

Academic procrastination and statistics anxiety

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Statistics anxiety, which is experienced by as many as 80% of graduate students, has been found to debilitate performance in statistics and research methodology courses. As such, it is likely that statistics anxiety is, in part, responsible for many students delaying enrollment in these courses for as long as possible. Moreover, it is possible that, once enrolled in these courses, students with high levels of statistics anxiety tend to procrastinate on assignments. Thus, the purpose of this study was: (a) to examine the prevalence of procrastination among graduate students, and (b) to investigate the relationship between academic procrastination and six dimensions of statistics anxiety. Participants were 135 graduate students enrolled in three sections of a required introductory-level educational research course at a university in the southeastern part of the USA. Findings revealed that a high percentage of students reported problems with procrastination on writing term papers, studying for examinations, and completing weekly reading assignments. A canonical correlation analysis ($R_{c1} = .51$) revealed that academic procrastination resulting from both fear of failure and task aversiveness was related significantly to worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor. Implications for statistics anxiety reduction as a procrastination intervention are discussed.

It has been estimated that as many as 80% of graduate students experience uncomfortable levels of statistics anxiety (Onwuegbuzie & Wilson, 2003). According to Onwuegbuzie, DaRos, and Ryan (1997), statistics anxiety is the apprehension which occurs when individuals encounter statistics in any form and at any level. Moreover, statistics anxiety is situation-specific, inasmuch as the symptoms only emerge at a particular time and in a particular situation—specifically, when learning or applying statistics in a formal setting (Zeidner, 1991; Onwuegbuzie *et al.*, 1997). Many students tend to experience high levels of statistics anxiety when confronted with statistical ideas, problems, or issues, instructional situations, or evaluative situations (Feinberg & Halperin, 1978; Zeidner, 1991; Onwuegbuzie & Seaman, 1995; Onwuegbuzie & Daley, 1996). Indeed, statistics anxiety appears to involve a

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complex array of emotional reactions which, in mild forms, may induce only a minor discomfort. Severe forms, however, can result in negative outcomes, such as apprehension, fear, nervousness, panic, and worry (Onwuegbuzie *et al.*, 1997).

Research indicates that statistics anxiety is a multidimensional construct (Cruise & Wilkins, 1980; Cruise *et al.*, 1985; Onwuegbuzie *et al.*, 1997). Using factor analysis, Cruise *et al.* (1985) identified six components of statistics anxiety, namely: (a) worth of statistics, (b) interpretation anxiety, (c) test and class anxiety, (d) computational self-concept, (e) fear of asking for help, and (f) fear of statistics teachers. According to these authors, *worth of statistics* refers to a student's perception of the relevance of statistics. *Interpretation anxiety* is concerned with the anxiety experienced when a student is faced with making a decision from or interpreting statistical data. *Test and class anxiety* refers to the anxiety involved when taking a statistics class or test. *Computational self-concept* involves the anxiety experienced when attempting to solve mathematical problems, as well as the student's perception of her/his ability to do mathematics. *Fear of asking for help* measures the anxiety experienced when asking a fellow student or professor for help in understanding the material covered in class or any type of statistical data, such as that contained in an article or a printout. *Fear of statistics teachers* is concerned with the student's perception of the statistics instructor.

Statistics anxiety either as a unidimensional or as a multidimensional construct has been found to be related to mathematics self-concept, number of college mathematics courses completed, academic major, academic status, perception of previous success in mathematics courses, the time elapsed since students' last mathematics course, mathematics ability, mathematics preparation, calculator use, learning style, ethnicity, and expected grade (Robert & Saxe, 1982; Tomazic & Katz, 1988; Benson, 1989; Zeidner, 1991; Wilson, 1997; Onwuegbuzie, 1999a).

A growing body of research has documented a consistent negative relationship between statistics anxiety and course performance (Zeidner, 1991; Elmore *et al.*, 1993; Lalonde & Gardner, 1993; Onwuegbuzie & Seaman, 1995). In fact, statistics anxiety has been found to be the best predictor of achievement in research methodology (Onwuegbuzie *et al.*, 2000) and statistics (Fitzgerald *et al.*, 1996; Onwuegbuzie, in press) courses. Moreover, a causal link between statistics anxiety and course achievement has been established. In particular, Onwuegbuzie and Seaman (1995) found that graduate students with high levels of statistics test anxiety who were randomly assigned to a statistics examination which was administered under timed conditions tended to have lower levels of performance than did their low-anxious counterparts who were administered the same test under untimed conditions. Additionally, using qualitative techniques, Onwuegbuzie (1997a) reported that statistics anxiety primarily affects a student's ability to understand fully research articles, as well as to analyze and to interpret statistical data.

