



Statistics Anxiety and Instructor Immediacy

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Journal of Statistics Education Volume 18, Number 2 (2010),

www.amstat.org/publications/jse/v18n2/williams.pdf

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Key Words: Anxiety; Psychological support; Graduate student anxiety.

Abstract

The purpose of this study was to investigate the relationship between instructor immediacy and statistics anxiety. It was predicted that students receiving immediacy would report lower levels of statistics anxiety. Using a pretest-posttest-control group design, immediacy was measured using the Instructor Immediacy scale. Statistics anxiety was measured using the Statistics Anxiety Rating Scale (STARS).

Results indicated that instructor immediacy is significantly related to six factors of statistics anxiety, with immediacy explaining between 6% and 20% of the variance in students' anxiety levels. Instructors should attempt to increase their use of immediacy behaviors in order to decrease anxiety.

1. Introduction

Statistics anxiety is experienced by as many as 80% of graduate students in the social and behavioral sciences ([Onwuegbuzie and Wilson, 2003](#)), and is at least partly responsible for the procrastination of students enrolling in required statistics courses ([Onwuegbuzie, 1997](#)). This anxiety can affect students' performance in statistics classes, and cause feelings of inadequacy and low self-efficacy for statistics-related activities ([Blalock, 1987](#); [Dillon, 1982](#)). Statistics anxiety has been linked to students' performance in statistics and research courses ([Lalonde and Gardner, 1993](#); [Onwuegbuzie and Seaman, 1995](#), [Zanakis and Valenza, 1997](#)), and has been recognized as a deterrent to students' finishing their degrees ([Onwuegbuzie, 1997](#)).

1.1 Review of the Literature

Anxiety is the anticipation of a threat that is non-specific ([Rachman, 1998](#)) and is accompanied by a fear component ([Barlow, 1988](#)). The person experiencing anxiety has difficulty identifying the exact source of the threat, but he/she is expecting something negative or even painful to occur in connection with a certain stimulus. The expectation of unpleasantness then contributes to avoidance behavior, wherein the anxious person avoids situations where he/she expects to encounter the threat ([Rachman, 1998](#)). In other words, it is the prediction of future harm that afflicts the person with anxiety and causes him/her to avoid any situation believed to be threatening, rather than any actual threat of harm. [Barlow \(1988\)](#) points out that anxiety also involves a perception of lack of control over future events and that it may become associated with any number of different situations.

Anxiety in academic settings has been well-documented, and can take many forms, among which test anxiety and math anxiety appear to be the most prevalent ([Hembree, 1990](#)). Math anxiety includes a component of test anxiety, as well as fear of failure and negative attitudes toward math ([Bessant, 1995](#)). For example, [Bessant \(1995\)](#) found that in the 173 students surveyed, math anxiety was related to test anxiety, but also to components of reading, studying, thinking about, and using mathematical skills. Additionally, students' math anxiety was negatively related to attitudinal variables of math enjoyment, value, and social importance. The author points out that math anxiety is complex and multidimensional, which leads to some confusion over the meaning. Though many have attempted a clear definition of math anxiety (e.g. see Hembree's 1990 meta-analysis of the construct math anxiety), a commonly cited definition is that given by [Richardson and Suinn \(1972\)](#) as "the feelings of tension and anxiety that interfere with the manipulation of numbers and solving of mathematical problems in a wide variety of ordinary life and academic situations". Researchers have traced the origination of math anxiety to negative elementary and secondary education experiences ([Cornell, 1999](#); [Harper and Dane, 1998](#); [Jackson and Leffingwell, 1999](#)) which tend to affect performance and subsequent avoidance of math classes ([Meece et al., 1990](#)). Additionally, math anxiety has been found to have an effect on confidence for teaching math in pre-service teachers. [Brady and Bowd \(2005\)](#) explored the relationship between math anxiety, previous experiences with math, and confidence for teaching math in a sample of pre-service elementary education teachers. They found that with one-third of their participants reporting enrollment in math classes throughout high school, and 12% reporting having experienced math classes beyond their freshman year of college, math anxiety was significantly negatively related to the participants' highest level of math instruction ($r = -.28, p < .01$). Through qualitative methods (i.e. open-ended questions), the authors found that 39% of participants said that math was their least favorite subject, and that while 60% had enjoyed math in elementary school, only 43% still enjoyed it during their secondary years. Given this information, the authors found a significant positive relationship between math anxiety and math being the least-liked subject ($r = .52, p < .01$). Additionally, math anxiety was significantly negatively related to confidence for teaching math ($r = -.46, p < .01$). The authors conclude that negative experiences in their own elementary and secondary school math instruction contributed to participants' math anxiety, and affected their confidence for teaching math.

