

VOCABULARY DEPTH KNOWLEDGE AND ACADEMIC READING COMPREHENSION OF BUSINESS EFL UNDERGRADUATES: A CORRELATIONAL DESIGN STUDY

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Abstract

Purpose of the study: An in-depth investigation of vocabulary depth knowledge by lexical researchers plays an important role in language learning and teaching. The present study examined vocabulary depth knowledge of Business EFL learners and its correlation and prediction to academic reading comprehension, employing morphological knowledge and analytical relations with syntagmatic and paradigmatic relations as part of vocabulary depth knowledge.

Methodology: The study employed standard multiple regression analysis under a quantitative approach among 120 Business undergraduate EFL students at the tertiary level.

Main Findings: Results showed vocabulary depth knowledge, i.e., syntagmatic and paradigmatic relations, had the strongest and significant correlation with reading comprehension compared to other independent variables. Significantly, vocabulary knowledge, combined with paradigmatic and syntagmatic relations, was found to be a significant and unique predictor of academic reading comprehension. About 62.2 percent of the variance in academic reading comprehension was explained jointly by all three independent variables. About 32 percent of the variance was explained by the vocabulary depth knowledge test alone. Also, syntagmatic and paradigmatic relations, represented the depth of vocabulary knowledge test made the most significant unique contribution (uniquely explained about 20.25 percent) to explaining academic reading comprehension in comparison with other dimensions of vocabulary depth knowledge. These findings were elaborated in the perspective of combined paradigmatic and syntagmatic relations as the depth of vocabulary knowledge, derivative word forms as morphological knowledge, part-whole relations as analytic relations and their relationship and contribution to reading comprehension.

Applications of this study: The study suggests that the depth of vocabulary knowledge would have practical use for the students, English teachers at the tertiary level and further implications for lexical researchers.

Novelty/Originality of this study: The inclusion of analytic relations with paradigmatic and syntagmatic relations and morphological knowledge, which represented the depth of vocabulary knowledge, has added to the body of lexical knowledge.

Keywords: *Academic Reading Comprehension, Analytic Relations, Correlation, Prediction, Vocabulary Depth Knowledge.*

INTRODUCTION

Vocabulary dimension of language teaching and learning has gained much prominence, and it has been extensively researched in the second language (L2) acquisition, assessment, and instruction (Schmitt, 2010; Zhang & Yang, 2016). L2 vocabulary language researchers (e.g. Bogaards & Laufer, 2004; Chapelle, 1998; Henriksen, 1999; Nation, 1990, 2001; Qian, 1998, 1999, 2002; Read, 2000; Wesche & Paribakht, 1996) reckon that vocabulary knowledge comprises multiple facets. Qian (1999) and Wesche and Paribakht (1996) propose that vocabulary knowledge encompasses at least two attributes, i.e., size or breadth of vocabulary knowledge and depth or quality of vocabulary knowledge.

In terms of dimension, the breadth or size of vocabulary knowledge signifies a learner's knowledge of the number of words, i.e., the learner requires to have a minimum understanding of words' meaning; on the other hand, vocabulary depth knowledge refers how deeply or well a word is known (Qian, 2005; Qian & Schedl, 2004). Vocabulary depth knowledge includes multifarious components, namely pronunciation, spelling, frequency, meaning, register, syntactic and morphological traits (Qian, 1998, 1999). Researchers who work on vocabulary have primarily stressed on the important role of vocabulary size or breadth knowledge in reading comprehension (i.e., Jeon & Yamashita, 2014; Laufer, 1992, 1996; Milton, 2013; Na & Nation, 1985). Furthermore, Qian (2002) and Schmitt (2014) propagate that in the field of L2/foreign language (FL) research, vocabulary researchers have not given due recognition for the important role depth of vocabulary knowledge plays till to date. Furthermore, Qian (2002) asserts that a few experimental research works investigated the relationship between reading comprehension and vocabulary depth knowledge (Qian, 1998, 1999; de Bot, Paribakht & Wesche, 1997). Qian (2002) contends that both breadth of vocabulary knowledge and vocabulary depth knowledge merit equal consideration for examining the important role knowledge of vocabulary functions in reading comprehension. Consequently, yardsticks that have the capability of evaluating vocabulary depth knowledge get

imperatively sought after since L2/FL vocabulary knowledge investigation has demonstrated 'a clear imbalance' (p. 699) regarding its multidimensionality, particularly in terms of depth of vocabulary knowledge (Zhang & Yang, 2016).

Moreover, Hasan and Shabdin (2016) provided rationales for including various components of vocabulary depth knowledge, represented by paradigmatic relation (hyponymy, synonyms, antonymy), syntagmatic relation (collocation), the major derivative word forms, which represented morphological knowledge, part-whole relation known as analytic relations (meronymy) as indispensable aspects of vocabulary depth knowledge for examining their relationship with and prediction to reading comprehension. According to Zhang and Koda (2017), paradigmatic relation is "an associate of the same word class as the stimulus word (i.e., free association) and performing the same grammatical function in a sentence" (p. 2), such as a synonym (i.e., *sudden, quick* and *surprising*); on the other hand, syntagmatic relation refers "an associate of a different word class from the stimulus word and having a sequential relationship with the stimulus word" (p. 2), such as a collocate (i.e., *sudden change* or *sudden noise*). In addition, analytic relations connote "words that always belong to the target word," such as yellow, fruit, and peel for banana (Zhang & Koda 2017, p. 13). While discussing research design, Creswell (2014) defines that an explanatory research design "is a correlational design in which the researcher is interested in the extent to which two variables (or more) co-vary, that is, where changes in one variable are reflected in changes in the other." (p. 366). On the other hand, Creswell (2014) propounds that the objective of a prediction research design is to determine variables that predict a result or criterion.

To the best knowledge of the authors of this paper, little is known of empirical research studies that examined the associations and prediction of the mentioned diversified components (i.e., syntagmatic and paradigmatic relations, morphological knowledge and analytic relations) as inseparable aspects of vocabulary depth knowledge to reading comprehension in English as a second language (ESL)/English as a foreign language (EFL) context. The present study attempts to examine the degree to which different parts of vocabulary depth knowledge predict academic reading comprehension. It also seeks to determine the degree to which dissimilar aspects of vocabulary depth knowledge, such as syntagmatic relation (collocation), analytic relations (meronymy), morphological knowledge (affixes), and paradigmatic relation (synonyms, hyponymy, antonymy) as inseparable dimensions of vocabulary depth knowledge have the effect on EFL learners' academic reading comprehension. To this end, employing two independent variables, morphological knowledge and analytical relations with syntagmatic and paradigmatic relations, which represented vocabulary depth knowledge test, the present study examines three aspects of vocabulary depth knowledge of Bangladeshi Business EFL learners and their correlation and prediction to academic reading comprehension.

