READING ABILITY AS A PREDICTOR OF AFRICAN-AMERICAN GRADUATE STUDENTS' WRITING PROFICIENCY IN THE CONTEXT OF STATISTICS COURSES

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Assessing technical writing skills, such as writing results stemming from statistical analysis of real data, is considered by some statistics instructors as a viable way of providing authentic assessment. Unfortunately, many students find such technical writing extremely difficult. Because writing result sections of quantitative studies involves the ability to receive, to encode, to translate, and to reproduce material presented in statistical textbooks, it is likely that reading ability plays an important role in the technical writing process. This study's purpose was to examine this link among 115 African-American graduate students. A canonical correlation analysis revealed that reading ability significantly predicted students' abilities to write the results of the following four statistical analyses: correlation analysis, independent samples t-test, dependent samples t-test, and chi-square analysis.

INTRODUCTION

Studies conducted in the context of graduate-level courses in educational research indicate that reading ability is a significant predictor of achievement (Collins and Onwuegbuzie, 2002; Onwuegbuzie, Slate, and Schwartz, 2001). Because empirical research has focused primarily on White students, little is known about the reading ability of minority students in general and African-American graduate students in particular. Collins and Onwuegbuzie (2002/2003) examined African-American graduate students' reading ability by comparing their reading comprehension and reading vocabulary scores, as measured by the Nelson-Denny Reading Test-Form G (NDRT) (Brown, Fishco, and Hanna, 1993), to the same set of scores obtained by two samples of White graduate students and a large normative sample of undergraduates. Results indicated that the African-American students obtained statistically significantly lower reading comprehension scores and reading vocabulary scores than did the undergraduate normative sample (Brown *et al*., 1993) and the two comparative samples of White graduate students (Collins and Onwuegbuzie, 2002; Onwuegbuzie and Collins, 2002). Specifically, 11.5% of reading comprehension scores and 13.7% of reading vocabulary scores of the African-American graduate sample were in the 1st percentile of the Brown *et al*.'s (1993) undergraduate norms. Results also indicated a strong relationship between reading ability (comprehension and vocabulary) and achievement (midterm and final exam scores). More recently, this methodology was replicated utilizing a sample of African-American graduate students attending a Historically Black College or University (HBCU) and the findings indicated that the African-American graduate students' reading comprehension scores were higher than the scores reported for the normative sample of undergraduate students (Onwuegbuzie, Mayes, Arthur, Johnson, Robinson, Ashe, Elbedour, and Collins, 2004). However, the African-American graduate students in this current study attained lower levels of reading comprehension and reading vocabulary than did a comparison graduate sample of White graduate students (Onwuegbuzie and Collins, 2002). These results underscore the importance of continuing to evaluate reading ability as a factor impacting African-American graduate students' achievement levels.

PURPOSE

One of the most realistic and specific ways for graduate students to learn to write technically is by writing up formally their statistical analyses. Because writing quantitative results sections involves use of statistical terminology, the ability to receive, to encode, to translate, and to reproduce material presented in statistical textbooks appears to be vital. Moreover, because these are all aspects of the reading process (Hacker, 1998; Otero and Kintsch, 1992), it is likely that reading ability is important to technical writing. The purpose of the present inquiry was to continue to assess reading comprehension as

a predictor of African-American graduate students' achievement levels by examining the relationship between reading ability, as measured by African-American graduate students' scores on the NDRT, and their ability to write in a technical manner--specifically, to be able to write results sections of quantitative research reports. As such, the current investigation replicates and extends the work of Collins and Onwuegbuzie (2002/2003), who documented a relationship between African-American students' reading ability and overall performance in a quantitative research methodology course. It was hypothesized that reading ability differentially impacts students' capacity to write technical reports.

METHOD

Participants were 115 African-American graduate (i.e., Master's and Doctoral) students attending a HBCU in the eastern United States, who were enrolled in five sections of an introductory-level statistics course. Most were female (78.2%). Participants were administered Form G of the NDRT (Brown *et al*., 1993) on the first day of class to measure reading comprehension and reading vocabulary. This instrument contains 118 multiple-choice items covering seven reading passages that are divided into two subtests: Comprehension (38 items) and Vocabulary (80 items). Each item contains five response options. For the present investigation, score reliability, as measured by KR-20, was .97 for both the reading comprehension subtest (95% confidence interval [CI] = .95, .98) and the reading vocabulary subtest (95% CI = .96, .98).

Technical writing in the statistics courses was assessed via what has been referred to in the literature as statistics notebooks (Onwuegbuzie and Leech, 2003). To develop the notebooks, students are required to analyze real data provided by the instructor for every statistical technique taught in the course and to write up formally the results in a report in the same manner as would appear in a published journal article. In the present study, statistics notebook report scores corresponding to the following statistical techniques were analyzed: correlation analysis, independent samples *t*-test, dependent samples *t*-test, and chi-square analysis. The present study compared the students' measured reading ability with scores achieved on four different tasks (i.e., associated with the aforementioned four statistics notebook reports) as a way of assessing their technical writing achievement.

