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The perceived barriers toward reading empirical articles among graduate students: A mixed methods investigation

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Abstract: This mixed methods study identified doctoral students' perceptions of barriers that prevent them from reading empirical articles. A secondary purpose was to examine the relationship between the students' perceived barriers and their levels of reading vocabulary and comprehension. Participants were 148 doctoral students in education at a large metropolitan research extensive university. The students were enrolled in sections of a one-semester research design course offered over a 2-year period. A thematic analysis (qualitative phase) revealed the following six barriers that students perceived as preventing them from reading empirical articles: lack of time (76.4%), psychological-physical factors (14.8%), lack of relevancy (10.8%), lack of statistical background (7.4%), language style (4.7%), and accessibility (2%). Lack of time was statistically significantly related to levels of reading ability (quantitative phase). Moreover, students with high levels of reading vocabulary were 3.4 times more likely than were their counterparts to perceive time as a barrier. Also, students with high levels of reading comprehension were 2.8 times more likely than were their counterparts to perceive time as a barrier. Implications of the findings are discussed.

Keywords: reading empirical research, barriers, reading ability, graduate students, higher education

I. Introduction.

Doctoral students from the field of social and behavioral sciences in general and the field of education in particular typically are required to enroll in at least one research methodology course during their degree programs. A major curricular goal of these courses is to prepare students to become consumers of research (i.e., to possess the ability to read, to interpret, to synthesize, and to utilize research) (Ravid and Leon, 1995). Indeed, the ability to read and critique empirical research is an important outcome of doctoral programs (Walpole, Burton, and Kanyi, 2002). Although some students will embrace the academic rigor and demands involved in becoming an expert in the field of education, others face difficulties with reading and comprehension. Thus, identifying the barriers that students experience when reading empirical

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research articles (i.e., articles that involve the collection, analysis, and interpretation of quantitative and/or qualitative data) is important for instructors to help graduate students to meet the objective of becoming consumers of research literature. Unfortunately, scant information exists about what barriers prevent doctoral students from reading empirical research articles.

A. Theoretical Framework.

Graduate students in advanced degree education programs are actively seeking expertise in their chosen areas of study. Alexander's (1995, 2003) Model of Domain Learning (MDL) is a framework that explains the process of developing expertise in an academic domain. The development of expertise is a dynamic process that progresses through three stages: acclimation, competence, and proficiency. Knowledge comprises academic domain knowledge or the breadth of the subject area and topic knowledge or the depth of knowledge in specific areas of the domain (Alexander and Jetton, 2000). In the final stage of proficiency, when students become experts in their chosen fields, they add new knowledge to the domain through research (Alexander, 1995, 2003).

The Construction-Integration (CI) Model (Bruning, Schraw, Norby, and Ronning, 2004; Kintsch, 1988) of reading comprehension explains how readers develop expertise in a domain through reading text. Readers build their vocabularies and thus their understanding of domain specific concepts and strategies as they read complex texts within their domains. The CI Model is an interactive process that the reader cycles through as he or she comprehends the text. Reading comprehension begins with the reader integrating the words with his or her vocabulary knowledge base to create a rich network of associative propositions or concepts. These associations are elaborated upon and become integrated with the reader's past knowledge to form comprehension of the sentence, phrase, and passage. The deepest comprehension integrates the richest interconnected associative net with the reader's prior knowledge base of vocabulary and concepts in the domain. Thus, prior vocabulary knowledge, which supports a rich and dense associative web, helps automate a reader's comprehension (Bruning et al., 2004; Kintsch, 1988).

As graduate students advance in levels of formal education and gain expertise in the content area, the complexity of their reading assignments increases (Pressley, 1995; Winne, 1995). This increased scholarship in the reading material causes the cognitive load required for vocabulary comprehension to be amplified (Alexander and Jetton, 2000). When comprehension does not automatically occur, the reader must systematically use meta-cognitive processes to plan, monitor, evaluate, and adjust his/her learning activities, motivation, affect, and learning environment (Alexander, 1995, 2003; McCombs and Marzano, 1990; Paris and Paris, 2001; Pressley, 1995; Winne, 1995, 1996; Zimmerman, 1990). As such, reading ability represents one construct that might help to determine the ease with which graduate students are able to understand empirical research articles.