Unfortunately, most of the correlates of statistics anxiety which have been identified either are immutable (e.g. ethnicity; Onwuegbuzie, 1999a) or involve predispositions which cannot be altered within a particular statistics course (e.g. mathematics preparation; Wilson, 1997). Consequently, although knowledge of these factors has helped to increase our understanding of the nature and etiology of

statistics anxiety, they offer limited implications for intervention. Nevertheless, it is clear that the levels of statistics anxiety experienced by students can be so great that undertaking research methodology and statistics classes has come to be regarded by many as a negative experience (Onwuegbuzie, 1997a). In fact, as a result of anxiety, graduate students often delay enrolling in research methodology and statistics courses for as long as possible, sometimes waiting until the final semester of their degree programs—which is clearly not the optimal time to undertake such courses (Onwuegbuzie, 1997a, b). Thus, although not yet empirically tested, it is likely that the propensity for academic procrastination is related to levels of statistics anxiety.

Academic procrastination, which is experienced by approximately 95% of college students (Ellis & Knaus, 1977), is defined as the purposive and needless delay in beginning or completing tasks (Rothblum *et al.*, 1986). Solomon and Rothblum (1984) noted that nearly one-quarter of Caucasian-American college students report problems with procrastination on academic tasks such as writing term papers, studying for examinations, and keeping up with weekly readings. Further, Clark and Hill (1994) found that between 30% and 45% of African-American undergraduate students in their sample reported problems with procrastination on writing a term paper, studying for examinations, and keeping up with weekly reading assignments. Also, between 55 and 60% of the students wanted to decrease their procrastination on these tasks. Academic procrastination has been found to be associated with negative academic outcomes, including missing deadlines for submitting assignments, delaying the taking of self-paced quizzes, low course grades, and course withdrawal (Semb *et al.*, 1979; Beswick *et al.*, 1988).

Using factor analysis, Solomon and Rothblum (1984) found that fear of failure and task aversiveness are the primary reasons for procrastinating, with the former explaining 49% of the variance in why students procrastinate, and the latter accounting for 18% of the variance. The fear of failure factor includes items which relate to evaluation anxiety and overly perfectionistic standards for one's performance, and low self-confidence. In contrast, the task aversiveness factor comprises items which reflect a dislike of engaging in academic activities and a lack of energy. These findings led them to conclude that there are two groups of procrastinators at the undergraduate level: (a) a relatively small but extremely homogenous group of students who report procrastinating as a result of fear of failure, and (b) a relatively heterogeneous group of students who report procrastinating as a result of aversiveness of the task.

Surprisingly, however, no research appears to have examined the prevalence of academic procrastination among graduate students. This was the first purpose of the present study. The second purpose of the current research was to investigate the relationship between academic procrastination and statistics anxiety.

According to Rothblum *et al.* (1986), academic procrastination includes the self-reported tendency to nearly always or always experience problematic levels of anxiety associated with this procrastination. Moreover, because academic procrastination has been related positively to generalized and specific kinds of anxiety such as test anxiety and social anxiety (Solomon & Rothblum, 1984; Rothblum *et al.*, 1986), it was hypothesized that academic procrastination would be positively related

to statistics anxiety associated with worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor.

Ferrari, Parker, and Ware (1992, p. 496) asserted that ‘understanding the conceptual “make-up” of procrastinators from nonprocrastinators on personality measures is needed’. Thus, it was hoped that findings from this study not only would increase our understanding of procrastination, but also would further our understanding of statistics anxiety—which, in turn, could assist in designing instructional and counseling strategies to improve students’ related deficiencies in these areas.