LITERATURE REVIEW

Depth of Vocabulary Knowledge and Reading Comprehension

Concerning L2 research, Qian (1998, 1999) and Paribakht and Wesche (1997) pointed out that few empirical studies had been administered to investigate the relationship between vocabulary depth knowledge and reading comprehension. de Bot et al. (1997) examined that different facets of vocabulary knowledge, namely word associations and morphological knowledge aspects, had a strong connection with the processes of reading comprehension.

A review of relevant literature shows inconclusive results regarding the correlation and prediction of depth of vocabulary knowledge to reading comprehension. Studies (i.e., Choi, 2013; Kang et al., 2012; Mehrpour, Razmjoo, & Kian, 2011; Rashidi & Khosravi, 2010) found that depth of vocabulary knowledge was a stronger predictor of reading comprehension than the breadth of vocabulary knowledge. On the other hand, other research works (i.e., Chen, 2011; Farvardin & Koosha, 2011; Li & Kirby, 2015; Kameli et al., 2013; Moinzadeh & Moslehpour, 2012; Rouhi & Negari, 2013; Wang, 2014) also showed that the breadth of vocabulary knowledge was a stronger predictor of reading comprehension than the depth of vocabulary knowledge.

Morphological Knowledge and Analytical Relations

Particularly, the measures that investigated multifarious dimensions of vocabulary depth knowledge in English made a larger and stronger effect on reading comprehension compared with the yardstick that merely tested a term of one word solely (Nassaji, 2004). The present study has employed one facet of morphological knowledge (i.e., derivative forms of words) considering as an integral aspect of vocabulary depth knowledge; however, according to Weixia (2014), other dimensions of morphological knowledge, namely register, spelling, pronunciation, and parts of speech are reckoned as significant parts of the depth of vocabulary knowledge. Morphological knowledge is a significant dimension of vocabulary depth knowledge because Li and Kirby (2015) argued that when learners knew affixes and roots, the knowledge could help them comprehend the organization of words. The knowledge of the word-formation successively would expand learners' comprehension of the associations amidst words. On the other hand, Winston, et.al., (1987) propagate that concerning semantic relation, analytic relations, particularly part-whole relation, is considered a significant category. Furthermore, Schmitt and Meara (1997) claimed the significance of the knowledge of word association in the language learning field; as a result, analytic relations (part-whole) is considered as one important dimension of depth of vocabulary knowledge.

Lately conducted research works (e.g., Chen, 2011; Choi, 2013; Kezhen, 2015; Li & Kirby, 2015; Rashidi & Khosravi, 2010) that have examined the relationship between vocabulary depth knowledge and reading comprehension have solely

encompassed paradigmatic relation (antonymy, synonyms, and superordinate under hyponymy) and syntagmatic relation (collocations) as dimensions of vocabulary depth knowledge. However, vocabulary researchers have not explored other facets, like analytic relations and morphological knowledge as essential dimensions of vocabulary depth knowledge and their associations with text comprehension.

Vocabulary Research in the Bangladeshi Context

[Afrin \(2016\)](#) and [Khan and Akter \(2011\)](#) mention that most of the students at the tertiary level in Bangladesh are weak in English language skills. Even after completing their secondary and higher secondary levels of study, they fail to show their expected level of English language proficiency ([Arju, 2011](#); [Afrin, 2016](#); [Khan & Akter, 2011](#)) because of a lack of vocabulary knowledge ([Arju, 2011](#)). In addition, [Mirza and Mahmud \(2012\)](#) state that regarding the context of an academic reading comprehension text, which contains vocabulary with a different meaning that is situated without students' prior knowledge, students' understanding of the reading comprehension text becomes difficult. In other words, lack of vocabulary knowledge hinders understanding of their academic reading comprehension texts. Students face enormous difficulty in understanding English written textbooks primarily because of their inadequacy of vocabulary knowledge ([Jahan & Jahan 2011](#)); as a result, the lack of vocabulary knowledge in English of the students at the tertiary level in Bangladesh negatively affects the academic performance of the students. Moreover, according to [Jahan and Jahan \(2011\)](#), students cannot acquire the coveted result (CGPA) in their studies.

In the context of Bangladesh, the related studies that have been conducted on vocabulary have mainly focused on the challenges that EFL teachers face while they teach vocabulary and the students learn vocabulary in EFL classrooms, vocabulary learning strategies, and prevalent vocabulary teaching practice. With a specific focus on the attitude and achievement of the students, in the context of Bangladesh, the study of [Siddiqua \(2016\)](#) has put stress on the difficulties or challenges that EFL teachers face while they teach vocabulary in classrooms and the reasons that make teaching vocabulary difficult for them. Regarding the use of vocabulary learning strategies, the study of [Bristi \(2016\)](#) has emphasized the investigation of vocabulary learning strategies employed by EFL students at the tertiary level in Bangladesh. Moreover, in the context of Bangladesh, another study by [Ashraf \(2015\)](#) that deals with students' vocabulary problem focuses on the strategies that students can use to overcome their lack of vocabulary knowledge.

Vocabulary related other studies ([Afrin, 2016](#); [Khan & Akter, 2011](#); [Opel et al. .2009](#)) that have encompassed vocabulary aspect in the context of Bangladesh relate to different dimensions, for example, vocabulary and English writing skill, the effect of preschool dialogic reading on expressive vocabulary, etc. Moreover, [Afrin \(2016\)](#) also mentions that the majority of the students at the tertiary level in Bangladesh possess limited vocabulary and struggle to express their ideas. Though her ([Afrin, 2016](#)) study has included and elaborated on the vocabulary knowledge aspect at the tertiary level in Bangladesh, the main focus of her study is on the students' English writing skills. Furthermore, the study of [Opel, et.al., \(2009\)](#) have encompassed the effect of preschool dialogic reading on vocabulary among rural Bangladeshi students with a view to increasing their expressive vocabulary. Their study has included vocabulary knowledge aspect and reading comprehension, but their study has researched on storybook reading, including group dialogic reading of the rural Bangladeshi preschool learners to improve their (children's) expressive vocabulary. In summary, in the context of Bangladesh, the studies as mentioned above (i.e., [Afrin, 2016](#); [Arju, 2011](#); [Ashraf, 2015](#); [Bristi, 2016](#); [Hasan, 2014](#); [Jahan & Jahan, 2011](#); [Khan & Akter, 2011](#); [Opel, et.al., 2009](#); [Siddiqua, 2016](#)) have included the vocabulary knowledge aspect of the students. However, the mentioned studies have not focused on the different constituents of the depth of vocabulary knowledge and their correlation and prediction to the academic reading comprehension skill of EFL Business school students at the tertiary level in Bangladesh.