Statistics anxiety has been found to be related to math anxiety ([Onwuegbuzie et al. 1997](#)), yet researchers postulate that the two are different forms of anxiety ([Balaglu, 1999](#); [Benson, 1989](#);

[Benson and Bandalos, 1989](#); [Cruise et al., 1985](#); [Onwuegbuzie et al. 1997](#); [Zeidner, 1991](#)). Whereas math anxiety has been defined as anxiety over manipulating numbers ([Richardson and Suinn, 1972](#)), statistics anxiety involves more than math anxiety. It includes such additional factors as anxiety over interpretation of data and statistical outcomes, fear of asking for help, and fear of statistics teachers ([Cruise et al., 1985](#)). To illustrate, a qualitative study conducted by [Onwuegbuzie et al. \(1997\)](#) found that although some students reporting high math anxiety also reported high statistics anxiety, there were other highly anxious statistics students who reported low levels of math anxiety. In one interview, a student revealed “I’ve never been frightened of math. In fact, I received an A in my last math class. Yet I am terrified of statistics.” [Zerbolio \(1999\)](#) explains that statistics is more closely related to verbal reasoning than it is to mathematical reasoning, and suggests that logical reasoning skills are utilized more than are math skills in solving statistical problems. [Cruise et al. \(1985\)](#) defined statistics anxiety as “a feeling of anxiety when taking a statistics course or doing statistical analysis; that is gathering, processing, and interpreting data”. [Onwuegbuzie et al. \(1997\)](#) defined statistics anxiety as an anxiety which occurs when a student encounters statistics in any form and at any level. [Zeidner \(1991\)](#) adds to these definitions by stating that this anxiety is accompanied by worry, tension, and physiological symptoms of stress when students are faced with taking a statistics class.

The negative effects of statistics anxiety have also been documented. In an in-depth qualitative study of statistics anxiety, [Onwuegbuzie et al. \(1997\)](#) engaged 21 graduate students in interviews, focus groups, and journal writing as a method to explore their attitudes and perceived experiences in an intermediate statistics class in a department of education. The authors found that students were reporting psychological symptoms such as depression, frustration, panic, and worry, as well as physiological signs of headaches, muscle tension, perspiration, and “feeling sick”. Observation by one of the researchers as a participant-observer revealed students’ anxious behaviors such as nail-biting, anger, and tears. [Rachman \(1998\)](#) points out that any type of anxiety is unpleasant at best, and that most people will seek to avoid this discomfort. [Onwuegbuzie \(1997\)](#) suggests many students delay enrolling in statistics classes because of their anxiety, and once enrolled, tend to procrastinate on their assignments ([Onwuegbuzie, 2004](#)). In his 2004 study, Onwuegbuzie surveyed 135 education graduate students concerning statistics anxiety and academic procrastination. He found that as many as 45% of the students reported procrastination problems in areas such as reading assignments, studying for tests, and writing papers. Additionally, the author found procrastination was significantly related to four dimensions of statistics anxiety, though no causal relationship was implied. Other researchers have found that statistics anxiety can affect students’ performance in both statistics and research classes ([Lalonde and Gardner, 1993](#); [Onwuegbuzie, 2000](#); [Onwuegbuzie and Seaman, 1995](#); [Zanakis and Valenza, 1997](#)). [Lalonde and Gardner \(1993\)](#) found that students’ learning in statistics classes was indirectly affected by their anxiety because of the impact that anxiety had on students’ attitudes toward statistics and their motivation. Similarly, [Onwuegbuzie and Seaman \(1995\)](#) found that students who were given statistics tests under timed conditions showed significantly lower levels of performance than students who were tested under untimed conditions. On subsequent studies [Onwuegbuzie \(1995; 1997\)](#) determined that statistics anxiety affects students’ ability to understand research articles, data analysis, and interpretation of analyses.

