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Beyond breadth: The contributions of vocabulary depth to reading comprehension among skilled readers

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Abstract

This study investigated the relationships among vocabulary breadth, vocabulary depth, reading comprehension, and reading rate among college-aged students. While the relationships of some of these variables have been explored in previous research, the current study's focus on the role of vocabulary depth on the literacy measures within a sample of skilled readers is new and produced several interesting findings. First, consistent with the hypotheses, both vocabulary breadth and depth were significantly correlated with reading comprehension and reading rate. Second, while both types of vocabulary knowledge explained unique variance in reading comprehension, only vocabulary breadth explained unique variance in reading rate. Finally, although vocabulary breadth was significantly correlated with both of the vocabulary depth measures, the two depth measures were not significantly correlated with each other. This work implies that a strong depth of vocabulary affects reading comprehension, in addition to the well-established relationship between vocabulary breadth and comprehension.

There can be no doubt that vocabulary skills play an important role in the acquisition of higher-order literacy skills, regardless of whether reading comprehension (e.g., Carlisle, 2000; Nelson & Stage, 2007; Ouellette, 2006; Verhoeven & Van Leeuwe, 2008) or writing skills (Olinghouse & Leaird, 2009; Olinghouse & Wilson, 2013) are assessed. Most often, vocabulary breadth (i.e., how many words one person has in his/her vocabulary) is used when vocabulary skills are assessed and implicated in other abilities. However, vocabulary is more than just how many words one knows. People also differ on how much is known, or the quality of the information, about those particular words. For example, Proctor, Silverman, Harring, and Montecillo (2012) argue that knowledge of vocabulary depth is akin to metalinguistic awareness and includes the knowledge of semantic, syntactic, and morphological aspects of each word in a person's vocabulary. Thus, contemporary notions of vocabulary are expanding to suggest that the role of vocabulary depth in literacy development deserves greater attention and understanding. The purpose of this project was to measure both vocabulary breadth and depth in a sample of skilled, college-aged readers to determine if both of these variables explain variance in reading comprehension and reading rate.

Role of Vocabulary Depth

Vocabulary depth refers to how much is known about each lexical entry, or the “richness of word understandings” (Proctor et al., 2012, p. 1636). For example, vocabulary depth for the word *board* would include the word meaning such that the noun *board* can be synonymous with *plank*, but can also be a verb when used to describe how we enter air planes as in the phrase “*boarding* the plane.” In this way, vocabulary depth implies an understanding that the role a word plays, as well as its meaning, can vary. The role morphology plays is also important. Knowing that the root *happy* can be altered to create *happiness*, *happily*, *unhappy*, etc. aids in the deep understanding of that word. Other researchers emphasize the decontextualized nature of vocabulary depth (e.g., Corrigan, 2008; Greenhalgh & Strong, 2001; Snow, Burns, & Griffin, 1998). Decontextualized knowledge encompasses the ability to know the meaning of the word independent of the context in which the word was initially encountered. Corrigan also notes the importance of recognizing that affect or attitudes conveyed by the writer/speaker can have a profound effect on what that word or phrase means in that affective context (e.g., sarcasm).

Ouellette (2006) has demonstrated the differential effects of breadth and depth to various literacy skills such as reading rate, word recognition, and reading comprehension, in 4th grade students. He found that breadth explained variance in decoding skills. One explanation for this finding is that having more words in one’s lexicon may give a reader more exposure to phonemic units, which would lead to decoding efficiency. Ouellette also found that both breadth and depth explained variance in word recognition. Perhaps greater exposure to more words coupled with one’s depth of experience with those words may aid in retrieval efficiency. Moreover, he found that only depth was a unique predictor of reading comprehension abilities. Asserting that having a solid understanding of the meaning and the role a word plays in a particular context may aid in developing a more coherent discourse representation. Other researchers have also found stronger associations between tasks that tap vocabulary depth and reading comprehension for developing readers (Roth, Speece, & Cooper, 2002; Snow, Tabors, Nicholson, & Kurland, 1995; Nation & Snowling, 2004).