There exists a lack of experimental research works that included three components, i.e., syntagmatic and paradigmatic relations, morphological knowledge, and analytic (part-whole) relations jointly as indispensable dimensions of vocabulary depth knowledge and examined the relationships between three parts of vocabulary depth knowledge and reading comprehension. Moreover, [Ma and Lin \(2015\)](#) have claimed that considering an investigation with the mentioned line (i.e., research gap) is worth conducting. To address the research gap in the previous studies and based on the consideration in the literature review, the following research questions were formulated:

1. To what extent do scores of three aspects of vocabulary depth knowledge (i.e., syntagmatic and paradigmatic relations, represented vocabulary depth knowledge test, the four major derivative forms, namely noun, verb, adjective, and adverb, represented morphological knowledge, and six dimensions of analytic relations) correlate each other?
2. To what extent are three aspects of vocabulary depth knowledge (i.e., syntagmatic and paradigmatic relations, represented vocabulary depth knowledge test, the four major derivative forms, namely noun, verb, adjective, and adverb, represented morphological knowledge, and six dimensions of analytic relations) related to academic reading comprehension?
3. Which one out of the three aspects of vocabulary depth knowledge does predict the most in comparison with the other two aspects of vocabulary depth knowledge?

4. To what degree do scores of three aspects of vocabulary depth knowledge have a significant effect on predicting academic reading comprehension performance?

METHODOLOGY

Participants

The participants of the study were a sample of 120 Bangladeshi EFL students (five sections from Business school) in the first year of their undergraduate study from a private university in Dhaka, Bangladesh. The native language of the study's learners was Bengali (from one language background), and the students of the study used English as a foreign language. The students in the study had an average of 12 years of exposure to English learning. Out of the participated students, 72 were male (60%), and 48 were female (40%) who were majoring in Bachelor in Business Administration in different majors, like Human Resource Management, Finance, Marketing, Bachelor in Business Administration in Accounting and Information Systems, and Bachelor of Science in Economics under School of Business and Economics. The average age of the students was about 19 years and 9 months.

Purposive sampling in the first place and random sampling as the second step were employed for the present study. Furthermore, for the current study, the university was chosen since one of the researchers had access to get permission from the concerned authority to administer the tests. The rationale for choosing the employed four tests over the others for the current study is given in the following sentences. For the current study, the researchers intended to examine the depth of vocabulary knowledge of the students. Depth of vocabulary knowledge test was designed to measure the vocabulary depth knowledge of L2 learners and is considered a reliable test to assess several paradigmatic and syntagmatic characteristics of vocabulary knowledge (Qian, 2000). Concerning depth of vocabulary knowledge test, Read (2000) affirmed, "... is perhaps the best-written test of the depth of vocabulary knowledge that is available" (p. 90). Winston et al. (1987) pointed out that analytic relations was a significant constituent of vocabulary depth knowledge. For the current study, the morphological knowledge test was particularly fashioned as a depth of vocabulary knowledge test, and it complemented the depth of vocabulary knowledge test. In addition, the morphological knowledge test is particularly designed to cater to ESL or EFL learners. The justification for the chosen technique regarding the reading comprehension test in the current study is given in the following sentences. The other test, i.e., International English Language Testing System (IELTS) that was not chosen for the current study generally consists of long passages and has different question patterns to measure English language proficiency. The present study adopted three passages of the TOEFL reading comprehension test since the focus of the study was on examining the correlation and prediction of depth of vocabulary knowledge to academic reading comprehension.

Measures

Participants took part in three vocabulary tests: a depth of vocabulary knowledge test, a morphological knowledge test, an analytical relations test, and a reading comprehension test that consisted of three multiple-choice questions and answers.

Depth of vocabulary knowledge test

The depth of vocabulary knowledge test administered for the current study was partly the version of the Word Associates Test (WAT). In other words, version 4 of the WAT and depth of vocabulary test used by Qian and Schedl (2004) were adapted and employed in order to assess the vocabulary depth knowledge of the Business students of the current study. The depth of vocabulary knowledge test comprised 40 items, and it proposed to evaluate two constituents of vocabulary depth; they were paradigmatic (meaning/synonyms) and syntagmatic (collocation) relations of words. Under each item, there were two groups, and each group contained words. Each different column had four words, and out of the eight words, four words were associates with the stimulus words, whereas the other four words worked as distractors. An incorrect selection of the answer was given 0; as a result, the maximum achievable score of vocabulary depth was $4 \times 40 = 160$ (Hasan & Shabdin, 2017).

Analytic relations test

The analytic relations test for the current study was adapted on the basis of the idea about part-whole relations propagated by Winston et al. (1987). The analytic relations test consisted of 30 blanks, and the testees were required to write/fill either part or whole meaning of the words in the blanks. In scoring analytic relations, one point was given for each appropriate answer, so the highest score for the test was 30 (Hasan & Shabdin, 2017).

Morphological knowledge test

The morphological knowledge test of the present study was executed by checking the learners' productive knowledge of the four major derivative word forms of a word family, i.e., noun, verb, adjective, and adverb. Students were asked to jot down the correct derivative forms of the target word in the provided (each) blank. If the learners believed that no derivative form did exist, they simply placed an X in the blank. For the current study, the structure of the morphological test was adopted on the basis of the test designed by Schmitt and Zimmerman (2002). In scoring for the morphological

knowledge test, one point was awarded to the learners for their correct answers. An incorrect answer provided 0 points. The morphological test had 30 blanks, so the maximum possible score for the test was 30 (Hasan & Shabdin, 2017).