Less attention in the research has been devoted to dealing with, or reducing, statistics anxiety in students. [Dillon \(1982\)](#) demonstrated that students' anxiety can be decreased by encouraging them to talk about their fears, and then suggesting ways that they can cope with their anxiety. [Schacht and Stewart \(1990\)](#) explored the use of humorous cartoons in statistics classes to reduce anxiety. By introducing cartoons and applying "statistical applications" to the content (e.g. calculating probability of runaway pets using fictitious data based on a cartoon depicting a man looking for his runaway cat), the authors found that this type of humor not only reduced the students' anxiety, but also improved their learning. In 1991, the same authors reported on their use of gimmicks (attention-getting teaching techniques) in statistics instruction, claiming that such techniques are underused in statistics classes. By gathering data from the students themselves (e.g. opinion-related ordinal data based on a vignette), and then having the students perform simple calculations such as obtaining the mean, they found that students' anxiety was reduced and their motivation to become involved in the class was increased. [V.A. Wilson \(1996\)](#) found that although humor was somewhat effective in reducing students' anxiety in statistics class, instructor personality and reassurances were even more effective. In subsequent studies ([1999](#), [2000](#)), Wilson found that the instructor's interpersonal style was more effective than specific strategies used to address students' anxiety. After gathering answers to the open-ended question "What, if anything, did your instructor do to reduce anxiety in the statistics class?" for three years, the author concluded that instructor behaviors such as conveying a positive attitude, encouragement, reassurances of the students' ability, acknowledgement of students' anxiety, and use of humor reduced their anxiety at higher rates than did allowing students to work together or "making it easy to get an A". Additionally, [Pan and Tang \(2005\)](#), using a focus group format, found that when the instructor was sensitive to students' concerns, students' anxiety was reduced and learning was enhanced.

The commonality in the techniques of researchers to help students manage or even reduce their anxiety strongly resembles aspects of immediacy, which is the psychological availability of instructors to their students.

1.2 Immediacy

Immediacy refers to a set of communicative behaviors that influence the perception of physical and psychological closeness ([Andersen et al., 1981](#); [Gorham, 1988](#)). [Mehrabian \(1971\)](#) first discussed immediacy in terms of approach-avoidance. In the approach-avoidance theory of affect, people tend to approach things that give them pleasure and avoid things that elicit pain or fear. The more pleasurable a situation, person, or thing, the more it will be favored by others. Non-verbal behaviors can signal the promise of pleasure (or displeasure), and in turn approachability (or avoidance), to others within interpersonal relationships. This holds true for the instructor-student relationship as well. When instructors practice immediacy, students regard them as being available and welcoming ([Mehrabian, 1969](#)). [Andersen \(1979\)](#), who was the first to investigate immediacy in the classroom context, described the immediate instructor as one who "is more likely to communicate at a close distance, smile, engage in eye contact, use direct body orientation, use overall body movement and gestures, touch others, relax, and be vocally expressive" (p.548). Her study of immediacy and affective learning (e.g. students' attitudes, beliefs, and values toward the subject matter and factors associated with the learning experience) revealed that non-verbal instructor immediacy predicted 46% ($R^2 = .46$) of the variance in

college students' affect toward their instructor and 20% ($R^2 = .20$) of the variance in affect toward course content. Correspondingly, in their 1985 investigation, [Kearney, Plax, and Wendt-Wasco](#) surveyed 642 business majors concerning their teachers' immediacy behaviors and their levels of affective learning. The authors found that teacher immediacy accounted for 35% of the variance in student affect. Similarly, [Sorenson \(1989\)](#) examined the relationship between immediacy and affective learning in 617 communication students, and found that 41% of the variance in students' affective learning was attributed to immediacy behaviors. Other researchers have also found a significant relationship between nonverbal immediacy and affective learning (e.g. [Andersen and Withrow, 1981](#); [Plax et al., 1986](#); [Witt et al., 2004](#); [Witt and Schrodt, 2006](#)).