Recently, the reading ability measured via the Nelson-Denny Reading test (NDRT; Brown, Fishco, and Hanna, 1993) as comprising reading comprehension and reading vocabulary scores has been found to be significantly related to student achievement in graduate-level research methodology and statistics courses (Collins and Onwuegbuzie, 2002, 2002-2003, 2004; Onwuegbuzie and Collins, 2002). Moreover, Onwuegbuzie and Collins (2002) found that graduate students' NDRT scores were statistically significantly higher than were the normative sample of undergraduate students reported by Brown et al. (1993). However, a small percentage

of the graduate students' scores were extremely low in contrast to the normative sample. Disturbingly, several graduate students' scores pertaining to reading comprehension and reading vocabulary represented the 14th percentile and 24th percentile, respectively. In another study conducted by Onwuegbuzie, Slate, and Schwartz (2001), 87% of graduate students surveyed reported that after reading several pages of a textbook, they were unable to recall or comprehend the contents of those pages. Similarly, Collins and Onwuegbuzie (2002) established that some graduate students demonstrate limited comprehension while reading research methodology textbooks. These results suggest that for some graduate students, reading ability might have a debilitative effect on their levels of academic performance. Moreover, it is likely that students with low reading abilities might find it difficult to read and understand empirical research articles. However, to date, this link has not been investigated formally.

B. Purpose of Study.

Because the majority of graduate students have adequate to high levels of reading comprehension and reading vocabulary (Onwuegbuzie and Collins, 2002), it is reasonable to assume that lack of reading ability is not the sole barrier that prevents graduate students from reading and understanding empirical research articles. Thus, the primary purpose of this study was to identify doctoral students' perceptions of barriers that prevent them from reading empirical studies. The secondary purpose was to examine the relationship between these barriers and levels of reading vocabulary and comprehension. This study was unique in at least three ways. First, it represented one of the few studies in which the role of reading ability on educational outcomes among doctoral students has been examined. Second, it appears to be the first formal attempt to investigate what doctoral students perceive to be barriers that prevent them from reading empirical research articles. Third, although virtually all studies that have examined the construct of reading ability among graduate students have involved the use of quantitative (i.e., monomethod) techniques, the present investigation utilized mixed methods procedures (i.e., quantitative *and* qualitative approaches) such that the resulting mixture or combination was likely to result in "complementary strengths and nonoverlapping weaknesses" (Johnson and Turner 2003, p. 299).

C. Mixed Methods Research Questions.

The following mixed methods research questions were addressed: (a) what is the relationship between reading vocabulary ability and perceived barriers among doctoral students in education when reading empirical articles? and (b) what is the relationship between reading comprehension ability and perceived barriers among doctoral students in education when reading empirical articles?

D. Significance of the Study.

This study was important because all doctoral students in education must be proficient with reading empirical research articles in order to develop expertise in their chosen fields within the domain of education. It was anticipated that the results from this study would guide faculty in planning supportive programs within the College of Education that facilitate students'

development of expertise in evaluating and conducting quality educational research. Also, it was expected that the doctoral-level education programs in similar institutions of higher learning would be able to apply the results of this study to improve their respective programs.

II. Method.

A. Participants.

The sample comprised 148 doctoral students in the College of Education at a large southern metropolitan, Carnegie-designated research-extensive university (Carnegie Foundation for the Advancement of Teaching, 2005) in the United States. These students enrolled in sections of an advanced research design course that was offered by the College of Education each semester over a 2-year period. These participants represented a convenience sample for both the qualitative and quantitative phases of the study. Approximately one half of the students (51%) were female. The participants varied in ages from 22 to 56 years, with the majority of students (87.2%) pursuing a Doctorate of Philosophy (i.e., Ph. D.) degree, and the remainder (12.8%) pursuing a Doctorate of Education (Ed. D.) degree.