Measuring Vocabulary Depth

A wide variety of tasks have been used to measure depth of vocabulary. Proctor et al. (2012) highlighted the roles of semantic, morphological, and syntactic knowledge in depth. The semantic aspect has been assessed using synonym tasks (Ouellette, 2006; Proctor et al., 2012), polysemy tasks in which participants are asked to generate as many meanings as they can for a given word (Carlo et al., 2004; Tannenbaum, Torgesen, & Wagner, 2006), and word definition tasks (Ordonez, Carlo, Snow, & McLaughlin, 2002; Ouellette, 2006; Tannenbaum et al., 2006). The definition tasks were scored in such a way as to probe the quality of the lexical representation. For example, Ordonez et al. assessed definitions for paradigmatic (more formal information that defines the properties of a word, “a nose is a body part, like an ear or an eye”) and syntagmatic information (information about appearance or use, “an envelope is rectangular and used to send letters”). Paradigmatic knowledge was indicative of a deeper, richer representation of the word’s meaning. Other researchers code definitions in terms of providing information about the semantic category to which the item belongs and

the attributes that are associated with the word (Ouellette, 2006). Despite the varied approaches each of these researchers were assessing how nuanced and complete participants' lexical representations were.

Morphological awareness is also an important component of vocabulary depth (Proctor et al., 2012). Morphological awareness has been assessed using tasks that either require the participant to take a root word and add an affix to it to successfully complete a sentence (e.g., Farm. My uncle is a ____; farmer.) or to strip a complex word of its affix to complete a sentence (e.g., Driver. Children are too young to ____; drive.). These tasks demonstrate a person's knowledge of word structure and how the role of the word or the meaning of the word may change depending on the affix that is added to the root word. Thus, morphological awareness taps both semantic and syntactic abilities. That is, a person has to understand that adding the prefix *un-*, changes the meaning to the root word's opposite as in *censored* to *uncensored*. Also, derived morphologically complex words often change the part of speech of the root word. The word *work* becomes a noun when *-er* is added. Morphological awareness is probably an important aspect of vocabulary depth, which is why morphological awareness has been showing up as a reliable predictor of comprehension, over and above vocabulary breadth (Carlisle, 2000; Deacon & Kirby, 2004; Jarmulowicz, Hay, Taran, & Ethington, 2008; Nagy, Berninger, & Abbott, 2006).

An interesting task that assesses all three components of depth (morphology, semantics, and syntax) is the Vocabulary Depth Task (VDT, Richard, 2011). The VDT measures word usage in multiple different sentence contexts. In a trial, participants are given six sentences, each presented with a blank. Each blank can be filled in with the same target word; therefore, the participant's task is to find the one target word that correctly fits into each sentence via the context. Morphological and syntactic awareness are needed in this task since participants need to transform the morphological structure or amend the syntactic role of the target word to make it fit into multiple sentences. The semantic component is demonstrated by the participant knowing the different contexts in which the word may be used.

Current Study

Vocabulary has been demonstrated to be a broader construct than just breadth, and depth may be an important component of vocabulary abilities. As some researchers (e.g., Fukkink, Blok, & de Glopper, 2001) have suggested, vocabulary depth might be a stronger predictor of reading comprehension for more advanced readers. Thus, we assessed these variables in a group of skilled college-aged readers, which is a group that is missing from the literature, as most studies of vocabulary depth have looked at the contributions of depth in emergent readers (children and adult learners of other languages). Thus, the purpose of this study was to examine how vocabulary breadth and depth were related to reading comprehension performance. To assess depth, participants were given two tasks. In one of them, participants were given a root word and were asked to produce as many forms of that word using prefixes and suffixes. Our second assessment of depth was the VDT task, in which participants were given a set of six sentences, each with a word omitted, and were asked to identify the target word that would complete each sentence. We also administered a standardized reading comprehension and vocabulary breadth test to participants. We

hypothesized that all of our measures would be significantly correlated, and more importantly, that both vocabulary breadth and depth would independently contribute to predicting reading comprehension performance.

Method

Participants

The participants for this study were 107 female college students who were enrolled in a four year undergraduate single sex institution in the northeastern region of the United States. The ages of the participants ranged from 18 – 40, with a median age of 19 ($SD = 2.91$). Of the participants who reported racial identity (83%), 26% were Asian/Asian American, 6% were African American, 59% were Caucasian, and 9% reported as “other”. Participants received either research credit hours or were entered into a gift card raffle.