The relationship between non-verbal immediacy and cognitive learning has also been extensively explored. In 1987, [Richmond, McCroskey, Kearney, and Plax](#) developed a measure of perceived cognitive learning, called "learning loss", wherein students reported their own perceived learning in relation to their own expected learning. Learning loss was found to be significantly negatively related to instructor immediacy. Likewise, [Christensen and Mentzel \(1998\)](#) surveyed 115 undergraduate students concerning the relationship between perceived affective, behavioral, and cognitive learning and concluded that significant linear relationships did exist between instructor immediacy and all three types of learning. Others have demonstrated a relationship between immediacy and cognitive learning as well ([Christophel, 1990](#); [Prisbell and Hilt, 2000](#); [Rodriguez, et al., 1996](#)). In 2001, [Hess and Smythe](#) became concerned about previous researchers' methods of measuring cognitive learning (i.e. measures of learning loss), claiming that students' perceptions of their own learning are tainted by a halo effect based on student perceptions of teachers' attitude toward them. In an attempt to remedy this, as well as explore whether evidence exists for the relationship between cognitive learning and immediacy, the authors asserted that immediacy affects cognitive learning only through the mechanism of affect. Utilizing 318 undergraduate communication students, [Hess and Smythe \(2001\)](#) demonstrated that although student perceived cognitive learning was significantly related to immediacy, actual learning as measured by exam scores was not. Their evidence suggests that instructor immediacy promotes student liking, which in turn makes students believe they have learned more than they actually have. These findings lend support to their contention that immediacy is largely an affective construct. These findings are similar to those of [Rodriguez and colleagues \(1996\)](#), who found evidence that cognitive learning was mediated by affective learning in 224 communication studies undergraduate students. Their research showed that nonverbal immediacy behaviors of instructors was significantly related to affective learning ($r = .73$), and affective learning was significantly related to cognitive learning ($r = .69$), with the direct relationship between immediacy and cognitive learning at $r = .53$, indicating mediation. [Rodriguez et al. \(1996\)](#) also found evidence that motivation was a significant mediator as well. This finding is similar to that of other researchers who have explored the mediation link between immediacy and cognitive learning, demonstrating that the mediating variable is motivation ([Christophel, 1990](#); [Christophel and Gorham, 1995](#); [Frymier, 1994](#)) in that students are motivated to learn when under the tutelage of immediate teachers.

Although immediacy was originally conceptualized as consisting of primarily non-verbal behaviors, verbal indicators of immediacy have also been defined. [Gorham \(1988\)](#) identified a set of verbal immediacy behaviors based on a series of "brain-storming" sessions wherein 47

undergraduate students identified nonverbal and verbal behaviors that characterized their favorite teachers. Several verbal behaviors were identified including self-disclosure, use of humor, addressing students by name, conversing with students outside of class, and seeking students' opinions about assignments. In her 1988 study, [Gorham](#) utilized the resulting immediacy scale and found that students' self-reports of learning were affected by both non-verbal and verbal instructor behaviors. Instructors' humor, praise, engagement in conversation, and personal self-disclosure were among the verbal immediacy variables that contributed to student learning. Overall, the author found that over 38% of the variance in college students' affect was accounted for by instructor immediacy. Comparably, [Mentzel and Carrell \(1999\)](#) explored the perceived learning outcomes of 256 undergraduate students, and found that verbal immediacy explained more variance in student perceived learning ($\omega^2 = .15$) than did student and instructor genders ($\omega^2 = .02$). Along the same lines, [Baker \(2003\)](#) found that graduate students participating in an online education course (n=145) reported higher levels of perceived cognitive learning when their instructors engaged in verbal immediacy behaviors. Other researchers report similar results ([Sanders and Wiseman, 1990](#); [Neuliep, 1997](#); [Prisbell and Hilt, 2000](#)).

Previous research is replete with examples of the positive effects of instructor immediacy on student learning outcomes, but few studies were found that investigated the relationship between immediacy and academic anxiety or stress. Only one study could be found that even partially addressed student stress. [Chesebro and McCroskey \(2001\)](#), in addition to immediacy's effects on affective and cognitive learning, investigated the relationship between instructor nonverbal immediacy and student state receiver apprehension. Utilizing a sample of 360 undergraduate college students, Chesebro and colleague hypothesized that teacher immediacy behaviors would have a negative association with student apprehension, a form of state-anxiety. The instrument used, the A-State anxiety measure ([Spielberger et al., 1968](#)), is intended to measure anxiety caused by a specific stimulus. Students in the study were asked to report on their affective experiences when learning from "the instructor in your class most recently before this class". The authors asserted that this method ensured instructor behaviors from a wide variety of academic disciplines would be represented. Their hypothesis was supported, with a significant correlation of -.46, indicating that students with more immediate teachers experienced less state anxiety.

