.535**	0.189**	0.530**	0.457**
MAT				-	0.563**	0.585**	0.221**	0.505**	0.465**
WKT[b]					-	0.458**	0.321**	0.517**	0.467**
GKT						-	0.215**	0.538**	0.589**
MARQ							-	0.243**	0.227**
LCT								-	0.442**
RCT									-

Note. PRT = Pseudoword Reading Test; WRT = Word Reading Test; PASSRT = Passage Reading Test; WKT = Word Knowledge Test; GKT = Grammar Knowledge Test; MARQ = Metacognitive Reading Questionnaire; LCT = Listening Comprehension Test; RCT = Reading Comprehension Test.

[a] The variable has been transformed inversely for this zero-order correlation analysis and therefore the order of variables has been reversed; because this transformation has the effect of reversing the order of scores, a larger value now signifies a higher performance level. As a result, higher correlation in this table means higher strength of association between the two variables.

[b] The variable has been transformed logarithmically. The order of scores remains unchanged. As a result, higher correlation in this table means higher strength of association between the two variables. *$p < .05$ **$p < .01$

Exploratory Factor Analysis

The first research question concerned the extent to which oral passage reading fluency was related to other components of L2 reading. To answer this question, an exploratory factor analysis was carried out with data from three oral reading fluency tests (Pseudoword Reading Test, Word Reading Test, and Passage Reading Test), Morphological Awareness Test, Word Knowledge Test, Grammar Knowledge Test, Listening Comprehension Test, Metacognition Awareness Reading Questionnaire, and Reading Comprehension Test. Values of Kaiser-Meyer-Olkin Measure of Sampling Adequacy (.863) and Bartlett's Test of Sphericity Factors

(Approximate χ^2 = 1108.513, *df* = 36, *p* = .000) were both acceptable. Factors with an eigenvalue greater than one were retained. Promax rotation, a type of oblique rotation, was used due to the assumption that the latent factors of L2 reading abilities are more likely to be correlated than not (see Shiotsu, 2010, for a similar rationale). As a result, a well-defined two-factor solution was generated. The eigenvalues of the first and second factor were 4.453 and 1.312, respectively. The two components explained 64% of total variance. Following Tabachnick and Fidell (2001), the indicators with a factor loading greater than .45 were considered in the interpretation of the factor. The results of the factor analysis are summarized in Table 3.

Given that most of the indicators that loaded highly on the first factor represented meaning-based comprehension, Factor 1 was labeled as the Comprehension Factor. Factor 2, on which all three oral reading fluency variables loaded highly, on the other hand, was labeled as the Fluency Factor. Of the nine indicators, oral passage reading fluency (as measured by the Passage Reading Test) was the only one that crossloaded on both factors with a loading of .482 for Factor 1 and .755 for Factor 2.

Table 3. *Factor loadings for exploratory factor analysis with Promax Rotation of nine variables*

	Factor 1: Comprehension	Factor 2: Oral Reading Fluency
Pseudoword Reading Test	0.121	**0.914**
Word Reading Test	0.126	**0.916**
Passage Reading Test	**0.482**	**0.755**
Morphological Awareness Test	**0.721**	0.305
Word Knowledge Test	**0.718**	0.288
Grammar Knowledge Test	**0.760**	0.244
Metacognitive Awareness Reading Questionnaire	**0.521**	0.067
Listening Comprehension Test	**0.660**	0.356
Reading Comprehension Test	**0.731**	0.175

Note. Factor loadings > .45 are in boldface.

Sequential Regression Analyses

To investigate the individual and collective contribution of the three oral reading fluency variables to silent reading comprehension, four sequential regression analyses were carried out. Results of the regressions showed that the Passage Reading Test alone explained a significant 20.9% (*p* = .000) of variance in the Reading Comprehension Test (see Table 4). After controlling for the Passage Reading Test, neither the Pseudoword Reading Test nor the Word Reading Test explained a statistically significant additional reading variance (see Tables 4 and 5). When entered into the regression after the Pseudoword Reading Test and Word Reading Test, Passage Reading Fluency still made an independent and statistically significant contribution (12.4%, *p* = .000) to the Reading Comprehension Test (see Table 6). Additionally, the regressions (Tables 6 and 7) showed that the amounts of reading variance independently accounted for by the Pseudoword Reading Test and the Word Reading Test were comparable (7.9% each), indicating that among the present study participants, phonemic decoding fluency and real word reading fluency were not very different constructs. Together, the three oral reading fluency variables explained a statistically significant 21.2% of variance in silent reading comprehension.