Materials

To measure participant vocabulary breadth and reading comprehension, the Nelson-Denny Reading Test (form H) of Vocabulary, Comprehension, and Reading rate was administered. This test contains two sections. The first section measures the breadth of a participant’s vocabulary, which was defined as the number of words in a participant’s lexicon. In the vocabulary section of the Nelson-Denny, there were a total of 80 questions, and the participants were presented with a vocabulary word and asked to choose the correct definition of that word from five options (*e.g., To explain something is to: A. make it clear B. say it C. reveal it D. confuse it E. compare it*). The participant’s score for this section was the total number of correct responses out of the 80 questions, with no penalties given for incorrect responses. The second section of the Nelson-Denny began with a one minute assessment of each participant’s reading rate, followed by the reading comprehension test. In this section, participants read a total of seven passages, and answered a total of 38 factual and inferential questions (5–8 questions per passage). These scores were the total number of correctly answered comprehension questions, with no penalties for incorrect answers. Brown, Fishco, and Hanna (1993) report reliabilities of .68 and .81 for Reading rate and Comprehension, respectively.

There were two additional assessments to measure a participant’s vocabulary depth. The first depth measure was a Word Families task (WF). Participants were presented with 10 root words and instructed to write down as many derivatives from the target word as possible (*e.g., root word: act, derivatives: acts, acting, actor, etc.*). Scores for this task included the total number of correct words provided by the participant, summed across the 10 target words. The second measure of vocabulary depth was the Vocabulary Depth Task (VDT, Richard, 2011). The VDT measures word usage in multiple different sentence contexts. Participants were shown 30 sets of groups of six sentences, each with brackets marking a word that had been removed. The participant’s goal was to correctly identify the one word that could be used to complete all of the sentences.

An example from the target word task is as follows:

Target Word: Lose

- a. I hear Linda is going to ☐ her job.
- b. I do not want to ☐ this game.
- c. To ☐ your family so young is sad.
- d. I want to ☐ five kilograms, so I am exercising more.
- e. Do not ☐ time in attacking your enemy.
- f. Relax! Do not ☐ it.

Procedure

After informed consent was obtained, participants were asked to fill out a demographic form. They were then administered the Nelson-Denny, the Word Families task, and the target word task. In total, the 3 tests took an hour and a half for each participant to complete. Participants were allowed thirty minutes to complete the first part of the Nelson-Denny and the Vocabulary Test and twenty minutes to complete the second part of the Nelson-Denny and the Reading Comprehension Test. Finally, they were given ten minutes for the Word Families task, followed by 30 minutes for the VDT.

Results

First, we examined correlations among the predictor variables to ensure that multicollinearity was not an issue, and then we correlated the predictor variables with the outcome variables in an effort to determine which predictors should be included in the regression analyses. For the regression analyses, two hierarchical multiple regression analyses were conducted to see if the two depth measures explained variance in reading comprehension and then reading rate, after controlling for vocabulary breadth.

Correlations

We first examined the relationships among the predictor variables, and we found that both vocabulary depth measures were significantly correlated to the vocabulary breadth measure. While the correlation of the word families task with breadth was smaller in magnitude, the VDT was strongly related to breadth. However, the two depth measures were not significantly correlated with one another. All three vocabulary scores were correlated with reading comprehension (with moderate to strong correlations), and reading rate (small to moderate correlations). See Table 1 for correlations between the variables.

Regressions

As mentioned above, two hierarchical multiple regression analyses were conducted to see if the depth measures explained variance in reading comprehension and reading rate, after controlling for vocabulary breadth. See Table 2 for the β weights. In the first step of the regression, vocabulary breadth was entered into the equation to explain reading comprehension, and the $R^2 = .33$ was significant, $F(1, 104) = 53.31, p < .001$. In the second step, both of the vocabulary depth measures were entered into the equation, and there was a significant increment in the R^2 . These two variables accounted for an R^2 increase of .06, $F(2, 102) = 5.22, p = .007$, which is a small, but significant amount. The R^2 associated with

the final model was .40. In the final model, the β coefficients for all three predictors were significant: vocabulary breadth, $\beta = .395$, $t = 3.94$, $p < .001$; VDT, $\beta = .234$, $t = 2.36$, $p = .02$; and the Word Families task, $\beta = .169$, $t = 2.14$, $p = .04$.

In the second regression analysis, reading rate was used as the outcome variable. In the first step of the regression, vocabulary breadth was entered into the equation to explain reading rate, and the $R^2 = .14$ was significant, $F(1, 104) = 17.01$, $p < .001$. In the second step, both of the vocabulary depth measures were entered into the equation, but there was not a significant change in the R^2 , $F < 1$.

