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Test anxiety and beliefs about testing in college students with and without learning disabilities.

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TEST ANXIETY AND BELIEFS ABOUT TESTING IN COLLEGE STUDENTS WITH AND WITHOUT LEARNING DISABILITIES

A Dissertation Presented

by

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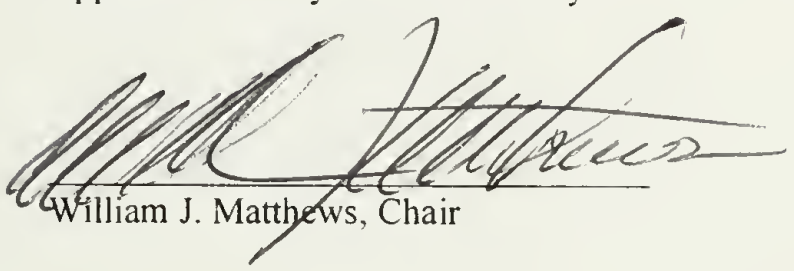

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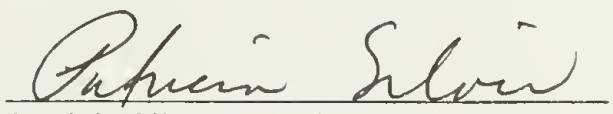

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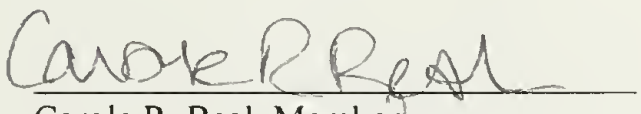

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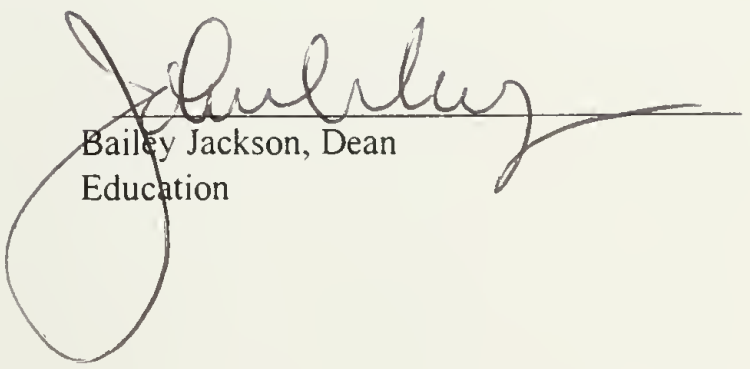

Bailey Jackson, Dean
Education

To

My Parents

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ABSTRACT

TEST ANXIETY AND BELIEFS ABOUT TESTING IN COLLEGE STUDENTS WITH AND WITHOUT LEARNING DISABILITIES

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Differences in beliefs about, reactions to, and perceived control over testing between learning disabled and non learning disabled students at the postsecondary level were investigated. Additionally, the effect of the use of support services by students with LD on their beliefs about and reactions to testing was also investigated. Students with and without LD were given published measures of test anxiety and academic locus of control, as well as survey questionnaires/scales created for the study. Additional information on students' with LD diagnoses and use of support services was gathered from archival data. Results indicated that students with LD reported significantly higher levels of test anxiety, particularly test irrelevant thinking, than their non-LD peers. Students with and without LD also differed significantly in their anxiety ratings of particular evaluation conditions, academic subject areas, and modifications to the testing environment. An external academic locus of control was found to be related significantly to higher test anxiety for all students. For students with LD, use of support services was not related to test anxiety. High levels of test anxiety were found to be related to reported avoidance of testing intensive courses and subject areas for all students. Females consistently scored significantly higher than males on all generalized measures of anxiety. Findings suggest that test anxiety is a phenomenon that varies both quantitatively and qualitatively as a function of individual differences in academic history, areas of academic strength and need, and as a function of specific aspects of the test situation (e.g., subject area testing is being conducted in, presence of distractions); in addition to its well documented negative effects on test performance, test anxiety may also have long term effects on academic and career choices. Support services appear to be perceived as useful by anxious students, however, utilization of such services

does not appear to mitigate generalized test anxiety, though use of such services is related to higher GPA. Based on study findings, a variety of possible modifications to the testing environment and to classroom grading procedures at the postsecondary level are suggested.