Method

Participants

Participants were 135 graduate students from a number of education disciplines (e.g. early childhood education, elementary education, middles grades, secondary education, speech language pathology, and psychology) enrolled in several sections of a graduate-level research methodology course at a small public southeastern university. Participation in the study was voluntary and anonymous, with no participant declining. In order to participate, students were required to give their consent by signing informed consent documents. Participants received extra course credit. The ages of the participants ranged from 21 to 51 (*mean* = 26.0, *SD* = 6.8). Mean academic achievement, as measured by grade point average, was 3.57 (*SD* = 0.36). The overwhelming majority of participants was female (92.6%) and Caucasian-American (93.3%). However, a (non-parametric) Wilcoxon two-sample *t*-test (Hollander & Wolfe, 1973) revealed no gender difference ($p < .05$) with respect to levels of overall academic procrastination, fear of failure, and task aversiveness. Indeed, this finding is consistent with other studies in which procrastination scores by males and females were not significantly different (e.g. Effert & Ferrari, 1989; Ferrari, 1989a, 1991a, b). Additionally, a series of Wilcoxon two-sample *t*-tests revealed no gender difference ($p < .05$) with respect to the six dimensions of statistics anxiety. Nor was a gender difference found with respect to grade point average. Thus, all data were collapsed across gender.

Instruments and procedure

Participants were administered the Statistical Anxiety Rating Scale (STARS) and the Procrastination Assessment Scale-Students (PASS). The STARS, which was developed by Cruise and Wilkins (1980), is a 51-item, 5-point Likert-format instrument assessing statistics anxiety in a wide variety of academic situations. The STARS has six subscales, namely, worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor. A high score on any subscale represents high anxiety in this area. For the present study, the score reliability of the STARS subscales, as measured by coefficient alpha, was as follows: worth of statistics (.96; 95% Confidence Interval

[CI] = .95, .97), interpretation anxiety (.90; 95% CI = .87, .92), test and class anxiety (.88; 95% CI = .85, .91), computational self-concept (.86; 95% CI = .82, .89), fear of asking for help (.81; 95% CI = .75, .86), and fear of the statistics instructor (.83; 95% CI = .78, .87).

The PASS, which was developed by Solomon and Rothblum (1984), contains two parts. The first part lists six academic tasks involving writing a term paper, studying for examinations, keeping up with weekly reading assignments, performing administrative tasks, attending meetings, and performing academic tasks in general. Respondents are asked to complete three rating scales for each of the six tasks indicating the frequency with which they procrastinate on that task (1 = Never procrastinate; 5 = Always procrastinate), whether their procrastination on the task is a problem (1 = Not at all a problem; 5 = Always a problem), and whether they want to decrease their procrastination on the task (1 = Do not want to decrease; 5 = Definitely want to decrease). As recommended by its authors (Solomon & Rothblum, 1984), the PASS items pertaining to (a) the frequency with which respondents procrastinate on a task, and (b) whether their procrastination on that task is a problem were summed to provide an overall measure of academic procrastination, with total scores ranging from 12 to 60. Higher scores indicate academic procrastination.

The second section of the PASS asks students to think of the last time they procrastinated on writing a term paper and to indicate how much each of 26 reasons reflects why they procrastinated (1 = Not at all reflects why I procrastinated; 5 = Definitely reflects why I procrastinated). A factor analysis undertaken by the authors on the reasons why college students procrastinate indicated two factors, namely, fear of failure and task aversiveness. For the present study, the coefficient alpha score reliability estimates of the PASS measures were .84 (95% CI = .80, .88) for the procrastination scale, .85 (95% CI = .82, .89) for the fear of failure factor, and .76 (95% CI = .68, .82) for the task aversiveness factor.

Results

The means and standard deviations pertaining to the PASS scale and the fear of failure and task aversiveness subscales are presented in Table 1. The PASS scale mean was compared to the mean reported by the developers of the PASS (Solomon & Rothblum, 1984). The norm groups used in Solomon and Rothblum's (1984) study comprised 342 university students (101 men, 222 women, 19 unknown gender) who were enrolled in two sections of an introductory-level psychology course. Ninety percent of the participants were 18 to 21 years of age. Interestingly, the mean procrastination score reported by the graduate students in the present study (i.e. 34.52) was higher than that computed for participants in Solomon and Rothblum's (1984) study (i.e. 33.39 for the full sample). Unfortunately, although these authors did not report the standard deviation of the PASS scores needed to conduct an independent *t*-test, the closeness in procrastination means suggests that the graduate students in the current study had the same propensity to procrastinate as did the undergraduate norm group.