The available literature on statistics anxiety provides evidence that this form of academic anxiety can be reduced through behaviors that are not formally identified as immediacy, but that clearly reflect some aspects of immediacy. Additionally, there is ample evidence in the immediacy literature that nonverbal and verbal immediate behaviors can influence various student affective and other learning outcomes. Finally, though scant, evidence supporting the contention that academic anxiety may be reduced as a result of instructor immediacy provides a logical extension to more specific academically anxious conditions. In light of previous research, a logical argument can be made that instructor immediacy may also help reduce students' statistics anxiety in introductory statistics courses. Therefore, the current study seeks to explore the relationship between instructor immediacy and statistics anxiety in graduate students.

2. Purpose and Predictions

The purpose of the current study is to explore the relationship between instructor immediacy and statistics anxiety in graduate students. Ample evidence for the detrimental effects of statistics anxiety exists in the literature, as well as the factors that contribute to statistics anxiety. Though research exists on methods for managing or reducing statistics anxiety, this area has received comparatively little attention. Factors that have been found to manage or alleviate statistics anxiety include discussion of student concerns, humor, instructor sensitivity, and instructor interpersonal style. The common theme among them appears to be that they are all instructor behaviors that reflect a psychological availability, also known as immediacy, on the part of the instructor. Since these behaviors, though apparently useful, have been studied in isolation, it is the goal of this study to incorporate a combination of instructor behaviors and attitudes that represent the construct of instructor immediacy. For the current study, it is predicted that students who report higher levels of instructor immediacy will also report lower levels of statistics anxiety.

3. Method

3.1 Participants

The current study employed a pre-test post-test control group design wherein instructor immediacy served as the independent variable and students' statistics anxiety served as the dependent variable. The sample consisted of 76 graduate students from a variety of disciplines (e.g., education, nursing, personal financial planning, exercise sports sciences, mass communications, and forensic sciences) enrolled in four sections of a graduate-level introductory statistics course in a College of Education in a large Southwestern university. Two of the sections were taught by the author and served as the treatment group ($N = 38$), and two were taught by other instructors and served as the control group. The age range was 22-76 (mean = 32.2, $SD = 9.68$). The sample consisted of 55 female and 21 male students.

Initially, the intended design of the study was a pretest-posttest design, as all students were registered for the author's two sections of the course. However, as the first class day approached, and enrollment grew beyond the desired limit (18-20 students per section), two additional sections were opened. The educational department secretary transferred one quarter of the students from the author's sections into each of the two new sections. These new sections were taught by adjunct faculty, both of whom utilized the author's syllabus, course topic schedule, and chosen textbook. Two sections of the course occurred on Monday evenings from 6:00 pm to 8:50 pm, one taught by the author and one by an adjunct instructor. The other two sections occurred on Tuesday evenings from 6:00pm to 8:50pm, also with one section taught by the author and the other taught by a second adjunct instructor. Students in all four sections were given a 10 minute break approximately halfway through each class period. The learning objectives for the course were determined by a course template provided by the department, and included developing the ability to apply basic descriptive statistics, basic inferential statistics, and gaining an understanding of the usefulness and importance of statistics in educational research. These objectives are expected to be achieved through practice in certain topics

outlined by the course template (e.g. frequency distributions, correlation and regression, probability, t-tests, one-way ANOVA). Homework was given at the end of each topic (usually each week) by all instructors, and was due the following week at the beginning of class. Assignments consisted of hand-written work, with no utilization of computer programs such as SPSS or Excel. Care was taken to ensure that students in all four sections of the course were exposed to classroom conditions that were as similar as possible with the exception of the treatment variable of instructor immediacy.

3.2 Procedure and Instruments

On the first day of class, students were invited by the researcher to participate and assured that their responses would remain anonymous and confidential and would not be accessible by their instructors. In order to avoid unintended contamination of the control group, the instructors teaching the control group were not given any indication of the treatment variable (immediacy) being implemented by the author in the treatment group. Similarly, in order to avoid expectation bias, the students in both groups were kept unaware of the treatment variable. For students agreeing to participate, demographic information was requested concerning age, gender, and academic status. Students were then given an envelope containing the pre-test questionnaire and the post-test questionnaire, and instructed to complete the pre-test questionnaire only. Upon completion, the students were asked to seal the envelopes and write the last 4 digits of their phone numbers on the outside for temporary identification purposes. The envelopes were stored in a locked cabinet until the end of the semester. Near the last day of the semester, the sealed envelopes were returned to the students and they were asked to complete the post-test questionnaire and destroy the outer envelopes in order to preserve anonymity.