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS v

ABSTRACT vi

LIST OF TABLES xi

LIST OF FIGURES xiv

Chapter

INTRODUCTION 1

1. LITERATURE REVIEW 3

The Concept of Test Anxiety 3

Definition and Brief History of the Construct 3
Components of Test Anxiety 3
Effects of Test Anxiety on Memory and Cognition 5
Effects of Anxiety on Academic Tests and Performance 6
Effects of Test Anxiety on Test-Taking Behaviors and Related Cognitions 7
Theoretical Models of how Test Anxiety Operates 8
Conclusion - General Concept of Test Anxiety 11

Group and Individual Differences in Test Anxiety 11

Gender 11
Cultural/Ethnic Differences 12
Ability 14
At-Risk Students 14
Age/Grade Level 15
Students with Learning Disabilities 15
Differences in Classroom Personality Measures 18
Self-Concept Variables, Success/Failure Attributions, and Learned Helplessness 18
Conclusion - Group and Individual Differences 20

Environmental Variables Contributing to Test Anxiety 20

Curriculum 21
Test Construction Factors 22

Types of Questions 22
Computer and Self Adaptive Testing and Perceived Control 23
Presence of Defects on Tests 25
Constructing Tests for Students with Disabilities 25

General Testing Parameters and Conditions 26

Take Home and Open Book Conditions 26
Untimed Testing 27

Scheduled and Unscheduled (Surprise) Testing 27
Frequency of Testing 28
Presence of Distractions 29
Penalties for Guessing 29
Classroom Structure 29
Effects of Support Systems of Test Anxiety Levels 30

Conclusion - Environmental Factors 30

Overview of Reviewed Research, and Statement of the Current Research Problem, Questions, and Hypotheses 31

Statement of the Problem 34
Specific Research Questions and Corresponding Hypotheses 35

2. METHODS 37

Design 37
Independent and Dependent Variables 37
Participants 38
Instruments 44

Test Anxiety 44
Perceived Control 44
Rating of Test Situations 46
Rating of Testing Modifications/Accommodations 47
Course and Subject Area Avoidance 47
Subject Area Ratings 49
Demographs 49
Students with Learning Disabilities Support Data 50

Procedure 53

3. RESULTS 57

General Academic Success 57
Hypothesis One 59
Hypothesis Two 65
Hypothesis Three 71
Hypothesis Four 84
Hypothesis Five 94
Hypothesis Six 99
Hypothesis Seven 103
Hypothesis Eight 108
Hypothesis Nine 110
Hypothesis Ten 115

4. DISCUSSION 119

Research Question One 120
Research Question Two 121
Research Question Three 124
Research Question Four 127

Research Question Five 127
Research Question Six 132
General Discussion 135
Conclusion 140

APPENDICES

A. DATA COLLECTION INTRUMENTS 141

Revised Test Anxiety Scale (RTA) 141
Academic Locus of Control Scale (ALOCS) 143
Perceived Control Over Testing Scale (PCOT) 145
Test Situations Rating Scale (TSRS) 147
Test Modifications Rating Scale (TMRS) 149
Demographic Data, non LD 151
Demographic Data, LD 152
LDSS Data Sheet 153

B. INFORMED CONSENT FORMS 154

Informed Consent, non LD 154
Informed Consent, LD 155

C. ACADEMIC MAJOR CATEGORIES 156

REFERENCES 158

LIST OF TABLES

Table

Page

1. Sample demographic data - categorical - as a function of LD status 40

2. Sample demographic data - categorical - as a function of sex 41

3. Sample demographic data - means - as a function of LD status 41

4. Sample demographic information - means - as a function of sex 42

5. Additional demographic data for students with learning disabilities for the total LD sample, and as a function of sex 42