Reading comprehension test

The reading comprehension test of the study was a standard multiple-choice academic reading comprehension test, and this test was adopted from the Longman Test of English as a Foreign Language (TOEFL) (Philips, 2006: 343-345). Out of several passages, three texts were selected for the current study, and the total number of multiple-choice questions was 20. The maximum possible score for the reading comprehension test was 20 as there was a total of 20 questions (Hasan & Shabdin, 2017).

Research Design and Data Collection Procedures

The present study followed the quantitative approach, and multiple regression analysis as a statistical tool was used to describe the variables' potential predictions to the outcome/dependent variable. The participation of the students for the test measure was voluntary. One reading comprehension test and an analytic relations test were administered in one session. The depth of vocabulary knowledge test and morphological knowledge test were administered in another session with a one-week interval between them, i.e., the four tests were conducted in two successive sessions in regular English classes of the students. The time assigned for the depth of vocabulary knowledge was 40 minutes and 30 minutes for the morphological knowledge test. After one week, a reading comprehension test and analytic relations test were conducted. The students were provided 25 minutes to answer the reading comprehension test and another 30 minutes to perform the analytic relations test (Hasan & Shabdin, 2017).

In order to find out the level of intercorrelations among a depth of vocabulary knowledge test, analytic relations, morphological knowledge, and reading comprehension, the two-tailed Pearson correlation was selected for analyzing the data. To determine the powerful predictor of reading comprehension, standard multiple regression analysis was carried out. In other words, force-entry multiple regression (not stepwise) analysis was applied to find out the significant role played by knowledge of vocabulary depth in explaining academic reading comprehension. SPSS version 24 (Statistical Package for Social Studies) was exercised as the key statistical program for analyzing the data.

RESULTS

Descriptive Statistics and Reliability

Table 1 shows the performance of the learners ($N = 120$) on all four language tests and the reliability coefficient values of the tests (Hasan & Shabdin, 2017).

Table 1: Means, Standard Deviations and Reliability Coefficients Values

Tests	n*	Range	Minimum	Maximum	Mean	Std. Deviation	K-R Reliability Coefficients	MPS**
DVK ¹	40	22.00	137.00	159.00	147.80	6.677	0.750	160
MKT ²	30	14.00	12.00	26.00	19.15	3.717	0.516	30
AR ³	30	14.00	15.00	29.00	22.90	3.726	0.631	30
RC ⁴	20	10.00	8.00	18.00	12.85	3.281	0.630	20

** MPS= maximum possible score * n = number of items

DVK¹= Depth of Vocabulary Knowledge; MKT²= Morphological Knowledge Test; AR³= Analytic Relations; RC⁴= Reading Comprehension.

The r values (reliability coefficients) of the four tests, namely vocabulary depth knowledge test, morphological knowledge, analytic relations, and reading comprehension, were moderate even though the r value (0.516) of morphological knowledge was the lowest in comparison with r values of other tests. In spite of that, the score of morphological knowledge can be considered to have an acceptable level of reliability since the number of items ($n = 20$) was small. Importantly, the acceptable K-R-21 score is dependent on the type of conducted test (Hasan & Shabdin, 2017). Generally, a score, that is, above 0.05 is regarded as reasonable. According to Salvucci, et al., (1997), in terms of the range of reliability measure, when the r value is less than 0.50, the reliability is considered low; if the r value is between 0.50 and 0.80, the reliability is regarded as moderate whereas the r value is greater than 0.80, the reliability is treated as high. Even though K-R 21 employs less information to compute, it always provides a lower reliability index than produced by other methods (Alderson et al., 1995). To conclude, it can be said that all the tests were valid and reliable.

Correlation among the Variables

In order to investigate the first two research questions, a two-tailed Pearson correlation analysis was run to examine the associations between three dimensions of the depth of vocabulary knowledge and academic reading comprehension. The Pearson correlation values of all the variables are given in Table 2.

Table 2: Correlations among the Variables

	DVK ¹	MKT	AR
MKT ²	.644**		
AR ³	.156	.275	
RC ⁴	.702**	.429	.446*

** $p < .01$ * $p < .05$

DVK¹= Depth of Vocabulary Knowledge; MKT²= Morphological Knowledge Test; AR³= Analytic Relations; RC⁴=Reading Comprehension.

In terms of the first research question, as Table 2 illustrates, only the correlation ($r = .644$; $p = .002$) between morphological knowledge and depth of vocabulary knowledge was found positive, strong, and significant at the level of 0.01. According to [Cohen \(1988\)](#), the value r close to 0.50 shows a strong correlation between the variables. Besides, he suggests that when the coefficient value r is between ± 0.30 and ± 0.49 , the relationship is considered as a medium, and when r coefficient value is between ± 0.1 and ± 0.29 , the association is said to be as small. The correlation ($r = .156$; $p = .512$) between depth of vocabulary knowledge and analytic relations, and association ($r = .275$; $p = .241$) between morphological knowledge and analytic relation were found positive, but they were not statistically significant. The strong association between the depth of vocabulary knowledge and morphological knowledge shows that the two aspects were interconnected under the same construct, i.e. vocabulary depth knowledge.

Regarding the second research question, as shown in Table 2, the intercorrelations among two independent variables and one dependent variable were both positive and significant, but no significant correlation between morphological knowledge and reading comprehension was found. Table 2 shows that significant, positive, and high correlation at the 0.01 level ($r = .702$; $p < .01$) existed between academic reading comprehension and depth of vocabulary knowledge, and this suggests that EFL business students who had more both paradigmatic and syntagmatic relations (under vocabulary depth knowledge test) knowledge performed better in academic reading comprehension. Moreover, a significant positive correlation was found at the level of 0.05 ($r = .446$; $p < .05$) between academic reading comprehension and analytic relations. This indicates that those students also had six components of analytic relations (i.e., component-integral, member-collection, portion-mass, stuff-object, feature-activity, and place-area) knowledge performed better in academic reading comprehension. Out of both paradigmatic and syntagmatic relation knowledge and analytic relations, paradigmatic and syntagmatic relation of vocabulary depth knowledge had stronger positive correlation ($r = .702$; $p = .01$) with academic reading comprehension than analytic relations ($r = .446$; $p = .48$) with academic reading comprehension. Even though there was a positive relationship ($r = .429$; $p = .059$) between reading comprehension and morphological knowledge, the association between reading comprehension and morphological knowledge was not significant.