The pre-test consisted of the Statistics Anxiety Rating Scale (STARS) ([Cruise et al., 1985](#)) in order to obtain a baseline of statistics anxiety levels before any statistics instruction was given. The STARS consists of 51 items measured on a 5 point Likert-scale. The instrument includes six sub-scales, or factors, designed to assess anxiety in the areas of worth of statistics, interpretation anxiety, test and class anxiety, computation self-concept, fear of asking for help, and fear of statistics teachers. Worth of statistics refers to students' perceptions of the usefulness of statistics either in their personal, academic, or future professional lives. Sample items include "I wonder why I have to do all these things in statistics when in actual life I'll never use them" and "I don't understand why someone in my field needs statistics", and are scored along the continuum of 1 (strongly disagree) to 5 (strongly agree). Interpretation anxiety refers to how much anxiety students may feel when faced with having to interpret statistical data, or make a decision about an analysis outcome, and are scored from 1 (no anxiety) to 5 (high anxiety). Sample items reflecting this type of anxiety include "Interpreting the meaning of a table in a journal article" and "Interpreting the meaning of a probability value once I have found it". Test and class anxiety are measured on the same scale, with items such as "studying for an examination in a statistics course" and "enrolling in a statistics course". Computation self-concept is intended to represent students' anxiety concerning working math problems as well as their self-perceptions of mathematical ability (rather than actual mathematical ability). Sample items from this subscale, measured on a 5-point Likert scale from strongly disagree to strongly agree, include "Since I've never enjoyed math, I don't see how I can enjoy statistics" and "I'm too slow in my thinking to get through statistics". The final two subscales, fear of asking for

help and fear of statistics teachers, are also measured on a 5-point Likert scale with 1 indicating no anxiety and 5 indicating high anxiety. These subscales are designed to assess students' anxiety over asking for help in understanding statistics material, and students' perceptions of statistics teachers. Sample items include "asking one of your professors for help in understanding a printout" and "statistics teachers talk so fast you cannot logically follow them." Higher scores on each of the subscales indicate higher anxiety levels for that area. For the pre-test, Cronbach's reliability coefficients for the six subscales were .92 (worth of statistics), .90 (interpretation anxiety), .74 (test and class anxiety), .90 (computation self-concept), .95 (fear of asking for help), and .75 (fear of statistics teachers).

The post-test questionnaire consisted of the STARS as a follow-up measurement of post-test levels of statistics anxiety, and showed reliabilities of .94 (worth of statistics), .89 (interpretation anxiety), .93 (test and class anxiety), .88 (computation self-concept), .93 (fear of asking for help), and .85 (fear of statistics teachers). Additionally, the post-test measured instructor immediacy via the Instructor Immediacy scale ([Wilson, 2006](#)). The Instructor Immediacy scale is designed to measure both verbal and non-verbal indicators of instructor immediacy. The instrument consists of twenty-three questions, including 17 verbal-immediacy questions and 6 non-verbal immediacy questions. All questions are measured on a 5-point Likert scale and an overall immediacy score is obtained by computing the mean across items for each participant. Higher scores indicate higher levels of instructor immediacy. Sample items designed to assess the instructor's verbal immediacy include "Addresses students by name" and "Uses humor in class", and items meant to measure non-verbal immediacy include "Smiles at the class as a whole, not just a few select students" and "Looks at the class while talking". For the current study, Cronbach's alpha reliability coefficients were .89 for the verbal items and .73 for non-verbal items.