B. Instruments and Procedures.

On the first day of class, all participants were administered two scales, namely, the NDRT and the Reading Interest Survey (RIS). The NDRT was utilized in this investigation to measure reading ability. This instrument, developed by Brown et al. (1993), is a 118-item test divided into two subtests, Vocabulary (80 items) and Comprehension (38 items). Each item on the NDRT contains a five-choice response option. The NDRT assesses reading vocabulary, reading comprehension, and the reading rate of test takers. Through a series of revisions, content and statistical data have been updated, although the format of the test has remained unchanged over the years (Brown et al., 1993). This test was selected because of its widespread use among researchers and adequate score reliability (KR-20 = 0.92) and score validity that have been reported in the literature, as well as the fact that normative data are available on very large samples of high school and college students (Brown et al., 1993; Onwuegbuzie and Collins, 2002). For the purposes of the present investigation, both the reading vocabulary scores and comprehension scores were analyzed. Score reliability calculated for the reading vocabulary test, as measured by KR-20, was 0.82 (95% CI = 0.78, 0.86) and for comprehension scores, was 0.69 (95% CI = 0.62, 0.76). Participants also were administered a RIS containing 62 items, the majority of which were closed-items requiring students to provide information regarding their reading habits, preferences, and difficulties (e.g., "Please indicate your perception about reading empirical research articles: Please circle the option that best applies: 1 = EASY; 2 = SOMEWHAT EASY; 3 = NEUTRAL; 4 = SOMEWHAT DIFFICULT; 5 = DIFFICULT"). Included in the RIS also were a few open-ended items (e.g., "What barriers prevent you from reading more empirical research articles?"). Collectively, RIS contained both closed- and open-ended items, a mixed methods collection style that Johnson and Turner (2003) refer to as Type 2 data.

The researchers utilized a mixed methods concurrent equal status design (Onwuegbuzie and Johnson, 2004) involving identical samples (Collins, Onwuegbuzie, and Jiao, 2006, 2007;

Onwuegbuzie and Collins, 2007) for both the quantitative and qualitative components. Correlation analysis (a quantitative technique) was combined with a thematic analysis (a qualitative technique) for the joint purpose of triangulation (i.e., seeking convergence and corroboration of results from different methods studying the same phenomenon) and complementarity (i.e., seeking elaboration, enhancement, illustration, clarification of the findings from one method with findings from the other method; Greene, Caracelli, and Graham, 1989). With respect to the qualitative component of the study, the method of *constant comparison* (Glaser and Straus, 1967; Lincoln and Guba, 1985) was employed to identify themes that represented barriers to reading empirical articles reported by the participants. The researchers categorized the responses of the participants to create various barrier themes by allowing the actual words (i.e., *in vivo* codes) of the participants to guide the constant comparison process. These themes, in turn, then were correlated with the participants' reading vocabulary scores, yielding a sequential mixed methods analysis—specifically a quantitative-qualitative mixed methods analysis (Onwuegbuzie and Teddlie, 2003). The Statistical Analysis System (SAS Institute Inc., 2002) was used to undertake all statistical analyses.

As a framework for conducting mixed methods data analysis, the following five stages identified by Onwuegbuzie and Teddlie (2003) were incorporated in the present study: data reduction, data display, data transformation, data correlation, and data integration. *Data reduction* involved reducing the dimensionality of the qualitative data using thematic analysis and quantitative data using descriptive statistics; *data display* involved describing pictorially the qualitative data using matrices and quantitative data using tables; *data transformation* involved converting qualitative data into numerical codes that can be represented statistically (i.e., *quantitized*; Tashakkori and Teddlie, 1998); *data correlation* involved correlating qualitative data with quantitized data; and *data integration* involved combining both quantitative and qualitative data into a coherent whole. Mixed methods analysis was employed to enable the researchers get more out of the initial data, thereby enhancing the significance of the findings (Onwuegbuzie and Leech, 2004; Collins, Onwuegbuzie, and Sutton, 2006).

III. Results.

A. Quantitative Findings.

The reading vocabulary scores ranged from 42 to 80, with a mean performance score of 73.31 (SD = 5.72). As expected, the reading vocabulary scores were negatively skewed (i.e., skewness = -1.93), reflecting the high-achieving nature of doctoral students in general. Also, these scores represented a leptokurtic distribution (i.e., kurtosis = 6.01).

The reading comprehension scores ranged from 44 to 76, with a mean performance score of 68.14 (SD = 6.08). Again, the reading comprehension scores were negatively skewed (i.e., skewness = -1.36), reflecting the high-achieving nature of doctoral students in general. Also, these scores represented a leptokurtic distribution (i.e., kurtosis = 2.11). The correlation between vocabulary scores and comprehension scores was statistically significant ($r = 0.46$, $p < 0.0001$).