6. Continuous demographic information - comparison of means as a function of LD status 58

7. ANCOVA results for GPA 58

8. Continuous demographic information - comparison of means as a function of sex 59

9. Means and standard deviations for study measures as a function of LD status 61

10. Means and standard deviations for study measures as a function of sex 62

11. ANOVA results for hypothesis one 63

12. Results of Kruskal-Wallis one way ANOVA's for LD status and sex 63

13. Hypothesis one, multiple regression 65

14. MANOVA results for four RTA factor scores as a function of LD status, sex, and LD status x sex 66

15. Univariate F tests for RTA factor scores as a function of LD status 67

16. Univariate F tests for RTA factor scores as a function of sex 67

17. Results of Kruskal-Wallis one way ANOVA's for LD status and sex 68

18. Results of Kruskal-Wallis one way ANOVA's for LD status and sex 69

19. Results of Kruskal-Wallis one way ANOVA's for LD status and sex 70

20. Results of Kruskal-Wallis one way ANOVA's for LD status and sex 71

21. TSRS ratings means, standard deviations, and rank order from most to least anxiety producing, presented as a function of LD status 72

22. TSRS ratings means, standard deviations, and rank order from most to least anxiety producing, presented as a function of sex 73

23. TSRS ratings means, standard deviations, and rank order from most to least anxiety producing (situations are also listed in this rank order) for the total sample 74

24. MANOVA results for the 20 TSRS ratings as a function of LD status, sex, and LD status x sex 75

25. Univariate F tests for TSRS ratings as a function of LD status 77

26. Univariate F tests for TSRS ratings as a function of sex 79

27. Subject area test anxiety ratings: means standard deviations, and rank order from most to least anxiety producing, presented as a function of LD status 80

28. Subject area test anxiety ratings: means standard deviations, and rank order from most to least anxiety producing, presented as a function of sex 80

29. Subject area test anxiety ratings: means, standard deviations, and rank order from most to least anxiety producing (subject areas are also listed in this rank order) for the total sample 81

30. MANOVA results for the six subject area test anxiety ratings as a function of LD status, sex, and LD status x sex 82

31. Univariate F tests for subject area test anxiety ratings as a function of LD status 83

32. Univariate F tests for subject area test anxiety ratings as a function of sex 84

33. TMRS ratings: means, standard deviations, and rank order from most to least anxiety relieving, as a function of LD status 85

34. TMRS ratings: means, standard deviations, and rank order from most to least anxiety relieving, as a function of sex 86

35. TMRS ratings: means, standard deviations, and rank order from most to least anxiety relieving (modifications are also listed in this rank order) for the total sample 87

36. MANOVA results for TMRS ratings as a function of LD status, sex, and LD status x sex 88

37. Univariate F tests for TMRS ratings as a function of LD status 90

38. Univariate F tests for TMRS ratings as a function of sex 91

39. Univariate F tests for TMRS ratings as a function of the interaction between LD status and sex 94

40. Means and standard deviations for fine arts test anxiety as a function of nature of LD (sample is students with LD only) 96

41. ANOVA results for fine arts test anxiety as a function of nature of LD (sample is students with LD only) 96

42. Means and standard deviations for humanities test anxiety as a function of nature of LD (sample is students with LD only) 96

43. ANOVA results for humanities test anxiety as a function of nature of LD (sample is students with LD only) 97

44. Means and standard deviations for foreign language test anxiety as a function of nature of LD (sample is students with LD only) 97

45. ANOVA results for foreign language test anxiety as a function of nature of LD (sample is students with LD only) 97

46. Means and standard deviations for mathematics test anxiety as a function of nature of LD (sample is students with LD only) 97

47. ANOVA results for mathematics test anxiety as a function of nature of LD (sample is students with LD only) 98

48. Means and standard deviations for hard science test anxiety as a function of nature of LD (sample is students with LD only) 98