Table 4. *Summary of the first hierarchical regression analysis with passage reading test as the first order variable*

Model	*b*	SE	*β*	*T*	Sig.	Df	R^2	Adj. R^2	Δ R^2	Δ F	Sig. F change
1 Passage Reading Test	22.744	2.784	0.457	8.169	0.000	1, 253	0.209	0.206	0.209**	66.729	0.000
2.Passage Reading Test	25.686	3.929	0.516	6.538	0.000	2, 252	0.212	0.206	0.004	1.126	0.290
Pseudoword Reading Test	-7.168	6.754	-0.084	-1.061	0.290						
3 Passage Reading Test	25.663	4.080	0.515	6.29	0.000	3, 251	0.212	0.203	0.000	0.000	0.983
Pseudoword Reading Test	-7.279	8.534	-0.085	-0.853	0.395						
Word Reading Test	0.123	5.735	0.002	0.021	0.983						

Note. ***p* < 0.01, Criterion variable: Reading Comprehension Test

Table 5. *Summary of the second hierarchical regression analysis with passage reading test as the first order variable*

Model	*b*	SE	*β*	*T*	Sig.	Df	R^2	Adj. R^2	Δ R^2	Δ F	Sig. F change
1 Passage Reading Test	22.744	2.784	0.457	8.169	0.000	1, 253	0.209	0.206	0.209**	66.729	0.000
2 Passage Reading Test	24.342	3.772	0.489	6.453	0.000	2, 252	0.210	0.204	0.001	0.395	0.530
Word Reading Test	-2.857	4.545	-0.048	-0.629	0.530						
3 Passage Reading Test	25.663	4.080	0.515	6.290	0.000	3, 251	0.212	0.203	0.002	0.728	0.395
Word Reading Test	0.123	5.735	0.002	0.021	0.983						
Pseudoword Reading Test	-7.279	8.534	-0.085	-0.853	0.395						

Note. ***p* < 0.01, Criterion variable: Reading Comprehension Test

Table 6. *Summary of the third hierarchical regression analysis with pseudoword reading test as the first order variable*

Model	*b*	SE	*β*	*T*	Sig.	Df	R^2	Adj. R^2	Δ R^2	Δ F	Sig. F change
1 Pseudoword Reading Test	23.996	5.165	0.280	4.646	0.000	1, 253	0.079	0.075	0.079**	21.581	0.000
2 Pseudoword Reading Test	13.107	8.477	0.153	1.546	0.123	2, 252	0.088	0.081	0.009	12.166	0.107
Word Reading Test	9.606	5.941	0.160	1.617	0.107						
3 Pseudoword Reading Test	-7.279	8.534	-0.085	-0.853	0.395	3, 251	0.212	0.203	0.124**	22.540	0.000
Word Reading Test	0.123	5.735	0.002	0.021	0.983						
Passage Reading Test	25.663	4.080	0.515	6.290	0.000						

Note. ***p* < 0.01, Criterion variable: Reading Comprehension Test

Table 7. *Summary of the fourth hierarchical regression analysis with word reading test as the first order variable*

Model	*b*	SE	*β*	*T*	Sig.	Df	R^2	Adj. R^2	Δ R^2	Δ F	Sig. F change
1 Word Reading Test	16.904	3.619	0.282	4.671	0.000	1, 253	0.079	0.076	0.079**	21.822	0.000
2 Word Reading Test	9.606	5.941	0.160	1.617	0.107	2, 252	0.088	0.081	0.009	2.391	0.123
Pseudoword Reading Test	13.107	8.477	0.153	1.546	0.123						
3 Word Reading Test	0.123	5.735	0.002	0.021	0.983	3, 251	0.212	0.203	0.124**	39.563	0.000
Pseudoword Reading Test	-7.279	8.534	-0.085	-0.853	0.395						
Passage Reading Test	25.663	4.080	0.515	6.290	0.000						

Note. ***p* < 0.01, Criterion variable: Reading Comprehension Test

Discussion

The goal of this study was to examine the role of word- and passage-level oral reading fluency in L2 reading and to investigate whether oral reading fluency can be a proxy of reading comprehension among the current study participants. To this end, the Results section provided answers to the three research questions proposed earlier in the paper. The following Discussion section further elaborates on and interprets the present study findings in connection with relevant literature.