B. Qualitative Findings.

The *in vivo* (i.e., using the exact words of the participants) and descriptive (i.e., developing descriptive words or phrases as codes) coding procedures revealed the following six themes emerging from the students' responses characterizing their perceptions of barriers that prevent them from reading empirical studies: time, psychological-physical factors, relevancy, statistical background, language, and accessibility. *Time* referred to the lack of time to undertake reading empirical articles due to other equally demanding obligations such as work, family responsibilities, and other assigned school work. *Relevancy* was typified by phrases such as "not as appropriate to my field," "lack of relevance to my work," "Oftentimes empirically based article don't relate to my research interest areas, "Since my field is social studies, I prefer ethnographic and oral history type of articles." *Statistical background* referred to inadequate statistical background or knowledge needed to understand the information presented in the articles and was represented by phrases such as "if the article includes complicated statistical analyses, I find myself rather frustrated," "I feel a lack of knowledge in statistical data and methods even though I have had stats 1 and 2," and "Lack of understanding of statistical techniques used in many research articles." *Physical and psychological factors* were characterized by words/phrases such as "boredom," "lack of interest in the topic," "fatigue," "laziness," "burnout," "lack of concentration in the reading content," and "visual impairment." *Language* referred to the barrier due to difficulty understanding terminology and vocabulary used in the articles due to several reasons including lengthy and statistically laden articles or employs technical writing style. Finally, *accessibility* represented the difficulty in accessing empirical articles due to several reasons including online unavailability, too many articles to sort through, difficulty locating articles on topics of interest, dearth of empirical articles in some specialties. It was denoted by phrases such as "There is a lot of research out there and often it becomes tedious to sort through them all," "It also takes time to locate articles on topics of interest," and "accessibility and finding articles with the whole test (the study itself) is a problem."

C. Mixed Methods Findings.

Each theme was *quantitized* (i.e., transforming the qualitative data to a numerical form; Tashakkori and Teddlie, 1998) to determine the frequency of each theme. This process of quantitizing revealed that the order of endorsement level for each of the themes was as follows: time (76.4%), psychological-physical factors (14.8%), relevancy (10.8%), statistical background (7.4%), language (4.7%), and accessibility (2%). Thus, *time* was by far the most commonly cited theme. Also, counting the frequencies of the themes of other courses taken, "statistical-based courses" (i.e., "courses that focus on theory and application of statistical procedures to problems in education (or other fields)" was the most cited course category (cited by 80.4% of the sample). This was followed by "research-based courses" (45.3%) (i.e., "course that focus on theory and application of major design models to systematic inquiry…"), "qualitative-based courses" (25.6%) (i.e., courses that "focus on theory and application of major design models to systematic inquiry"), and "measurement-based courses" (21.6%) (i.e., courses that focus on measurement concepts such as construction of tests and measurement assessments to more advanced concepts).

To examine if there was a relationship between vocabulary performance and the type of barriers cited, we selected approximately 20% of the participants with the highest vocabulary scores and 20% of the participants with the lowest vocabulary scores. Participants who scored between 42 and 69 were classified as belonging to the *low* group (n = 30), whereas those who scored between 78 and 80 were classified as belonging to the *high* group (n = 34). The researchers hypothesized that these two groups with markedly different levels of reading vocabulary also would differ with respect to their endorsement levels of one or more of the six emergent barriers.

Similarly, to examine if there was a relationship between reading comprehension performance and the type of barriers cited, we selected approximately 20% of the participants with the highest comprehension scores and 20% of the participants with the lowest comprehension scores. Thus, participants who scored between 44 and 64 were classified as belonging to the *low* group (n = 34), whereas those who scored between 74 and 76 were classified as belonging to the *high* group (n = 32). Again, we hypothesized that these two groups with markedly different levels of reading comprehension also would differ with respect to their endorsement levels of one or more of the six emergent barriers. It must be noted, because there were only 38 comprehension items, the comprehension scores were multiplied by two to facilitate comparison with verbal scores, as recommended by the instrument developers (i.e., Brown et al., 1993).

Table 1 presents the frequencies and percentages of categories of courses taken as reported by students in both low and high groups. The upper part of Table 1 relates to vocabulary performance whereas the lower part relates to comprehension performance.