Table 2 presents the means and standard deviations of the statistics anxiety

Table 1. Means and standard deviations of procrastination measures

Measure	<i>M</i>	<i>SD</i>
Procrastination scale	34.52	12.80
Fear of failure	9.82	4.35
Task aversiveness	8.39	1.65

measures. Also presented are median percentile rank equivalent scores (MPRES). The MPRES were calculated by comparing the median anxiety scores in the present study (Table 2) to the percentile rank norms reported by the developers of the STARS (i.e. Cruise *et al.*, 1985). Thus, a MPRES of 86 for worth of statistics indicates that at least 50% of the present sample scored higher than did 86% of the norm group on this dimension. Because the MPRES range from 62 to 86, it is clear that the participants in this study represented a moderate to high statistics-anxious group.

An item analysis of the first part of the PASS was undertaken in order to determine the frequency of procrastination for a variety of academic tasks. This analysis revealed that 41.7% of the graduate students reported that they nearly always or always procrastinate on writing a term paper, 39.3% procrastinate on studying for examinations, and 60.0% procrastinate on keeping up with weekly reading assignments. The corresponding percentages for the undergraduate students in Solomon and Rothblum's (1984) study was 46%, 27.6%, and 30.1%. As in Solomon and Rothblum's study, a smaller percentage of graduate students reported that they nearly always or always procrastinate on administrative tasks (17.3%), attendance tasks (6.8%), and school activities in general (16.5%). The corresponding percentages for Solomon and Rothblum's study were 10.6%, 23.0%, and 10.2%, respectively. A series of Fisher's Exact Tests was used to compare the prevalence rates between the present sample and the norm group. Findings revealed that, although compared to the norm group, a significantly ($p < .05$) smaller pro-

Table 2. Means, standard deviations, medians, and median percentile rank equivalents¹ of statistics anxiety measures

Dimension	<i>M</i>	<i>SD</i>	Median	Median percentile rank equivalent
Worth of statistics	42.53	14.03	42	86
Interpretation anxiety	31.76	8.39	32	78
Test and class anxiety	27.10	7.12	28	70
Computational self-concept	18.33	6.21	18	70
Fear of asking for help	8.21	3.59	8	66
Fear of the statistics instructor	12.21	4.07	12	62

¹The median percentile rank equivalent scores were obtained by comparing median anxiety scores to the percentile rank norms pertaining to graduate students reported by Cruise *et al.* (1985).

portion of graduate students reported that they nearly always or always procrastinate on attendance tasks (*odds ratio* = 0.24), a significantly larger proportion of graduate students reported that they nearly always or always procrastinate on studying for examinations (*odds ratio* = 1.76), keeping up with weekly reading assignments (*odds ratio* = 3.46), administrative tasks (*odds ratio* = 1.72), and school activities in general (*odds ratio* = 1.69). In particular, the odds ratio pertaining to weekly reading assignments indicates that the graduate students in the present sample were nearly 3.5 times more likely to report that they nearly always or always procrastinate on keeping up with weekly reading assignments than were the undergraduate students in Solomon and Rothblum's study.

With respect to the degree to which the graduate students felt that procrastination was a problem for them, 23.7% reported that it was nearly always or always a problem when writing a term paper, 21.5% reported that this was a problem when studying for examinations, and 41.5% indicated that it was a problem when undertaking weekly readings. The corresponding percentages reported by Solomon and Rothblum were 23.7%, 21.2%, and 23.7%, respectively. Nearly one-third of graduate students in the present study (i.e. 30.1%) indicated that procrastination was a problem for them when undertaking administrative tasks. Less than 20% of participants reported that procrastination was a problem for them when they were involved in attendance tasks (18.8%) and school activities in general (8.3%). No statistics were reported by Solomon and Rothblum for these latter three types of activities, although these authors stated that 'Procrastination was less of a problem with the remaining tasks and school activities in general' (p. 505). The Fisher's Exact Tests revealed that graduate students were 2.28 times more likely ($p < .05$) to report that procrastination was nearly always or always a problem when studying for examinations than were the norm group.