Prediction of Depth of Vocabulary Knowledge, Morphological Knowledge, Analytic Relations to Reading Comprehension

To address the third research question and examine which one out of three dimensions of the depth of vocabulary knowledge had the strongest prediction to academic reading comprehension, the researchers conducted multiple regression analysis (force-entry). Table 3 shows the prediction values of all three independent variables to the dependent variable and the significance value of the model's fitness. Since the 'F' statistics of the ANOVA table were significant at the 0.001 level ($R^2 = .622$), $F(3, 16) = 8.788$, $p < 0.001$, the run regression model was found to be well-fitted for the data.

Table 3: Prediction Value of Independent Variables and ANOVA Value

R	R ²	Adjusted R ²	Std. Error of the Estimate	ANOVA			
				df	Mean Square	F	p
0.789	0.622	0.551	2.19738	3	42.432	8.788	.001

a. Dependent Variable: Reading Comprehension; b. Predictors: (Constant), Analytic Relations, Vocabulary Depth Knowledge Test, Morphological Knowledge Test

From Table 3, it can be said that the regression model, using three predictors (independent) variables explained about 62.2 percent of the variance in academic reading comprehension. The R^2 value is .622, so it can be said that 62.2 percent of the variation for the criterion/dependent variable, that is, academic reading comprehension, was accounted for jointly by three independent variables, depth of vocabulary knowledge test, morphological knowledge, and analytic relations. As shown in Table 4, squaring the part correlation values indicates the contribution of that/each variable to the total R^2 . In other words, this tells how much of the total variance in the outcome is uniquely explained by that variable. Squaring

the value (.567)² means that the depth of vocabulary knowledge uniquely explained about 32 percent (32.1489) of the variance in total reading comprehension score. Squaring the part coefficient value (.112)² indicates that morphological knowledge uniquely explained about 1.25 percent (1.2544) of the variance in total reading comprehension score. On the other hand, squaring the part coefficient value (.358)² indicates that analytic relations uniquely explained about 13 percent (12.8164) of the variance in the total reading comprehension score.

The Beta values of the run regression model have answered research question 4, and the Beta values of all the variables are given in Table 4.

Table 4: Coefficients of All Variables

	Unstandardized	Standardized	<i>t</i>	Sig	Correlations		Collinearity Statistics	
	Coefficients	Coefficients			Partial	Part	Tolerance	VIF
	<i>B</i>	β						
DVK ¹	.364	0.741	2.943	.002	.678	.567	0.585	1.709
MKT ²	-.133	-0.150	1.799	.477	-.179	-.112	0.554	1.804
AR ³	.328	0.372	2.329	.033	.503	.358	0.924	1.083

a. Dependent Variable: Reading Comprehension; DVK¹= Depth of Vocabulary Knowledge; MKT²= Morphological Knowledge Test; AR³= Analytic Relations;

As shown in Table 4, the Beta value of depth of vocabulary knowledge test (i.e., both paradigmatic and syntagmatic relations knowledge) was the largest ($\beta = 0.741$). In terms of Beta value discussion, it is known that a large *t* value paired with small significance value suggests (*t* and 'sig' value) the predictor value (independent value) has a large impact on the criterion or dependent value.

Moreover, the largest Beta value shows that depth of vocabulary knowledge test ($\beta = .741$; $t = 3.690$, $p = .002$ (significant) ($p < .01$)) made the largest effect on explaining the outcome variable, academic reading comprehension when the variance was explained by all other variables jointly. The Beta values of other independent variables, namely analytic relations and morphological knowledge informs that morphological knowledge ($\beta = .150$; $t = -.728$, $p = .477$ (significant) ($p < .05$)) made lesser effect on explaining the outcome variable, reading comprehension than analytic relations ($\beta = .372$; $t = 2.329$, $p = .033$ (significant) ($p < .05$)), and morphological knowledge had the least effect on explaining the outcome variable, academic reading comprehension.

With a careful look of Table 4, it can be found that out of all three independent variables, depth of vocabulary knowledge test made a statistically significant unique contribution to the prediction (at the 0.01 level, $p = .002$) of the outcome in the model as the 'sig' value of vocabulary depth knowledge was less than 0.01 ($p < .01$). Out of two other variables, analytic relations also made a statistically significant unique contribution to the prediction (at the 0.05 level, $p = .033$) since the 'sig' value of analytic relations of vocabulary depth was less than 0.05 ($p < .05$). The other independent variable, namely morphological knowledge, did not make a statistically significant unique contribution to the prediction ($p = .477$) of the outcome since the 'sig' value of morphological knowledge was more than 0.10 ($p > .05$). From the above result discussion, it can be said that two independent variables, namely vocabulary depth knowledge test and analytic relations out of three independent variables, made a statistically significant unique contribution to the prediction of the outcome.

DISCUSSION

Correlation among the Variables

The depth of vocabulary knowledge test represented by both paradigmatic and syntagmatic relations was positively and significantly correlated with academic reading comprehension. The found result corroborated the findings of [Qian \(1998, 1999, 2002\)](#). This indicates that those students who had more both paradigmatic and syntagmatic relations knowledge (under vocabulary depth test) performed better in academic reading comprehension than other aspects of depth of vocabulary knowledge, namely morphological knowledge and analytical relations. Moreover, EFL business students who gained analytical relations (part-whole) knowledge performed better in reading comprehension than students with morphological knowledge. On the contrary, the study of [Horiba \(2012\)](#) found no unique and significant effect of depth of vocabulary depth knowledge on reading comprehension.

Prediction of Depth of Vocabulary Knowledge Test, Morphological Knowledge, and Analytic Relations to Reading Comprehension

Depth of vocabulary knowledge, measured by different dimensions, namely paradigmatic and syntagmatic relations, morphological knowledge, and analytical relations jointly and significantly contributed more than 62.2 percent variation in the dependent variable, academic reading comprehension. However, the blend of paradigmatic and syntagmatic relations, which represented the vocabulary depth knowledge test, made the strongest contribution to explaining the outcome variable, academic reading comprehension when the variance was explained by all other variables jointly. The present result corroborated other previous findings of L2 learners of English (e.g., [Li & Kirby, 2015](#); [Qian, 1998, 1999](#),

2002; Zhang & Yang, 2016). On the other hand, analytical relations predicted stronger in explaining the variance in academic reading comprehension than morphological knowledge, and morphological knowledge was the least predictor to explaining the outcome. The least contribution by morphological knowledge substantiated the previous findings (e.g. Qian, 1998, 1999, 2002); on the contrary, Zhang (2016) found out that derivational awareness, i.e., morphological awareness directly and significantly predicted reading comprehension of ESL learners.