Place of Oral Reading Fluency in the Latent Structure of L2 Reading Abilities

The first research question investigated how the three oral reading fluency variables relate to other predictors of L2 reading. The exploratory factor analysis produced a two-factor solution in which the three oral reading fluency variables formed one factor and the remaining six variables formed another. These results were in accordance with Shiotsu (2010) in many regards. First, as in Shiostu, the present study found that there is a single construct underlying linguistic knowledge variables (i.e., morphological awareness, word knowledge, grammar knowledge), a metacognition variable, and text comprehension variables (i.e., reading comprehension, listening comprehension). Although all three linguistic knowledge variables loaded highly with the text comprehension variables, similar to Shiotsu, grammar knowledge showed the highest factor loading (.760) indicating the importance of grammar knowledge in L2 text processing.

The factor loadings of the other two linguistic knowledge variables, word knowledge and morphological awareness, were also high (i.e., .721 and .718). Considering that a large portion of the Morphological Awareness Test involved the semantic aspect of L2 (e.g., knowledge of derivational morphemes and inference of new word meaning) and therefore, is closely related to word knowledge, the high loadings of morphological awareness and word knowledge found in this study corroborate previous findings that support the importance of vocabulary knowledge in L2 reading (e.g., Droop & Verhoeven, 2003; Nassaji, 2003; Schoonen, Hulstijn, & Bossers, 1998; van Gelderen et al., 2004).

The second similarity between the present study and Shiotsu (2010) is that in both studies, one factor was indicated by a group of speed variables (e.g., oral reading fluency variables in the present study and processing efficiency variables in Shiotsu, 2010) and the other factor was indicated by power variables (e.g., linguistic knowledge variables in the present study and in Shiotsu, 2010). Although this may at first look like a simple artifact of data type (i.e., efficiency data vs. accuracy data), a closer look at the current study's factor analysis reveals a unique observation; oral passage reading fluency, an efficiency variable which primarily and highly loaded with the fluency factor also crossloaded with the second factor indicated by morphological awareness, word knowledge, grammar knowledge, metacognitive of reading, listening comprehension, and reading comprehension. While crossloading in an exploratory factor analysis is typically considered problematic especially when its purpose is to develop a new test (see Tabachnick & Fidell's, 2001, discussion on the problems of crossloadings), in this study, passage reading fluency's crossloading provides an important insight into the nature of this variable. As previously noted, L1 research has consistently reported that correlations with silent passage reading comprehension were higher for passage level fluency than for word level fluency. To account for this difference between the two different types of reading fluency variables, Fuchs et al. (2001) conjectured that passage-level fluency may substantially differ from word-level fluency because it represents multilevel processes (e.g., lexical access, sentence-level processing, background knowledge activation, and inferences) above and beyond decoding. Although differing in detail, the factor analysis results and the loading pattern of oral passage reading fluency found in the present study empirically support Fuchs et al.'s conjecture.

Independent and Collective Contributions of Oral Reading Fluency to L2 Reading Comprehension

The second and third research questions investigated a more practical issue with oral reading fluency, namely, the potential of oral reading fluency as the proxy of silent reading comprehension in L2. To this end, the study examined how much variance in L2 reading comprehension is collectively and individually explained by fluency variables. The regression analysis results showed that the three reading fluency variables collectively explained a statistically significant 21.2% (p = .000) of variance in silent reading comprehension and that passage reading fluency was a more potent explanatory variable than word-level fluency variables. As the first variable to enter the regression, oral passage reading fluency explained a significant 20.9% (p = .000) of reading variance. When entered following the Pseudoword Reading Test and the Word Reading Test, the Passage Reading Test still accounted for an additional 12.4% of reading variance (p = .000). Why then, in the present study, did word-level reading fluency not make as substantial a contribution to reading comprehension as passage-level reading fluency? A possible explanation to this question seems to lie in the study participants' L1 (Korean) and age (grade 10).

The writing system of Korean, like that of English, is an alphabetic one, in which its graphemes map onto phonemes (Perfetti & Dunlap, 2008). At the time of the study, participants had been schooled in Korean for nearly ten years and were advanced decoders of an alphabetic script. It is then possible to assume that the participants' extended experience with an alphabetic script has had an effect on their reading of English, another alphabetic script which they had been studying for more than seven years by the time of the study, at least at the word level. The positive effects of the L1 writing system on L2 word reading when both languages are alphabetic have also been previously documented by Wang and Koda (2005). Their study reported that college-level Korean students were more accurate than their Chinese counterparts in naming English words regardless of their frequency or orthographic regularity. The authors suggested that the difference between the two L1 groups' performance was due to the difference between the L1 writing systems (alphabetic Korean vs. morphosyllabic and logographic Chinese). If the decoding experience of the Korean L1 has positive effects on decoding English among present study participants, simple decoding ability as measured by the Word Reading Test and the Pseudoword Reading Test might no longer be a strong predictor of individual differences in reading comprehension. The relatively low contribution of word-level oral reading fluency to reading comprehension found in the present study could be attributed to this learner characteristic.