Table 1. Frequency and Percentages of Courses Taken Reported by Participants with the Lowest and Highest Scores by Subtest as a Function of the Total Sample Size.

Group by Subtest		Courses			
		Statistics	Measurement	Qualitative	Research Methods
Vocabulary (N = 148)					
Low Score (42 to 69)	Count	21	5	10	15
	%	14.2%	3.4%	6.8%	10.1%
High Score (78 to 80)	Count	25	10	6	18
	%	16.9%	6.7%	25.7%	12.2%
Difference	%	2.7%	2%	18.9%	2.1%
Comprehension (N = 148)					
Low Score (44 to 64)	Count	28	7	10	12
	%	18.9%	4.7%	6.8%	8.1%
High Score (74 to 76)	Count	25	8	6	17
	%	16.9%	5.4%	4.1%	11.5%
Difference	%	2.0%	4.7%	2.8%	3.4%

Table 2 displays the barrier themes cited by students from both subgroups. The computation of both frequencies and percentages in Table 1 and Table 2 are based on total sample size (N = 148).

Table 2. Frequency and Percentages of Barriers Reported by Participants with the Lowest and Highest Scores by Subtest as a Function of the Total Sample Size.

Group by Subtest		Barriers					
		B1	B2	B3	B4	B5	B6
Vocabulary (*N* = 148)							
Low Score (42 to 69)	Count	19	7	2	3	3	2
	%	12.2%	4.7%	1.4%	2%	2%	1.4%
High Score (78 to 80)	Count	29	5	2	1	1	0
	%	19.6%	4%	1.14%	0.7%	0.7%	0%
Difference	%	7.4%	0.7%	0.26%	1.3%	1.03%	1.4%
Comprehension (*N* = 148)							
Low Score (44 to 64)	Count	24	5	4	6	1	0
	%	16.2%	3.4%	2.7%	4.1%	0.7%	0%
High Score (74 to 76)	Count	25	4	3	5	1	1
	%	16.9%	2.7%	2.0%	3.4%	0.7%	0.7%
Difference	%	0.7%	0.7%	0.7%	0.7%	0%	0.7%

Note. B1 = Time; B2 = Relevance; B3 = Statistical background; B4 = Psychological -physical factors; B5 = Language; B6 = Accessibility

Table 3 shows the frequencies and percentages of categories of courses taken by the sub-sample of participants with the lowest and highest levels of reading vocabulary and comprehension scores.

Table 3. Frequency and Percentages of Courses Taken Reported by Participants with the Lowest and Highest Scores by Subtest as a Function of the Sub-sample Sizes.

Group by Subtest		Courses			
		Statistics	Measurement	Qualitative	Research Methods
Vocabulary (*N* = 64)					
Low Score (42 to 69)	Count	21	5	10	15
	%	70%	17%	33%	50%
High Score (78 to 80)	Count	25	10	6	18
	%	74%	29%	18%	53%
Difference	%	4%	12%	15%	3%
Comprehension (*N* = 66)					
Low Score (44 to 64)	Count	28	7	10	12
	%	82.4%	20.6%	29.4%	35.3%
High Score (74 to 76)	Count	25	8	6	17
	%	78.1%	25%	18.8%	53.1%
Difference	%	4.3%	-4.4%	10.6%	-17.8%

Table 4 shows the barrier themes cited by the same sub-sample of participants based on vocabulary scores and comprehension scores. The computation of both frequencies and percentages in Table 3 and Table 4 are based on respective sub-samples, not the whole sample.

Table 4. Frequency and Percentages of Barriers Reported by Participants with the Lowest and Highest Scores by Subtest as a Function of the Sub-sample Sizes.

Group by Subtest		Barriers					
		B1	B2	B3	B4	B5	B6
Vocabulary (N = 64)							
Low Score (42 to 69)	Count	19	7	2	3	3	2
	%	63%	23%	7%	10%	10%	7%
High Score (78 to 80)	Count	29	5	2	1	1	0
	%	85%	15%	6%	3%	3%	0
Difference	%	22%	8%	1%	7%	7%	7%
Comprehension (N = 66)							
Low Score (44 to 64)	Count	25	4	3	5	1	1
	%	73.5%	11.8%	8.8%	14.7%	3.0%	3.0%
High Score (74 to 76)	Count	24	5	4	6	1	0
	%	75%	15.6%	12.5%	18.8%	3.1%	0
Difference	%	1.5%	3.8%	-3.7%	-4.1%	-0.1%	3.0%