Discussion

This present study investigated the relationships among vocabulary breadth, vocabulary depth, reading comprehension, and reading rate among college-aged students. We have several noteworthy findings. First, consistent with the hypotheses, both vocabulary breadth and depth were significantly correlated with reading comprehension and rate. Second, while both types of vocabulary knowledge explained unique variance in reading comprehension, only vocabulary breadth explained unique variance in reading rate. This finding suggests that vocabulary breadth and depth make significant independent contributions to comprehension, while only breadth makes a significant contribution to reading rate. Finally, although vocabulary breadth was significantly correlated with both of the vocabulary depth measures, the two depth measures were not significantly correlated with each other.

Consistent with a vast array of past research on children (e.g., Carlisle, 2000; Nelson & Stage, 2007; Ouellette, 2006; Verhoeven & Van Leeuwe, 2008), we found that vocabulary breadth explains variance in reading comprehension for college-aged readers. Also consistent with past research, vocabulary depth was found to explain variance in reading comprehension, over and above vocabulary breadth (Roth, Speece, & Cooper, 2002; Snow, Tabors, Nicholson, & Kurland, 1995; Nation & Snowling, 2004). While both variables explained independent variance in reading comprehension, only vocabulary breadth accounted for unique variance in reading rate. Thus, similar to the findings of Ouellette (2006), these different aspects of vocabulary play different roles for various reading skills. Having many words in one's lexicon (i.e., vocabulary breadth) aids in the processing efficiency of those words, and this speeds reading rate. However, knowing more about each individual word (i.e., vocabulary depth) also helps one to develop a more coherent representation of the text, thus aiding reading comprehension.

One surprising finding in our study was that the two measures of vocabulary depth were not significantly correlated with one another. One possible explanation for this is that the Word Families task and the VDT measured two different aspects of vocabulary depth, which means that vocabulary depth itself is a multi-faceted variable that needs various measures to capture all of its dimensions. Proctor et al. (2012) argued that vocabulary depth consists of morphology, semantics, and syntax. Understanding morphology enables people to make use of the root words' meanings to infer the meanings of their derivations. Semantics helps people relate each word to others and infer the meaning of a word from the context it is in. Lastly, syntax helps people understand the language constructions in which a specific word

appropriately appears, thereby, aiding reading comprehension. If we compare the dimensions that are measured with the Word Families task and the VDT, we can see that both tasks require semantic representations of the target words. However, the Word Families task may rely more on morphological awareness as the task specifically asks participants to provide the derived forms of words. The VDT also taps into morphological awareness as some target words only fit the sentences when in derived form, but the VDT also requires syntactic awareness. Several of the target words need to be re-assigned their constituent role in one of the six sentences in order to successfully identify the correct target (for example, the target word *question* appears as both a noun and a verb).

Since vocabulary depth is a relatively new construct, much more work needs to be devoted to properly assessing this variable. As mentioned earlier, several studies have used a wide variety of measures to assess this dimension of vocabulary. For example, the semantic aspect has been assessed using synonym, polysemy, and word definition tasks (Carlo et al., 2004; Ordonez et al., 2002; Ouellette, 2006; Proctor et al., 2012; Tannenbaum et al., 2006). The morphological aspect has been assessed using a variety of tasks that require that participants either add or delete morphemes to create new words (e.g., Berninger, Abbott, Billingsley, & Nagy, 2001; Berninger & Nagy, 1999; Carlisle, 2000). Finally, the syntactic aspect has been tapped by requiring participants to use the same target word in different contexts that tap different grammatical roles for that word (e.g., VDT, Richard, 2011). Thus, capturing vocabulary depth may require a more extensive battery of assessments, and then a better understanding of how these different components give rise to the construct of vocabulary depth.

Implications

Our study demonstrates that both depth and breadth are important elements of vocabulary, even for college students. Similar to our study, Perfetti, Yang, and Schmalhofer (2008) found that college students vary in terms of how flexible their semantic representations are. They concluded that this variability results in differences for the retrieval and integration of contextually appropriate meanings, which in turn may influence comprehension. This richness of semantic representations, or what we have referred to as depth, has important implications for college students as they read and attempt to learn specialized vocabulary in their classes. The more they read and acquire this new information on the nuanced meanings of various words, the more complex their lexical organization becomes, which ultimately allows them to more fluently access the appropriate meanings of words (Schmitt, 2014). This better developed network of semantic information allows the reader to move from a receptive understanding to a productive use of those words (Schmitt, 2014). Clearly, college students need to use that specialized language productively to demonstrate mastery of the material.