The amount of reading variance explained by oral passage reading fluency in this study is comparable to what was found by Jiang et al. (2012). Despite the differences in some participant characteristics (e.g., age, type of L1 orthography, and experience with academic L2), in Jiang et al., passage reading fluency alone explained 26% of silent reading variance. Additionally, in both studies, passage reading fluency was a much stronger predictor of reading comprehension than word reading efficiency variables. With 21.2% and 26% of reading variance explained by reading fluency alone, however, neither of the two studies offers strong support for reading fluency as a proxy of reading comprehension. A closer look at the correlations between fluency variables and reading comprehension reported in Lems' (2003) study also adds to this skepticism; as previously noted, although most of the correlations between oral reading fluency and reading comprehension were significant, the range was large (.04-.63) and most of the correlations (4 of 6 correlations) were small or moderate (.27-.41) in size.

Why then, unlike in L1, did oral reading fluency fail to explain a substantial amount of variance in L2 reading comprehension? Although lacking any empirical examination, Lems (2006) offers some plausible conjectures regarding this question. First, Lems noted that in contrast with L1, there may be more instances of "comprehension without recoding" (p. 240) in L2 reading. For example, an L2 reader who has the knowledge of a L2 word may be able to successfully recognize the word in a silent condition, but this may not guarantee a successful recoding of the word for multiple reasons (e.g., lack of oral rendition practice, failure to map proper phoneme onto the corresponding grapheme, and failure to properly sound out the phoneme of the corresponding grapheme). This may especially be a prevalent phenomenon among older L2 readers who come from an instructional setting where oral reading is not encouraged past certain grade levels, or is considered a boring or laborious activity (Taguchi, 1997). The statistically significant yet small correlation (r=.324) between the Word Knowledge Test and the Word Reading Test found in the present study also indicates that high semantic word knowledge does not necessarily guarantee high recoding ability. It must be noted, however, that the present study's Word Knowledge Test and Word Reading Test used two different sets of words, and therefore did not directly investigate the relationship between semantic word knowledge and recoding ability. In a future study therefore, it would be useful to correlate silent word recognition efficiency (e.g., speeded silent word recognition test) and oral recoding efficiency of the same set of L2 words. The results would help us determine whether involving the component of recoding in a reading assessment would pose advantages or threats to test validity.

Additionally, Lems (2006) noted that decoding without comprehension in L2 may be another source of concern when using oral reading fluency as a measure of reading comprehension in L2. According to Grabe and Stoller (2002), L1 children's oral vocabulary size ranges from 5,000 to 7,000 words by age six, at which time reading instruction typically starts. This means that once decoding is automatized, there will be little individual variability in word recognition success. This, however, is not the case in L2 reading where oral vocabulary development does not necessarily precede the mastery of decoding. The possibility of successful decoding, therefore, does not guarantee successful word recognition in L2. Relying on oral reading fluency as a proxy of reading comprehension would certainly be problematic in such a case.

Developmental Profile of L2 Oral Reading Fluency: Accuracy before Fluency

Although not initially intended for investigation, an interesting developmental picture of L2 reading accuracy and fluency emerged from the present study and is discussed here in comparison with two other L2 oral reading fluency studies. For convenience, points of comparison across the three studies are summarized in Table 8.

Table 8. *Comparison of Lems (2003; 2006; 2012)* [a]*, Jiang et al. (2012), and the present study* [b]

	Jiang et al. (2012)	Lems (2003; 2006; 2012)	Present study
Participants' age	Adults	Adults	Grade 10
Further information on participants	TOEFL test takers	Immigrants (older, working adults and young adults) in an English Speaking country	High school students studying English as a core subject at school in an EFL setting
Readability of passages (Flesch-Kincaid)	6.5	Passage 1: 2.7 Passage 2: 4.2 Passage 3: 12	9
Average accuracy (%)	97%	Over 99%	89%
Average oral passage reading rate (words per minute)	154.88	109.67	62.50

Note. [a] The three studies by Lems (2003; 2006; 2012) are based on the same data and therefore are reported here as one study to avoid repetition. [b] Although McTague et al. (2012) also investigated oral passage reading fluency and its relationship with reading comprehension among English Language Learners (Spanish-English bilingual children), the study did not report the data comparable to the three studies included here (e.g., no reporting on the readability statistic in the form of Flesch-Kincaid, no reporting of accuracy rate) and this made the comparison with other studies difficult. In addition, the study participants who were young bilinguals (some were born in the US and some immigrated during childhood) were thought to be substantially different in their characteristics from the study participants of the three studies in this table. As a result, McTague et al. was not included in this comparison.