Note. B1 = Time; B2 = Relevance; B3 = Statistical background; B4 = Psychological -physical factors; B5 = Language; B6 = Accessibility

An interesting finding was that the barrier of lack of time was cited less by the low-reading vocabulary group (63%) than by the high-vocabulary group (85%), as shown in the upper panel of Table 4. Moreover, the chi-square test yielded a statistically significant difference between these two groups with respect to how often the lack of time barrier was cited, whereby the lowest-scoring group were less likely to cite time as a barrier than were the highest-scoring group ($\chi^2(1) = 4.10$, $p = 0.0429$). The effect size associated with this difference, as measured by Cramer's V, was 0.25, indicated a moderate difference (Cohen, 1988). No other chi-square test was performed because the proportion of students who cited the remaining barriers was too small to obtain adequate statistical power (Erdfelder, Faul, and Buchner, 1996).

With respect to reading comprehension scores, again, the barrier, lack of time, was cited less by the low-reading vocabulary group (73.5%) than by the high-vocabulary group (75%), as shown in Table 4. The chi-square test yielded a statistically significant difference between these two groups with respect to how often the barrier was cited, whereby the lowest-scoring group were less likely to cite lack of time as a barrier than were the highest-scoring group ($\chi^2(1) = 5.25$, $p = 0.0219$). The effect size associated with this difference, as measured by Cramer's V, was 0.28, indicating a moderate difference. Because the proportion of students who cited the remaining barriers was too small to obtain adequate statistical power, no other chi-square test was performed.

Regarding the categories of courses taken, students in the low-performance vocabulary group had taken fewer courses in the area of educational measurement than did those in the high-performance vocabulary group, a difference of 12%. Conversely, students in the low-performance vocabulary group had taken 15% more qualitative courses than had the high-performance vocabulary group.

With respect to the categories of courses taken, again, students in the low-performance reading comprehension group had taken fewer courses in the area of educational measurement, statistics, and research methods than had those in the high-performance reading comprehension group, a difference of 4%, 4.3% and 17.8%, respectively. Conversely, students in the low-

performance reading comprehension group had taken 10.6% more qualitative courses than had the highest-scoring group (see Table 3).

IV. Discussion.

Research is an important part of any doctoral student's academic growth. To read and be able to analyze research in one's field is a primary goal of graduate programs in general and doctoral programs in particular (Walpole et al., 2002). In this study, the researchers were interested in identifying the perceptions of barriers that prevent doctoral students from reading empirical studies. Examined also was the relationship between these barriers and levels of reading vocabulary and comprehension. By collecting and analyzing quantitative and qualitative data within the same framework, the present inquiry has demonstrated the utility of using mixed methods approaches (cf. Tashakkori and Teddlie, 1998, 2003) to studying educational phenomena such as reading ability.

With respect to the first purpose, the following six barriers were identified: lack of time, psychological-physical factors, lack of relevancy, lack of statistical background, language style, and accessibility. Lack of time was by far the most common barrier cited for preventing doctoral students from reading empirical research articles, being mentioned by slightly more than three-fourths of the sample. The five other factors were cited less frequently than was this barrier theme, with psychological-physical factors being the second-most commonly mentioned barrier (14.8%; this was also the broadest barrier category). Because more than three fourths of the sample cited lack of time as a barrier, we can surmise that this is an important area of interest for further studies.

In comparing students whose levels of reading vocabulary represented the lowest 20% and highest 20% on the continuum, it was found that the low-performance vocabulary group had taken fewer measurement courses than had their high-performance counterparts (17% vs. 29%, respectively), but more qualitative courses (33% vs. 17%, respectively). Conversely, a dissimilar finding was reflected in a comparison of the lowest 20% and highest 20% with respect to levels of reading comprehension. Here, the low-performance reading comprehension group, in comparison to their high-performing counterparts, had taken slightly fewer measurement courses (12% vs. 14%, respectively) and slightly fewer qualitative courses (11% vs. 14%, respectively). What these data suggest is unclear, although there appears to be a link between doctoral students' levels of vocabulary performance and the type of research methods courses that they select.