In terms of the extent to which participants reportedly wanted to decrease their tendency to procrastinate, 65.2% indicated that they wanted or definitely wanted to reduce their procrastination when writing a term paper, 68.2% wanted to reduce it when studying for examinations, and 71.7% wanted to reduce it when undertaking reading assignments. The corresponding percentages reported by Solomon and Rothblum were 65.0%, 62.2%, and 55.1%, respectively. Nearly one-third of the graduate students (i.e. 30.1%) indicated that they wanted to decrease their tendency to procrastinate when undertaking administrative tasks, 24.1% when they were involved in attendance tasks, and 42.8% when undertaking school activities in general. Again, no statistics were reported by Solomon and Rothblum for these latter three types of activities, although these authors stated that 'For the remaining tasks, fewer participants wanted to reduce their procrastinatory behavior' (p. 505). The Fisher's Exact Tests revealed that graduate students were 2.09 times more likely ($p < .05$) to report that they wanted or definitely wanted to reduce their procrastination when studying for examinations than were the norm group.

Table 3 presents part of the correlation matrix from which the canonical roots were generated. It can be seen that after applying the Bonferroni adjustment, (a) the fear of failure factor was positively related to worth of statistics, computational self-concept, fear of asking for help, and fear of the statistics instructor; and (b) the

Table 3. Pearson product–moment correlations of procrastination measures and the statistics anxiety dimensions

Statistics Anxiety Factor	Procrastination measures		
	Procrastination scale	Fear of failure	Task aversiveness
Worth of statistics	.15	.34*	.38*
Interpretation anxiety	.23	.26	.25
Test and class anxiety	.20	.20	.24
Computational self-concept	.15	.30*	.32*
Fear of asking for help	.26	.39*	.26
Fear of the statistics instructor	.09	.31*	.37*

*Statistically significant (i.e., $p < .001$) after the Bonferroni adjustment.

task aversiveness factor was positively associated with worth of statistics, computational self-concept, and fear of the statistics instructor.

The strength of the relationship between the two sets of variables was assessed by examining the magnitude of the canonical correlation coefficients. These coefficients indicate the degree of relationship between the weighted procrastination dimension variables and the weighted statistics anxiety variables. In addition, the statistical significance of the canonical roots was tested via the F -statistic based on Rao's approximation (Rao, 1952).

The canonical analysis revealed that both canonical correlations combined were statistically significant ($F [12, 254] = 3.84, p < .05$). However, when the first canonical root was excluded, the remaining canonical root was not statistically significant. Together, these results suggest that the first canonical function was statistically significant, but the second canonical root was not statistically significant. However, because the calculated probabilities are sensitive to sample size, particular attention should be paid to the educational (practical) significance of the obtained results (Thompson, 1984). The educational significance of canonical correlations typically are assessed by examining their size (Thompson, 1984). The canonical correlation indicates how much variance the sets of weighted original variables share with each other (Thompson, 1984). In the present study, the first canonical correlation ($R_{c1} = .26$) appeared to be moderately educationally significant, contributing 6.8% (i.e. R_{c1}^2) to the shared variance. However, the second canonical correlation ($R_{c2} = .03$) did not appear to be educationally significant. Consequently, only the first canonical correlation was interpreted.

Data pertaining to the first canonical root are presented in Table 4. This table provides both standardized function coefficients and structure coefficients. 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, two of the six statistics anxiety dimensions (i.e. worth of statistics and fear of asking for help) made an important contribution to the

Table 4. Canonical solution for first function

Variable	Standardized Coefficient	Structure	
		Coefficient	Structure ²
Statistics Anxiety Dimension:			
Worth of statistics	0.460*	.850*	.723
Interpretation anxiety	-0.038	.604*	.365
Test and class anxiety	-0.233	.520*	.270
Computational self-concept	0.213	.735*	.540
Fear of asking for help	0.553*	.793*	.629
Fear of the statistics instructor	0.199	.799*	.638
Reason for Procrastination Dimension:			
Fear of failure	0.684*	.874*	.764
Task aversiveness	0.522*	.770*	.593

*loadings with large effect sizes

anxiety composite—with fear of asking for help being the major contributor. With respect to the reason for procrastination set, both dimensions (i.e. fear of failure and task aversiveness) made an important contribution to the composite set.