In the present study, analytic relations also made a statistically significant unique contribution to the prediction. As analytic relations is considered a significant aspect (e.g., Winston et al. 1987) of vocabulary depth knowledge, the significant role of analytic relations found in this study is not surprising. This is the new finding of the current research, and this aspect of inclusion of analytical relations under vocabulary depth knowledge and its contribution to academic reading comprehension in the present study contributes to the vocabulary knowledge domain. Greidanus and Nienhuis (2001) conducted a study on three types of association among paradigmatic, syntagmatic and analytic (defining characteristics, such as those used in dictionary definitions) relations, and they found that for both higher-proficiency learners and lower-proficiency learners, the scores for both paradigmatic association and analytic association were significantly higher than those for the syntagmatic association. Their study included 54 learners of French from two Dutch-speaking universities without considering learners from ESL/EFL background and investigated only association among paradigmatic, syntagmatic, and analytic relations. Their study investigated neither correlation nor prediction between paradigmatic, syntagmatic, and analytic relations and academic reading comprehension. In addition, Horiba (2012) investigated a depth test for types of association (i.e., paradigmatic, syntagmatic, and analytic relations). Her study investigated the only association among paradigmatic, syntagmatic, and analytic relations, and no correlation or prediction between paradigmatic, syntagmatic, and analytic relations and academic reading comprehension was explored.

PEDAGOGICAL IMPLICATIONS

Language teachers and practitioners would be able to make use of the results of the correlation and prediction of different constituents of vocabulary depth knowledge to reading comprehension. To gain a better understanding of the significant associations and predictions between syntagmatic and paradigmatic relations and analytic relations and reading comprehension, the findings of the current study have shown, which can, in turn, endorse their pedagogical decisions.

When language instructors would support learners in paying attention to the most significant components of vocabulary depth knowledge, namely syntagmatic and paradigmatic relations and analytic relations, the reading comprehension content for the learners will be easier to handle and the amount of work less challenging. This fosters an avenue for learning and teaching to become more effective. Since syntagmatic and paradigmatic relations and analytic relations constitute a significant part of the depth of vocabulary knowledge, the findings of the present study might suggest that EFL learners would be benefitted more in their EFL reading when they are equipped with a deeper knowledge of words, namely syntagmatic and paradigmatic relations and analytic relations of vocabulary depth knowledge.

Vocabulary instructors, in general, have put greater stress on different ways that can maximize learners' vocabulary size. In the process of doing so, the learners are offered with a long list of vocabulary items to be remembered, and the list of vocabulary items often comprises only plain dictionary meanings. This practice is fallacious since imparting only a restricted definition of a word might hinder learners from developing a deeper knowledge of words, and this process, in turn, might impede learners' reading performance. Therefore, in their vocabulary instruction, vocabulary instructors should include words that show that learners possess an in-depth understanding of words, encompassing syntagmatic and paradigmatic relations, morphological knowledge, and semantic relations, particularly analytic relations, which represent vocabulary depth knowledge.

CONCLUSION AND LIMITATIONS

When one seeks to generalize the findings of the current study, some caution needs to be considered as the sample size was taken from only one university. Future research deserves more attention to this aspect. Other aspects of depth of vocabulary knowledge, like spelling, pronunciation, meaning, frequency, register, etc. can be delved into to find out their correlation and prediction to reading comprehension skills and other English language skills as well. Moreover, any impact of the native language (i.e., Bengali) or background knowledge of the learners on the test results was not explored. The study has limited the scope for generalizations of the research findings concerning the participants' study of programs or major subjects.

From the discussion that has been dealt so far, it can be observed that the correlation between depth of vocabulary knowledge and academic reading comprehension was the strongest, and vocabulary depth knowledge test represented by syntagmatic and paradigmatic relations was the most significant predictor of reading comprehension. About 62.2 percent of the variance in academic reading comprehension was explained jointly by all the three independent variables. About 32 percent of the variance was explained by the depth of vocabulary knowledge test represented by syntagmatic and paradigmatic relations alone.

To the best knowledge of the researchers of the present study, little is known about research work that investigated analytical relations jointly with morphological knowledge and paradigmatic relation and syntagmatic relation, considering as indispensable dimensions of vocabulary depth knowledge to find out their correlation and prediction to reading comprehension. Conducting the present research comprising analytical relations with other aspects of vocabulary depth knowledge to investigate the correlation and prediction to text comprehension among EFL business students has added to the vocabulary knowledge domain.

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AUTHORS' CONTRIBUTION

All authors have contributed significantly to this research work. The first author is responsible for designing the conceptual framework and research design, analyzing the data, and corresponding to the publisher. Both the second and third authors assist in data processing, collecting the data, preparing and formatting the manuscript.