3.3 Limitations

Some potential limitations to the generalizability of the current study should be noted before proceeding to the results section. First, although care was taken to ensure the greatest possible similarity in classroom conditions between the four course sections, it is likely that differences existed between the author's and the other instructors' sections beyond that of immediacy behaviors. For example, even though the departmental course template specifies guidelines concerning topics to be covered in the course, different instructors may place differing emphases on those topics, which may have an effect on student anxiety. Second, the procedure utilized by the departmental secretary to select students to be moved into the newly created sections is unknown. The author acknowledges the possibility that there may be some difference between students who were moved and students who remained in the author's sections, which may be reflected in students' levels of anxiety. Although these differences are mathematically corrected for by the use of pre-test anxiety scores as covariates in the analysis, it is possible that some measure of difference still exists. Third, it is possible that some students elected to enroll in this particular introductory statistics course (as opposed to introductory statistics courses in other colleges within the university) either wholly or in part because of the author's instructor-reputation. If this was the case, students who were moved involuntarily into the other instructors' sections may have been affected by this lack of choice, which may have had an impact on their levels of anxiety. Additionally, the author acknowledges the possibility of

differing levels of instructor confidence and/or experience having some effect on instructor immediacy, which may in turn effect students' levels of anxiety. Granting these cautions, the results of this study should prove useful in furthering the understanding of the alleviation of graduate students' statistics anxiety.

4. Results

Because immediacy implies an involved teaching style, the possibility is acknowledged that instructors whose students were in the control group may have naturally used immediacy as a part of their teaching style. Therefore, in order to ensure the distinction between the treatment and control groups, an independent-samples t-test was conducted to test the significance of the mean difference on instructor immediacy. The treatment group reported significantly higher levels of instructor immediacy (mean = 4.26) than the control group (mean = 3.75), $t(74) = 4.48$, $p < .001$.

Means, standard deviations, and median scores for the STARS factors pre-test are shown in [Table 1](#). Median rank equivalent scores (MRES*) are also presented, and represent a comparison to the norm group reported by [Cruise et al. \(1985\)](#). Therefore, by comparison to this norm group, the current sample reported interpretation anxiety as their highest form of anxiety initially, indicating that at least half of the present sample of students scored higher than did 72% of the norm group on this dimension of statistics anxiety.

Table 1 – STARS Means, Standard Deviations, Medians, and Median Rank Equivalents

Factor	<i>mean</i>	<i>SD</i>	<i>Mdn</i>	MRES*
Worth of statistics	34.22	9.83	33	65
Interpretation anxiety	29.59	9.40	30	72
Test and class anxiety	27.41	10.10	28	70
Computational self-concept	17.07	6.39	17	65
Fear of asking for help	9.01	4.52	8	66
Fear of statistics instructor	11.20	3.59	11	54

*Median percentile rank equivalent scores were acquired through comparison to graduate student percentile rank scores listed by [Cruise et al. \(1985\)](#).

In order to test the prediction that students who reported higher levels of instructor immediacy would also report lower levels of statistics anxiety, one-way multiple analysis of covariance (MANCOVA) was conducted. MANCOVA was employed because the study utilized one categorical independent variable with two levels, treatment group = group 1 (N = 38) and control group = group 2 (N = 38), six continuous dependent variables, Worth of Statistics posttest, Interpretation Anxiety posttest, Test and Class Anxiety posttest, Fear of Asking for Help posttest, Computation Self Concept posttest, Fear of Statistics Teacher posttest, and six continuous covariates, Worth of Statistics pretest, Interpretation Anxiety pretest, Test and Class Anxiety pretest, Fear of Asking for Help pretest, Computation Self Concept pretest, and Fear of Statistics Teacher pretest. The pretest scores served as covariates in order to correct for initial differences

between groups because random assignment was not possible. Group means were adjusted for the influence of the covariates, and appear in [Table 2](#) along with the unadjusted means.

Table 2 – Adjusted and Unadjusted Means for STARS Factors by Group

Factor	Treatment		Control	
	Adjusted \bar{x}	Unadjusted \bar{x}	Adjusted \bar{x}	Unadjusted \bar{x}
Worth of statistics	30.67	33.45	35.07	32.29
Interpretation anxiety	22.39	23.13	26.38	25.63
Test and class anxiety	20.41	21.29	25.40	24.53
Computational self-concept	13.02	14.13	15.92	14.82
Fear of asking for help	7.17	7.34	9.02	8.84
Fear of statistics instructor	7.78	8.24	11.06	10.61

Results of the MANCOVA ([Table 3](#)) revealed significant differences between groups on the combined dependent variables ($p = .011$). The covariates of worth of statistics ($p = .000$), interpretation anxiety ($p = .002$), test/class anxiety ($p = .002$), and computational self-concept ($p = .002$) significantly influenced the combined dependent variables. The covariates of fear of asking for help ($p = .116$) and fear of statistics teachers ($p = .724$) did not influence the dependent variables.