Four scoring rubrics were used to evaluate the statistics notebook reports, with detailed feedback provided by the instructor. Each of the four rubrics consisted of a 5-point Likert-format scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) that was designed to provide a score for (a) the content of the statistics notebook report (28 items), and (b) the extent to which the report is free from grammatical and typographical errors and follows American Psychological Association's guidelines (18 items). Scores from each section of the rubric were converted into percentages. Thus, each statistics report received a score on a 100-point scale. Score reliability coefficients pertaining to the four statistics notebook reports were as follows: correlation analysis (.86; 95% CI = .80, .91), independent samples *t*-test (.87; 95% CI = .81, .92), dependent samples *t*-test (.85; 95% CI = .78, .91), and chi-square analysis (.82; 95% CI = .74, .89).

RESULTS

Canonical correlation analysis was used to determine the degree to which the reading ability variables were related to the technical writing achievement variables. Canonical correlation analyses provide indices of both statistical significance and practical significance. The canonical analysis revealed that both canonical correlations combined were statistically significant (F [8, 98] = 2.17, $p < .05$; Wilks' Lambda = .72). However, when the first canonical root was excluded, the remaining canonical root was not statistically significant. Together, these results suggested that the first canonical function was statistically significant and practically significant, with the first canonical correlation. However, the second canonical root was not statistically significant. In the current investigation, the first canonical correlation (R_{c1} = .51) was extremely educationally significant, contributing 26.0% (i.e., R_{c1}^2) to the shared variance (Cohen, 1988). However, the second canonical correlation (R_{c2} = .17) did not appear to be educationally significant. Consequently, only the first canonical correlation was interpreted.

An examination of the standardized canonical function coefficients revealed that, using a cutoff correlation of 0.3 recommended by Lambert and Durand (1975) as an acceptable minimum loading value, both reading comprehension (.66) and reading vocabulary (.39) made significant contributions to

the achievement composite, with reading comprehension making by far the largest contribution. With respect to the technical writing achievement set, the correlation analysis (.39) and the dependent samples *t*-test scores (.31) made important contributions to the composite set. The square of the structure coefficient indicated that reading comprehension and reading vocabulary explained 94.1% and 84.6% of the variance, respectively. With respect to the technical writing achievement set, all four statistics reports made noteworthy contributions, with the independent samples *t*-test report scores and the dependent samples *t*-test report scores making the largest contribution—both explaining 79.2% of the variance.

DISCUSSION

In the current study, reading comprehension and reading vocabulary were related simultaneously to achievement in a quantitative-based research methodology course—namely, a statistics course. More specifically, the two dimensions of reading ability were related to four measures of technical writing ability. This result supports Collins and Onwuegbuzie (2002/2003), who found that reading comprehension and reading vocabulary simultaneously were predictors of performance in quantitative-based research methodology courses among African-American graduate students. The prevailing relationship found in the present study is consistent with researchers who have found that domain expertise is important for use of adequate reading comprehension strategies (Baker, 1989). According to Baker (1989), in an attempt to understand the text, readers who are not familiar with a content domain often rely on word understanding, instead of utilizing effective comprehension strategies such as setting goals, examining text to recognize existing knowledge, establishing a set of strategies for receiving new information, and self-monitoring learning. Moreover, domain expertise influences the use of metacognitive strategies not only via knowledge of the type of text but also via knowledge of the content and subject matter (Baker, 1989). Unfortunately, many students interpret the material covered in statistics courses to be far removed from their fields of specialization (Onwuegbuzie, DaRos, and Ryan, 1997). Therefore, it is likely that for many African-American graduate students enrolled in these classes, effective comprehension strategies are replaced by word understanding. Because the statistics notebook reports represented the major components of the statistics course, it is likely that poor reading ability debilitates performance in statistics courses, especially in those classes in which writing statistical reports is required. However, the finding that performance on the first statistics notebook report (i.e., correlation analysis) was statistically and practically significantly lower than that for the other statistical notebook reports indicates that students improved their technical writing skills during the statistics course. In fact, the last assignment yielded the highest average scores. This is encouraging. However, it should be tempered by the fact that reading ability still places African-American graduate students at a disadvantage when students as a whole are reaching their peak in writing achievement in the course.

Sitko (1998) found that novice writers benefited from metacognitive training that was designed to elevate their awareness of the importance of the match between written text and a specific audience and the various steps involved in the writing process. It is possible that metacognitive strategy training would facilitate technical writing proficiency. Consequently, it would be useful to find out whether these research findings generalize to African-American graduate students.

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