REFERENCES

1. Afrin, S. (2016). Writing problems of non-English major undergraduate students in Bangladesh: An observation. *Open Journal of Social Sciences*, 4(3), 104-115. <https://doi.org/10.4236/jss.2016.43016>
2. Alderson, J.C., Clapham, C., and Wall, D. (1995). *Language test construction and evaluation*. Cambridge University Press.
3. Arju, S. (2011). A study on ESL vocabulary acquisition needs and classroom practice: A Bangladeshi context. *Stamford Journal of English*, 6, 54-71. <https://doi.org/10.3329/sje.v6i0.13902>
4. Ashraf, T. A. (2015). Teaching vocabulary to non-English majors: A general perspective. *DIU Journal of Humanities and Social Science*, 2, 167-175. <http://hdl.handle.net/20.500.11948/1198>
5. Bogaards, P., & Laufer, B. (2004). *Vocabulary in a second language*. John Benjamins Publishing Company. <https://doi.org/10.1075/llt.10>
6. Bristi, N. L. (2016). Exploring vocabulary learning strategies used by Bangladeshi undergraduate EFL learners: A comparative analysis of three proficiency level learners. *Global Journal of Human-Social Science Research*, 15(2), 1-13.
7. Chapelle, C.A. (1994). Are C-tests valid measures for L2 vocabulary research? *Second Language Research*, 10(2), 157-187. <https://doi.org/10.1177/026765839401000203>
8. Chen, K.Y. (2011). The impact of EFL students' vocabulary breadth of knowledge on literal reading comprehension. *Asian EFL Journal*, 51, 30-40.
9. Choi, H.Y. (2013). Effects of depth and breadth of vocabulary knowledge on English reading comprehension among Korean high school students. *Language Research*, 49(2), 419-452.
10. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd Ed.). Hillsdale, NJ, USA: Lawrence Earlbaum Associates.
11. Creswell, J. W. (2014). *Educational research: Planning, conducting and evaluating quantitative and qualitative research*. Pearson Education Limited.
12. de Bot, K., Paribakht, T.S., & Wesche, M.B. (1997). Toward a lexical processing model for the study of second language vocabulary acquisition: Evidence from ESL reading. *Studies in Second Language Acquisition*, 19(3), 309-329. <https://doi.org/10.1017/S0272263197003021>
13. Farvardin, M. T., & Koosha, M. (2011). The role of vocabulary knowledge in Iranian EFL students' reading comprehension performance: Breadth or depth? *Theory and Practice in Language Studies*, 1(11), 1575-1580. <https://doi.org/10.4304/tpls.1.11.1575-1580>
14. Greidanus, T., & Nienhuis, L. (2001). Testing the quality of word knowledge in a second language by means of word associations: Types of distractors and types of associations. *The Modern Language Journal*, 85(4), 567-577. <https://doi.org/10.1111/0026-7902.00126>
15. Hasan, N. (2014). Teaching vocabulary through collaboration: Students as independent readers. *Journal of Education and Practice*, 5(13), 60-68. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.905.2079&rep=rep1&type=pdf>
16. Hasan, M. K., & Shabdin, A. A. (2016). Conceptualization of depth of vocabulary knowledge with academic reading comprehension. *PASAA*, 51, 235-268.
17. Hasan, M. K., & Shabdin, A. A. (2017). The correlation and contribution of depth of vocabulary knowledge to reading success of EFL Bangladeshi tertiary students. *PASAA*, 53, 148-181.
18. Henriksen, B. (1999). Three dimensions of vocabulary development. *Studies in Second Language Acquisition*, 21(2), 303-317. <https://doi.org/10.1017/S0272263199002089>
19. Horiba, Y. (2012). Word knowledge and its relation to text comprehension: A comparative study of Chinese- and Korean-speaking L2 learners and L1 speakers of Japanese. *The Modern Language Journal*, 96(1), 108-121. <https://doi.org/10.1111/j.1540-4781.2012.01280.x>
20. Jahan, A., & Jahan, N. (2011). Working with vocabulary at tertiary level in Bangladesh. *Journal of Education and Practice*, 2(5), 45-57.

21. Jeon, E.H., & Yamashita, J. (2014). L2 reading comprehension and its correlate: A meta-analysis. *Language Learning*, 64(1), 160-212. <https://doi.org/10.1111/lang.12034>
22. Kameli, S., Mustapha, G., & Alyami, S. (2013). The predictor factor of reading comprehension performance in English as a foreign language: Breadth or depth. *International Journal of Applied Linguistics and English Literature*, 2(2), 179-184. <https://doi.org/10.7575/aiac.ijalel.v.2n.2p.179>
23. Kang, Y., Kang, H. S., & Park, J. (2012). Is it vocabulary breadth or depth that better predict Korean EFL learners' reading comprehension? *English Teaching*, 67(4), 149-171. <https://doi.org/10.15858/engtea.67.4.201212.149>
24. Kezhen, L.I. (2015). A study of vocabulary knowledge and reading comprehension on EFL Chinese learners. *Studies in Literature and Language*, 10(1), 33-40.
25. Khan, H. R., & Akter, M. Z. (2011). Students' mistakes and errors in English writing: Implications for pedagogy. Research Report No 1, Centre for Research and Training. East West University.
26. Laufer, B. (1992). *How much lexis is necessary for reading comprehension?* In P.J.L. Arnaud and H. Béjoint (Eds.), *Vocabulary and applied linguistics* (pp. 126-132). London: MacMillan. https://doi.org/10.1007/978-1-349-12396-4_12
27. Laufer, B. (1996). *The lexical threshold of second language reading comprehension: What it is and how it relates to L1 reading ability.* In K. Sajavaara, & C. Fairweather (Eds.), *Approaches to second language acquisition* (pp. 55-62). Jyväskylä: University of Jyväskylä.
28. Li, M., & Kirby, J.R. (2015). The effects of vocabulary breadth and depth on English reading. *Applied Linguistics*, 36(5), 611-634. <https://doi.org/10.1093/applin/amu007>
29. Ma, Y. H., & Lin, W.Y. (2015). A study on the relationship between English reading comprehension and English vocabulary Knowledge. *Educational Research International*, 1-14. <https://doi.org/10.1155/2015/209154>
30. Meara, P. (1996). *The dimensions of lexical competence.* In G. Brown, K. Malmkjaer and J. Williams (Eds.), *Performance and competence in second language acquisition.* (pp. 35-53) Cambridge, UK: Cambridge University Press.
31. Mehrpour, S., Razmjoo, S.A., & Kian, P. (2011). The relationship between depth and breadth of vocabulary knowledge and reading comprehension among Iranian EFL learners. *Journal of English Language Teaching and Learning*, 2(222), 97-127.
32. Milton, J. (2013). *Measuring the contribution of vocabulary knowledge to proficiency in the four skills.* In C. Bardel, C. Lindqvist, & B. Laufer (Eds.), *L2 Vocabulary acquisition, knowledge and use: New perspectives on assessment and corpus analysis* (pp. 57-78). Euro SLA.
33. Mirza, M. G. H., & Mahmud, K. (2012). Reading habits of the students with Bengali medium background at the English medium private universities in Bangladesh. *Higher Education Studies*, 2(2), 100-106. <https://doi.org/10.5539/hes.v2n2p100>
34. Moinsadeh, A., & Moslehpour, R. (2012). Depth and breadth of vocabulary knowledge: Which really matters in reading comprehension of Iranian EFL learners? *Journal of Language Teaching and Research*, 3(5), <https://doi.org/10.4304/jltr.3.5.1015-1026>
35. Nassaji, H. (2004). The relationship between depth of vocabulary knowledge and L2 learners' lexical inferencing strategy use and success. *The Canadian Modern Language Review*, 61(1), 107-134. <https://doi.org/10.1111/j.1540-4781.2006.00431.x>
36. Nation, ISP (1990). *Teaching and learning vocabulary.* Newbury House.
37. Nation, ISP (2001). *Learning Vocabulary in another language.* Cambridge University Press. <https://doi.org/10.1017/CBO9781139524759>
38. Na, L., & Nation, ISP (1985). Factors affecting guessing vocabulary in context. *RELC Journal*, 16(1), 33-42. <https://doi.org/10.1177/003368828501600103>
39. Opel, A., Ameer, S. S., & Aboud, F. E. (2009). The effect of preschool dialogic reading on vocabulary among rural Bangladeshi children. *International Journal of Educational Research*, 48(1), 12-20. <https://doi.org/10.1016/j.ijer.2009.02.008>
40. Paribakht, T.S., & Wesche, M. (1997). *Vocabulary enhancement activities and reading for meaning in second language acquisition.* In Coady, J. and Huckin, T. (Eds.), *Second language vocabulary acquisition: A rationale for pedagogy* (pp. 174-200). Cambridge, UK: Cambridge University Press. <https://doi.org/10.1017/CBO9781139524643.013>
41. Philips, D. (2006). *Longman complete course for TOEFL test.* Longman Group/A Pearson Education Company.
42. Qian, D. D. (1998). *Depth of Vocabulary Knowledge: Assessing its role in Adults' Reading Comprehension in English as a second language.* [Ph.D. thesis. University of Toronto].
43. Qian, D. D. (1999). Assessing the roles of depth and breadth of vocabulary knowledge in reading comprehension. *Canadian Modern Language Review*, 56(2), 282-307. <https://doi.org/10.3138/cmlr.56.2.282>
44. Qian, D.D. (2000). *Validating the role of depth of vocabulary knowledge in assessing reading for basic comprehension in TOEFL 2000.* Research Report. Princeton, NJ: Educational Testing Service.