Table 3 – Multivariate Tests using Wilks' Lambda (λ)

Effect	Value	<i>F</i>	<i>Sig.</i>	Partial Eta Squared
Worth of Statistics Pretest	.617	6.514	.000*	.383
Interpretation Anxiety Pretest	.719	4.113	.002*	.281
Test and Class Anxiety Pretest	.731	3.857	.002*	.269
Computational Self-Concept pretest	.719	4.094	.002*	.281
Fear of Asking for Help pretest	.854	1.789	.116	.146
Fear of Statistics Instructor pretest	.945	.606	.724	.055
Group (IV)	.775	3.052	.011	.225

*Significant at $p \leq .01$

Analysis of covariance (ANCOVA) was conducted on each dependent variable as a follow-up test to MANCOVA. Immediacy differences were significant for all six of the STARS factors (Table 4).

Table 4 – Follow-up ANCOVA for each Dependent Variable

Effect	<i>F</i> (1,68)	<i>Sig.</i>	Partial Eta Squared
Worth of Statistics Pretest	4.057	.048*	.056
Interpretation Anxiety Pretest	5.294	.024*	.072
Test and Class Anxiety Pretest	7.657	.007**	.101
Computational Self-Concept pretest	8.413	.005**	.110
Fear of Asking for Help pretest	3.954	.051	.055
Fear of Statistics Instructor pretest	16.843	.000**	.199

Significant at ** $p < .01$; * $p \leq .05$

5. Discussion and Conclusions

This study focused on the relationship between instructor immediacy and graduate students' statistics anxiety. The findings indicate that instructor immediacy is significantly related to the six factors of statistics anxiety described by [Cruise et al. \(1985\)](#), with immediacy explaining between 6% and 20% of the variance in students' anxiety levels. Although all six types of anxiety were reduced in the treatment group, the largest amount of variance in anxiety explained by immediacy was 20% for fear of statistics teachers. This finding makes sense when we consider the [Mehrabian's \(1971\)](#) immediacy principle: "People are drawn toward persons and things that they like... and avoid things they dislike..." (p.1). Therefore, when instructors communicate liking to their students, in other words when they practice immediacy, students are more likely to feel a reciprocation of liking instead of fear. To further this line of reasoning, [Rachman \(1998\)](#) writes that when people are suffering from anxiety, part of the problem is that they are over-predicting the amount of discomfort they expect to experience, and that certain "safety signals" represent a reprieve from the perceived threat. These safety signals can, in turn, reduce how much people will avoid the unpleasant stimulus. In the case of the statistics-anxiety afflicted graduate student, an instructor who practices immediacy shows the student his/her "humanness" and understanding through such behaviors as smiling, engaging in eye contact, and being verbally expressive, which may serve as safety signals thereby reducing fear of the statistics teacher.

Test/class anxiety (10%) and computational self-concept (11%) showed the next largest amounts of variance explained by the independent variable. If immediacy behaviors act as safety signals in the minds of the students, then it follows that test/class anxiety and anxiety stemming from

computational self-concept would also be reduced. When the instructor practices immediacy, he/she engages in additional positive behaviors such as praising students' actions and comments, encouraging students to share their points of view, and engaging in student-initiated discussion (Gorham, 1988). Students with statistics anxiety tend to expect high levels of discomfort while in class, taking tests, and doing statistical computations. Rachman (1998) writes that when the levels of discomfort actually experienced are lower than people expected, they find they have over-predicted their fears. Rachman goes on to say that "when their predictions are repeatedly disconfirmed, they begin to predict they will have less and less fear" (p. 16). Therefore, students whose fears are not realized experience less anxiety.

Although instructor immediacy has been found to be related to a reduction in graduate students' statistics anxiety, the mechanism by which this occurs is unclear. Future research should focus on other variables that may explain the nature of this relationship. For example, student expectation based on the reputation of the instructor may play a role in the flexibility (or lack thereof) of statistics anxiety. In other words, students who choose a section of statistics class because he/she had heard positive things about the instructor may be more open to the instructor's immediacy, and in turn experience a reduction in anxiety. At any rate, the instructor appears to have an important influence on the anxiety levels experienced by graduate students, and care should be taken to show students our concern for their feelings as well as for their learning.

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