Structure coefficients are the correlations between a given variable (dimension) and the scores on the canonical composite (i.e. latent variable) in the set to which the variable (dimension) belongs (Thompson, 1984). Thus, structure coefficients indicate the degree of relationship of a given variable in the set with the canonical composite for the variable set. The structure coefficients (Table 4) revealed that all six dimensions of statistics anxiety made important contributions to the first canonical variate. The square of the structure coefficient, which is the proportion of variance that the original variable shares linearly with the canonical variate, is used to determine the relative importance of the significant variables. The square of the structure coefficient (Table 4) indicated that worth of statistics, fear of the statistics instructor, fear of asking for help, and computational self-concept made very large contributions, explaining 72.3%, 63.8%, 62.9%, and 54.0% of the variance, respectively. (These variances are not unique and thus do not sum to 100%.) Interpretation anxiety and test and class anxiety made moderate contributions. With regard to the reasons for procrastination cluster, both dimensions made noteworthy contributions, with fear of failure making the largest contribution—explaining 76.4% of the variance.

Discussion

The purpose of this study was: (a) to examine the prevalence of procrastination among graduate students, and (b) to investigate the relationship between academic procrastination and six dimensions of statistics anxiety. Interestingly, this appears to be the first study to determine the prevalence of academic procrastination among graduate students. Findings revealed that from approximately 40% to 60% of the

graduate students reported that they nearly always or always procrastinate on writing a term paper, studying for examinations, and keeping up with weekly reading assignments. Additionally, between 20% and 45% of graduate students reported problems with procrastination in these three areas. Furthermore, between 65% and 75% of the students wanted to decrease their procrastination on these tasks. As noted by Solomon and Rothblum (1984), the high frequency of self-reported procrastination on writing term papers, studying for examinations, and keeping up with weekly reading assignments suggests that these tasks are deemed to be more important to students than are such tasks as attending classes or meetings, filling out forms, and registering for courses. According to Solomon and Rothblum, because students perceive performing the former set of tasks as important inasmuch as course grades are directly based on them, students are more likely to procrastinate on completing these tasks because they find them aversive and are afraid of failure.

An extremely disturbing finding is that a larger proportion of students in the present study than in the undergraduate norm group reported that they nearly always or always procrastinate on studying for examinations and on weekly reading assignments. These results are extremely surprising, bearing in mind that graduate students tend to represent the upper echelon of academic achievers. The mean grade point average of the present sample, 3.57, confirms their high-achieving status. Solomon and Rothblum (1984) did not report their mean but it is likely to have been significantly lower. Thus, it is important to determine why academic procrastination appears to be so high among graduate students. For example, it could reflect the complexity of course material and assignments at this level. That is, students who were low procrastinators as undergraduates, once they become graduate students, are intimidated by the increased level of complexity and academic standards—whether perceived or real—and thus procrastinate more. Thus, an interesting line of research would be whether levels of academic procrastination are stable across students' undergraduate and graduate years.

It is also possible that graduate students procrastinate more for different reasons than do undergraduates. Specifically, whereas the latter may procrastinate more as a result of low academic ability and low self-confidence (Rothblum *et al.*, 1986; Ferrari, 1989b), rebelliousness and resentment (Burka & Yuen, 1983; Rorer, 1983; Milgram *et al.*, 1988), or an attempt to protect a vulnerable self-esteem (Burka & Yuen, 1983), it is possible that for graduate students, delaying academic tasks such as writing a term paper are indicative of perfectionism. Indeed, as already noted (Solomon & Rothblum, 1984; Ferrari, 1992; Saddler & Sacks, 1993; Onwuegbuzie, 2000a), some procrastinators engage in perfectionism either to produce a flawless product (i.e. self-perfectionism) or to impress others (i.e. socially prescribed perfectionism). Indeed, Onwuegbuzie (1997a), in a qualitative study of graduate students enrolled in research methodology courses, found that perfectionistic behavior is associated with procrastinating over research proposals. Interestingly, levels of both self-oriented perfectionism and socially prescribed perfectionism are high among graduate students (Onwuegbuzie & Daley, 1999). Thus, knowledge of the interplay between procrastination, perfectionism, and achievement among graduate students would be helpful.