First, in all three studies, it was noted that participants' reading accuracy had reached a ceiling- or near-ceiling level. When the processing efficiency was taken into consideration (in the form of fluency or efficiency score), however, the achievement level was much lower. This trend was most notable in the present study, which had the youngest (and possibly the least experienced in L2 literacy) group of participants of the three L2 oral reading fluency studies; despite the reasonably good passage reading accuracy (89% accuracy), participants' processing efficiency was still very low; the average oral reading rate was 62.5 words per minute. Although it is not entirely appropriate to interpret this result using the L1 norm, a reading rate of 62.5 words per minute is close to the performance level of Grade 3 L1 readers in the lower 25th percentile of their age group (Hasbrouck & Tindal, 2006), indicating the present study participants' oral reading fluency was clearly far from mastery. Similarly, in Lems (2003) and Jiang et al. (2012), both of which involved adult L2 readers, a near-ceiling effect was found in accuracy (over 99% accuracy rate in Lems, 2003, and 97% accuracy rate in Jiang et al., 2012) while average reading rates of participants were clearly still developing (109.67 words per minute for Lems, 2003, and 154.88 for Jiang et al., 2012). In sum, the contrast between high accuracy and relatively low efficiency observed in oral passage reading seems to paint the developmental picture of L2 reading fluency.

Conclusion

The present study provided two key findings that add to the current understanding of oral reading fluency and reading comprehension in L2; first, the present study appears to be the first L2 study that investigated oral reading fluency in the context of multiple key reading predictors. Because of this comprehensive investigation, the present study was not only able to corroborate previous research findings that showed oral passage reading to be substantially different from word-level reading efficiency (e.g., Fuchs et al., 1988; Fuchs et al., 2000; Jiang et al., 2012) but also empirically explain that this difference arose from passage reading fluency's connection with other, more text comprehension-based processes.

Second, by including a group of younger L2 readers (and probably with less L2 literacy experience and lower L2 proficiency) than those who were included in previous studies (Jiang et al., 2012; Lems, 2003; 2006; 2012), the present study expanded the empirical appraisal of oral reading fluency as a potential measure of L2 reading comprehension. In line with Lems (2006) that concluded that oral reading fluency may not be an appropriate assessment tool for L2 readers whose language skills (e.g., oral vocabulary, syntactic processing) are not yet in place, oral passage reading fluency was found not to be an effective assessment tool for silent reading comprehension among the present study participants.

For a more thorough investigation of oral reading fluency and its role in reading abilities, it would be worthwhile in future research to draw a developmental trajectory of L2 reading fluency among L2 readers of varying characteristics (e.g., L1 background, L1 literacy experience, and L2 proficiency level) through a longitudinal investigation. As shown in Table 8, the number of words correctly read per minute (when reading a connected text) by the participants of the three studies varied considerably (from a striking low of 62 words in the present study and a high of 154.88 in Jiang et al., 2012), a result that provokes many compelling questions: Do L2 readers experience a "growth spurt" in oral reading fluency as they master basic language skills? How is it possible that Korean L1 speakers who were so disfluent at passage reading at 10th grade, exceed their Chinese counterparts in word reading when they reach university age (Wang & Koda, 2005)? Are Korean university students also more fluent in passage reading than their Chinese counterparts? Do L2 readers of different L1 writing system backgrounds differ substantially in their fluency development rate? Does L2 oral reading fluency become a more useful predictor of L2 reading comprehension among L2 readers who have gone past a certain language threshold?

The limited number of studies documenting oral reading fluency with a single measurement or cross-sectional measurement, however, fails to provide useful answers to these important questions. Answers to these questions would be best achieved through longitudinal investigation. Although longitudinal studies are highly taxing on resources and are typically much more difficult to carry out due to their unique challenges (e.g., participant attrition), the product of such studies would provide valuable answers to L2 reading researchers and practitioners. An active collaboration between reading researchers and practitioners would help realize this difficult yet possible enterprise.

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