According to the CI Model (Bruning et al., 2004; Kintsch, 1988), the development of a dense associative net or topical vocabulary facilitates comprehension. The structure and curriculum of these courses might influence the decisions of students with different levels of vocabulary performance when selecting courses. On one hand, the fact that more low-performance vocabulary students take more qualitative courses might result from the research methods taught in these courses. Qualitative methods focus on the analysis and synthesis of vocabulary to form themes, concepts, and principles. Applying qualitative methods to research in the students' interest areas within the domain of education might support students, who lack the vocabulary, in generating the vocabulary, concepts, and associative network required for expertise in their field. If increased topical vocabulary is a prerequisite for efficient reading comprehension, then offering qualitative methods courses to education doctoral students in the beginning of their programs might support their improved ability to read empirical articles.

On the other hand, the fact that more high-performance vocabulary students take more measurement courses also might result from the structure and curriculum of these courses. The nature of measurement methods are the opposite to those of qualitative methods. Rather than generate concepts from examples, measurement activities involve the creation of specific items to measure the concept. Experts generate specific questions or examples with exacting vocabulary to represent constructs. These measurement activities would require the students to have rich domain specific vocabulary resources and previous concept development for efficient application. Previous experiences of the students, who take more measurement courses, might have supported their development of a more advanced associative net, and as a result, they do not find the need to include more qualitative courses in their programs. The students with low-performance vocabulary levels, who take more qualitative courses, use these qualitative courses to support their developing vocabulary.

Further support for the relevancy of the CI Model for explaining reading comprehension of doctoral students is provided by the comparisions of courses taken by the high- and low-performing comprehension groups. The fact that students in the low-performance reading comprehension group took slightly fewer measurement courses and slightly fewer qualitative courses might be an indication of the time spent developing expertise within the doctoral program. According to the CI Model (Bruning et al., 2004; Kintsch, 1988), increased fluency in reading comprehension is facilitated by the denseness of the associative vocabulary net. Within the doctoral program, students continuously build this net. Therefore, reading comprehension within the domain of expertise is continuously developing and improving. Time studies with repeated measures are needed to document this development. Instruments will be needed to measure vocabulary level and empirical reading levels to verify the relationship between vocabulary development and reading comprehension.

If the CI Model explains how doctoral students increase their ability to read empirical research articles while developing expertise in the field, then the CI Model should guide the creation of recommended programs of study. Doctoral students, who have lower levels of domain specific vocabulary, should be encouraged to take qualitative methods courses first, because this would support the vocabulary development that is needed for success in later measurement methods courses. Future research should examine the development of vocabulary of doctoral students within the education domain. New measures are needed, because the NDRT did not measure the education specific vocabulary of doctoral students.

The majority of students in both the low- and high-performance groups in both vocabulary and comprehension scores cited lack of time as a barrier that prevented them from reading empirical research articles. However, the proportion of students who cited this barrier was statistically significantly larger (85% for vocabulary and 79% for comprehension) in the high-scoring group than in the low-scoring group (63% for vocabulary and 53% for comprehension).

The odds ratio revealed that students with high levels of reading vocabulary were 3.4 times more likely than were their low-scoring counterparts to perceive time as a barrier. One might have expected that students with the low levels of reading comprehension would be *more* likely to cite time as a barrier because they needed more time to read each empirical research article on account of their relative reading problems. However, the reverse was discovered. Consequently, the present finding might suggest that those individuals who have lower vocabulary performance than their peers might be more prone to find excuses not to read

empirical articles, possibly because of their discomfort with the relatively more advanced vocabulary. Moreover, these reading avoidance behaviors might stem from the fact that students who are not as proficient with respect to reading vocabulary are not able to self-regulate their study strategies, maintain motivation to accomplish their goals, actively seek the information they need, or be resilient and persevere when they encounter difficulties (Alexander, 1995, 2003; Bruning et al., 2004; Kintsch, 1988; McCombs and Marzano, 1990; Paris and Paris, 2001; Pressley, 1995; Winne, 1995, 1996; Zimmerman, 1990). The finding that students with the highest vocabulary levels are more likely to cite time as a barrier might reflect the fact that they have the greatest motivation to read empirical articles and thus are more cognizant of the limited time they have to do so. In support of this assertion, a small but statistically significant relationship was found between students' levels of reading ability and how often they read empirical articles ($r_s = 0.18$, $p < 0.05$).