45. Qian, D. D. (2002). Investigating the relationship between vocabulary knowledge and academic reading comprehension: An assessment perspective. *Language Learning*, 52(3), 513-536. <https://doi.org/10.1111/1467-9922.00193>
46. Qian, D.D. (2005). Demystifying lexical inferencing: The role of aspects of vocabulary knowledge. *TESOL Canada Journal*, 22(2), 34-54. <https://doi.org/10.18806/tesl.v22i2.86>
47. Qian, D.D., & Schedl, M. (2004). Evaluation of an in-depth vocabulary knowledge measure for assessing reading comprehension. *Language Testing*, 21(1), 28-52. <https://doi.org/10.1191/0265532204lt273oa>
48. Rashidi, N., & Khosravi, N. (2010). Assessing the role of depth and breadth of vocabulary knowledge in reading comprehension of Iranian EFL learners. *Journal of Pan-Pacific Association of Applied Linguistics*, 14(1), 81-108.
49. Read, J. (2000). *Assessing Vocabulary*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511732942>
50. Rouhi, M., & Negari, G. M. (2013). EFL learners' vocabulary knowledge and its role in their reading comprehension performance. *Journal of Second and Multiple Language Acquisition*, 1(2), 39-48.
51. Salvucci, S., Walter, E., Conley, V., Fink, S., & Saba, M. (1997). *Measurement error studies at the National Center for Education Statistics (NCES)*. Washington D. C.: U. S. Department of Education.
52. Schmitt, N. (2010). *Researching Vocabulary: A vocabulary research manual*. Palgrave Macmillan. <https://doi.org/10.1057/9780230293977>
53. Schmitt, N. (2014). Size and depth of vocabulary knowledge: What the research shows. *Language Learning*, 64(4), 913-951. <https://doi.org/10.1111/lang.12077>
54. Schmitt, N., & Meara, P. (1997). Researching vocabulary through a word knowledge framework: Word association and verbal suffixes. *Studies in Second Language Acquisition*, 19(1), 17-36. <https://doi.org/10.1017/S0272263197001022>
55. Schmitt, N., & Zimmerman, C.B. (2002). Derivative word forms: What do learners know? *TESOL Quarterly*, 36(2), 145-171. <https://doi.org/10.2307/3588328>
56. Siddiqua, A. (2016). Challenges of teaching English vocabulary at the higher secondary level in Bangladesh. *The Journal of EFL Education and Research*, 1(1), 1-8. <http://edrc-jeffler.org/images/submitted/7.-Challenges-of-Teaching-English-Vocabulary-at-the-Higher-Secondary-Level-in.pdf>
57. Wang, Z. (2014). A correlation analysis on the depth and breadth of ESL learners' vocabulary knowledge and their overall linguistic competence. *Theory and Practice in Language Studies*, 4(12), 2460-2465. <https://doi.org/10.4304/tpls.4.12.2460-2465>
58. Weixia, W. (2014). Assessing the roles of breadth and depth of vocabulary knowledge in Chinese EFL learners' listening comprehension. *Chinese Journal of Applied Linguistics*, 37(3), 358-372. <https://doi.org/10.1515/cjal-2014-0022>
59. Wesche, M., & Paribakhat, T. S. (1996). Assessing second language vocabulary knowledge: Depth versus breadth. *Canadian Modern Language Review*, 53, 13-40. <https://doi.org/10.3138/cmlr.53.1.13>
60. Winston, M.E., Chaffin, R., & Herrmann, D. (1987). A taxonomy of part-whole relations. *Cognitive Science*, 11(4), 417-444. https://doi.org/10.1207/s15516709cog1104_2
61. Zhang, D. (2016). (In press). Derivational morphology in reading comprehension of Chinese speaking learners of English: A longitudinal structural equation modeling study. *Applied Linguistics*, 1-26. <https://doi.org/10.1093/applin/amv072>
62. Zhang, D., & Koda, K. (2017). Assessing L2 vocabulary depth with word associates format tests: Issues, findings, and suggestions. *Asian-Pacific Journal of Second and Foreign Language Education*, 2(1), 1-30. <https://doi.org/10.1186/s40862-017-0024-0>
63. Zhang, D., & Yang, X. (2016). Chinese L2 learners' depth of vocabulary knowledge and its role in reading comprehension. *Foreign Language Annals*, 49(4), 699-715. <https://doi.org/10.1111/flan.12225>