Nevertheless, the fact that most graduate students appear to delay writing term papers and studying for examinations might explain why underachievement is prevalent in research methodology (Onwuegbuzie, 1997) and statistics (Onwuegbuzie *et al.*, 1997) classes. Presumably, procrastinating does not necessarily lead to underachievement in the majority of graduate students' courses, particularly those which represent their areas of study. However, in research methodology and statistics classes, which many students believe to be the most difficult (Onwuegbuzie, 1998a), it is likely that frequent procrastination debilitates performance—even if it results from perfectionism. As such, future studies should investigate the potential debilitating role of procrastination in these courses.

Perhaps the most disturbing finding in the present study was the fact that the graduate students were nearly 3.5 times more likely to report that they nearly always or always procrastinate on weekly reading assignments than were the undergraduate students in Solomon and Rothblum's study. Bearing in mind the complex and laconic nature of statistics and research methodology textbooks, it is likely that the frequency of procrastination on keeping up with weekly reading assignments is even higher in statistics and research methodology courses. The implications for procrastination for statistics and research methodology instructors is self-evident. This is particularly disturbing because highly procrastinating college students are more likely to report the presence of physical symptoms (Rothblum *et al.*, 1986) and depression (Saddler & Sacks, 1993).

The second major finding was that procrastination resulting from both fear of failure and task aversiveness appears to be related significantly to worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor. The finding that academic procrastination is related to statistics anxiety is consistent with the bulk of the literature which has documented a relationship between procrastination and generalized and specific kinds of anxiety such as fear of failure, test anxiety, social anxiety, and self-consciousness (Solomon & Rothblum, 1984; Rothblum *et al.*, 1986; Ferrari, 1991c; Milgram, 1991).

Solomon and Rothblum (1984) also reported a statistically significant positive correlation between the fear of failure factor and evaluation anxiety. In contrast, the relationship between procrastination resulting from task aversiveness and statistics anxiety contradicts Solomon and Rothblum's (1984) finding of no relationship between the task aversiveness factor and evaluation anxiety. This incongruity, however, perhaps highlights the uniqueness of the statistics anxiety construct from other forms of anxiety. In any case, the relationship between academic procrastination and statistics anxiety provides further evidence that procrastination is more than a deficit in time management and study skills, but includes cognitive-affective components (Solomon & Rothblum, 1984; Rothblum *et al.*, 1986). In fact, according to Rothblum *et al.* (1986), high procrastinators do not differ in their study behavior as much as they differ on anxiety.

Although there is strong evidence for a relationship between academic procrastination and statistics anxiety, it is not clear whether it is causal. If so, the present investigation does not establish whether academic procrastination is the cause of

statistics anxiety or vice versa. Alternatively, perhaps a bidirectional relationship exists between academic procrastination and statistics anxiety, with each affecting the other in an intricate manner. For example, it is possible that, once enrolled in statistics and research methodology courses, high procrastinators experience extreme elevations in statistics anxiety, because these classes threaten their self-esteem (Onwuegbuzie, 2000b), levels of hope (Onwuegbuzie, 1998b), and the like, which result from the perception that these courses are too difficult, as well as from an attitude that statistics is not relevant for them (Onwuegbuzie, in press). Individuals who experience increases in levels of statistics anxiety are more likely to postpone undertaking statistical activities and assignments (e.g. writing term papers, studying for examinations, and keeping up with the weekly readings) due to task aversiveness. Subsequent difficulties in understanding the course material may lead to them being anxious about asking for help from either their instructors or their peers, for fear of revealing their procrastinatory tendencies and other inadequacies. This increase in statistics anxiety associated with fear of asking for help and fear of the instructor may be accompanied by test and class anxiety and interpretation anxiety stemming from fear of failure-based procrastination. These aspects may lead to further procrastination about studying for examinations and writing term papers, which, in turn, intensifies levels of statistics anxiety. In any case, this cycle of procrastination and statistics anxiety is likely to continue until levels of both are maximized. Whereas for some students, the procrastination component of the cycle is likely to stem from a fear of failure, for others, task aversiveness is the driving force. It is likely that keeping up with weekly assignments is the most important challenge for high procrastinators, because a failure to do so would mean that the student would come to class unprepared and thus would feel more overwhelmed when presented with statistical concepts for the first time by her/his instructor.