Another explanation for why more students with higher vocabulary abilities indicated that time was a barrier that prevented them from reading empirical research articles could be that the perspectives of these different groups of students are different based on their accomplishments within their programs. Doctoral students, who have spent more time in their program and are taking higher level courses, might have increased expectations for reading empirical research articles when compared to doctoral students who are just beginning their program of studies. In addition, doctoral students enrolled in a greater number of courses, might also have increased expectations for the number of empirical articles to read. When numbers of articles to be read are a part of the equation, time might become a more influential barrier to reading. This finding also confirms the CI Model as an explanation for how students comprehend reading material and gain expertise. As students delve deeper into the domain, their associative vocabulary nets become denser, and their ability to comprehend empirical research in their field becomes more fluent. Parallel with the development of the students' expertise in the field, the rigor of readings in higher-level courses increases, while the expectations for their performance becomes more demanding. Because students at these higher levels of expertise are required to read greater quantities of more rigorous empirical research articles, they are more aware of the time required for reading these articles. Another important measure for future research will be the number and rigor of empirical research articles required for doctor students in the courses offered by the College of Education.

A. Implications for Future Research.

Understanding the role that reading comprehension plays in the learning process of graduate students is important, as evidenced by the recent increase in the number of studies conducted in this area (Collins and Onwuegbuzie, 2002-2003; Francis and Simpson, 2003; Jiao and Onwuegbuzie, 2003; Onwuegbuzie et al., 2001, 2004). Level of reading ability has been found to predict overall performance in research methodology courses (Collins and Onwuegbuzie, 2002, 2002-2003). Building on these works, the current investigation has documented another educational outcome that is linked to reading ability, namely, students' perceptions of the debilitative effect of time on their capacity to read empirical research articles. Future research should investigate this relationship between perceived lack of time and reading ability. More in-depth qualitative techniques (e.g., interviews, observations) can play an important role here. Quantitative techniques also could be used to see if this association between perceived lack of

time and reading ability varies as a function of demographic (e.g., gender, ethnicity, age, student's major field of interest), affective (e.g., level of motivation, level of self-efficacy) variables, program of studies variables (e.g., number of courses, numbers of empirical articles, reading level of empirical articles), and individual variables (e.g., level of domain specific vocabulary development and reading comprehension ability with empirical research articles).

An unexpected finding was the possible link between high reading vocabulary performance and enrollment in measurement-based courses, as well as the link between low-reading vocabulary performance and enrollment in qualitative courses. Although this was not a major focus in our study, there might be some important information to glean here regarding course preference of doctoral education students. In particular, it might be that doctoral students with the greatest reading vocabulary ability are more confident about enrolling in quantitative-based research courses because these courses necessitate the ability to receive, to encode, to translate, and to reproduce material presented in statistical textbooks, which are all aspects of the reading process (Hacker, 1998; Otero and Kintsch, 1992). Conversely, those with lower levels of reading ability might be more inclined to enroll in qualitative-based research courses because they support the development of domain specific vocabulary and its associative net utilized for reading comprehension (Kintsch, 1988). Whether doctoral students' choice of research methodology courses might stem, at least in part, from their levels of reading ability or whether reading ability is a result of those choices should be the subject of future investigations.

V. Conclusions.

An important limitation of the present findings warrants mention. Specifically, the results were obtained from a relatively homogeneous sample of doctoral students. This poses a threat to the external validity of the findings via population validity and ecological validity (Johnson and Christensen, 2008). Thus, it is not known whether the results are representative of doctoral students in general. As such, replications of the study are needed across various doctoral populations from various academic disciplines. This study also should be replicated on master's students and on undergraduate students.

Nevertheless, the current investigation indicates that for doctoral students from the field of education, reading ability might play an important role in the learning context. Moreover, to the extent that the negative relationship between levels of reading vocabulary and the perception that time prevents students from reading empirical articles might be indicative of reading avoidance behaviors or inadequate preparation among the poorest readers, this finding suggests that inadequate reading ability can place a student at risk of not learning the skills necessary to be a consumer of research (Ravid and Leon, 1995; Walpole et al., 2002). As such, reading ability in graduate school offers great potential for the design and implementation of interventions and course sequences that might effectively help address the research needs of graduate students and fully educate the future researchers and professional educators of tomorrow.

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