The exploration of vocabulary breadth and depth in vocabulary acquisition has also been previously examined in college-aged readers, but only for second language learners. Ehsanzadeh (2012) administered tasks that tapped both dimensions of vocabulary knowledge, and also had participants read a passage that included several nonwords. The researcher asked the participants to infer the meaning of the nonwords, and they were tested

on their vocabulary acquisition. Ehsandzadeh found that while both breadth and depth were good predictors of vocabulary acquisition, depth was the better predictor. Similarly, Qian (1999) measured participants' depth of vocabulary knowledge and used that information to create two groups: high and low depth. The participants had to learn new vocabulary words in context, and Qian found those in the high depth group were better able to use informative context to correctly infer word meanings. Those in the low depth group, on the other hand, tended to just focus on the new word (e.g., simply repeat the new word over and over), and they were not effective at finding the informative aspects of the context so that they could learn the new word. It is important to reiterate that both of these studies were conducted in the context of second language acquisition, so we need a better understanding of the contributions of breadth and depth in one's native language skills. The present study extends these findings to native language speakers and demonstrates that among skilled college readers, depth of vocabulary knowledge significantly impacts reading comprehension -- beyond the well-established relationship of vocabulary breadth and reading comprehension.

The present study and past research clearly demonstrate both breadth and depth are important in literacy development (Ouellette, 2006; Proctor et al., 2012). Previously, vocabulary breadth and depth have been shown to predict vocabulary acquisition skills for children. Coyne (2004) assessed two different vocabulary-teaching approaches during interactive reading sessions with kindergarteners. The main differences between the approaches were the amount of time spent teaching the vocabulary words, and how in-depth that teaching was. Embedded vocabulary instruction involved brief discussions of new target words that appeared during story-book readings with children. Embedded instruction focused on teaching for breadth of vocabulary in a time-efficient manner. Extended instruction involved longer periods of time spent explaining new target words that appeared during reading time, as well as teaching about these words in novel contexts outside of the book. Extended instruction focused on teaching for depth of vocabulary. As a control, the researchers used incidental exposure to target words, which consisted of students hearing target words in a story, but no further instruction on these words. Participants included 42 kindergarten students, each of whom was exposed to all three methods of teaching throughout the study. Their knowledge of all target words was then assessed to determine if words taught through one method of teaching were more accurately understood than those taught by another method. The results revealed that extended instruction showed a more accurate knowledge of the target vocabulary words, whereas embedded instruction showed a more limited knowledge of the target vocabulary words. Additionally, the breadth of vocabulary teaching approach (embedded) did not instill lasting understanding of novel words at a 6 week post-test. These results suggest that vocabulary depth is related to more long-lasting vocabulary knowledge in children. This "precision and sophistication of word knowledge" serves children well (Strasser & del Rio, 2013, pg. 182) since Cain and Oakhill (2014) have demonstrated that depth helps children to develop global coherence of the text, which is related to better comprehension (see also Ouellette & Shaw, 2014).

Summary

This work demonstrates that vocabulary depth, in addition to the traditional measure of vocabulary breadth, is an important variable to consider when assessing higher-level

processing such as reading comprehension. Indeed, knowing a lot of words is important for both reading comprehension and, as the present study demonstrates, reading speed. However, the quality of what one knows about those individual words matters in that this more nuanced knowledge assists in reading comprehension. Possessing a comprehensive understanding of the nuances of the meanings of words in different contexts will allow the reader to develop a better representation of the text, and in turn, this knowledge could help the individual better express himself/herself.

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Table 1

Correlation Coefficients between Vocabulary Breadth, the two Vocabulary Depth Measures, Reading Comprehension and Reading Rate.

Task	1	2	3	4	5
Vocabulary Breadth					
VD – Word Families	.23 *				
VD - VDT	.63 ***	.17			
Reading Comprehension	.58 ***	.30 **	.51 ***		
Reading Rate	.38 ***	.20 *	.26 **	.32 **	

Note:

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$.

Table 2

Regression Analysis for Vocabulary Depth and Breadth on Reading Comprehension and Reading Rate.

Tasks	<i>in R</i> ²	β	SE	<i>t</i>
Reading Comprehension (<i>R</i> ² full model = .40)				
Vocabulary Breadth	.33 ***	.40	.05	4.11 ***
Vocabulary Depth	.06 *			
Word Families		.17	.03	2.14 *
VDT		.23	.12	2.36 *
Reading Rate (<i>R</i> ² full model = .15)				
Vocabulary Breadth	.14 ***	.33	.96	2.75 **
Vocabulary Depth	.01			
Word Families		.12	.62	1.29
VDT		.03	2.61	.26

Note:

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