The fact that participants were predominantly female is an important limitation of the study. Nevertheless, the fact that no gender differences were found in the present study with respect to overall academic procrastination, fear of failure, task aversiveness, and all six dimensions of statistics anxiety, as well as the fact that the overwhelming majority of previous research has documented that males and females report similar levels of academic procrastination (e.g. Effert & Ferrari, 1989; Ferrari, 1989a, 1991a, b), suggest that the findings of the present study may be similarly generalizable to both male and female graduate students. However, female students have been found to report higher levels of statistics anxiety than do males (Demaria-Mitton, 1987; Benson, 1989; Benson & Bandalos, 1989; Zeidner, 1991), as well as to report higher levels of other academic-related anxiety, such as general test anxiety (Hembree, 1988; Zeidner & Safir, 1989; Everson *et al.*, 1991) and mathematics anxiety (Tobias & Weissbrod, 1980; Meece, 1981; Dew *et al.*, 1983, 1984; Levitt & Hutton, 1983; Llabre & Suarez, 1985; Ramirez & Dockweiler, 1987). These reported gender differences, as well as Solomon and Rothblum's (1984) finding that female undergraduate students reported higher levels of procrastination resulting from fear of failure than did their male counterparts, make it unclear how generalizable the findings of the present study are across gender. This necessitates replicating the present study using more males.

Another limitation of the current study stems from the fact that participants were almost exclusively Caucasian-Americans. Although Clark and Hill (1994) concluded that patterns of self-reported procrastination found in Caucasian-American undergraduate students generalize to African-American students, Onwuegbuzie (1999a) found that African-American graduate students have higher levels of statistics anxiety associated with worth of statistics, interpretation anxiety, and test and class anxiety than do their Caucasian-American counterparts—with effect sizes ranging from .45 to .56 standard deviations. As such, it cannot be assumed that the present findings generalize to graduate students of other ethnicities. Thus, more research in this area is needed using African-American and other ethnic groups.

The fact that academic procrastination was assessed via a self-report instrument, rather than on actual behavior, is perhaps another limitation of the study, because it is possible that students may give socially desirable responses. However, according to Rothblum *et al.* (1986, p. 388), ‘self-reported procrastination has been validated against delay in taking self-paced quizzes (Solomon & Rothblum, 1984), delay in submitting course assignments (Rothblum, Beswick & Mann, 1984), delay in participation in psychology experiments (Solomon & Rothblum, 1984), and lower course grades (Rothblum *et al.*, 1984)’. Nonetheless, future studies in this area should consider using behavioral measures of academic procrastination in addition to self-report instruments.

Several practical implications can be derived from the results of the present study. Because approximately two-thirds of graduate students report that they want to reduce their tendencies to procrastinate when writing a term paper, studying for examinations, and undertaking reading assignments, instructors should find ways to help them accomplish this. For example, statistics and research methodology instructors could break up their term projects into parts, and require that each part be submitted for formal or informal grading at regular intervals. With respect to reading assignments, students might be asked to undertake a written or oral summary of each assigned reading. In fact, students can even be required to develop advance- or post-organizers (e.g. concept maps) of all material read, because these techniques have been found to increase levels of performance (Onwuegbuzie, 1999b). In addition, whereas some high procrastinators may benefit from traditional interventions for procrastination such as time management and study skills counseling (Richards, 1975; Ziestat *et al.*, 1978; Green, 1982), self-discipline and self-criticism (Mulry *et al.*, 1994), compliance-based and defiance-based paradoxical strategies (Rohrbaugh *et al.*, 1981; Dowd & Swoboda, 1984; Dowd *et al.*, 1988), and the use of external contingencies (Green, 1982), as noted by Rothblum *et al.* (1986), others may benefit more from interventions which focus on anxiety management and reduction. The latter could be accomplished through a number of cognitive and behavioral techniques, such as relaxation therapy, systematic desensitization, and meditation (Gilliland & James, 1983). Such students also could be given information about how to direct attention away from self-centered worries when they are engaged in statistical activities. Whatever interventions are implemented, it is essential that their efficacy be documented.

Notes on contributor

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