49. ANOVA results for hard science test anxiety as a function of nature of LD (sample is students with LD only) 98

50. Means and standard deviations for social sciences test anxiety as a function of nature of LD (sample is students with LD only) 98

51. ANOVA results for social sciences test anxiety as a function of nature of LD (sample is students with LD only) 99

52. Correlation matrix for all continuous measures in the study, for the total sample (n =182) 100

53. Hypothesis six multiple regression 103

54. Correlation matrix for all continuous measures in the study, for students with LD only (n = 90) 105

55. Hypothesis seven multiple regression 108

56. Hypothesis eight multiple regression 110

57. Hypothesis nine, multiple regression one 112

58. Hypothesis nine, multiple regression two 113

59. Hypothesis nine, multiple regression three 114

60. Hypothesis nine, multiple regression four 115

61. Means and standard deviations of RTA scores for each major area as a function of LD status 116

62. Hypothesis ten ANOVA results 117

LIST OF FIGURES

Figure Page

1. Interaction between sex and LD status - TMRS 17: Outline of test in advance 92

2. Interaction between sex and LD status - TMRS 10: Partial credit for showing work 93

3. Interaction of LD status and major choice 118

INTRODUCTION

Today's students are under high pressure to achieve academically, as it is recognized in our society that high levels of academic achievement correlate significantly with desirable employment opportunities and higher incomes. Tests, particularly course final examinations and college and graduate school entrance examinations (e.g., SAT, GRE), play a critical role in determining students' academic futures. Anything that might affect an individual's performance on such important evaluations is of great general interest. The phenomenon of test anxiety is one such factor.

Test anxiety is quite prevalent. It is estimated that from 10% to 25% of the school age population suffer from test anxiety (King, Ollendick, & Gullone, 1990), and surveys have shown that testing is one of the biggest fears of adults returning to school (Diaz-Lefebvre, 1989). The nature and causes of test anxiety, as well as the development of assessment procedures and interventions that might mitigate the effects of this phenomenon, are thus valid and important research concerns.

Test anxiety does not uniformly affect all individuals. Research suggests that test anxiety levels vary to some degree with other characteristics of individuals, such as gender, IQ, and academic history, and that students who are in marginalized positions academically and/or socially likely to be more affected. Research also suggests that characteristics of the testing situation such as the subject area being tested, time pressure, distractions, and test construction factors (e.g., item order, item clarity) also affect individuals' test anxiety levels during a given test administration. These environmental factors are of particular interest because they can be manipulated, and as such might lead to viable interventions for the test anxious student.

The purpose of this study was to investigate differences in reactions to and beliefs about testing in college students with and without learning disabilities. Students with learning disabilities were chosen as a subject group because it was believed that the history of difficult academic experiences in most cases necessary to acquire such a diagnosis exemplified that suggested by research as contributing to higher levels of test anxiety. Thus, it was hoped that the effects of such a history could be definitively proven and analyzed in some detail. Beyond this, students with learning disabilities are already at a disadvantage in a university environment; investigating the anxiety levels of such students and the ways in which such

anxiety might be mitigated was envisioned as having potential benefits in terms of more appropriately accommodating such students. Finally, students with learning disabilities at the University of Massachusetts, Amherst are eligible to receive certain accommodations around testing (e.g., untimed tests), some of which begin to address the situational factors found to affect anxiety (e.g., time pressure). It was hoped that an investigation of the effect of these accommodations on test anxiety might shed some light on the effectiveness of environmental modifications in mitigating test anxiety.

In addition to the above concerns, the testing beliefs of non learning disabled students were also investigated, to develop an overall profile of what students in general find most anxiety producing about testing procedures. It was hoped that this profile might suggest recommendations for useful, viable modifications to testing procedures to make testing more reasonable and pleasurable for all students.

CHAPTER 1

LITERATURE REVEIW

The Concept of Test Anxiety

Definition and Brief History of the Construct

What is test anxiety? Sieber (1980) defined test anxiety in the most general sense as "a special case of general anxiety. It refers to those phenomenological, physiological, and behavioral responses that accompany concern about possible failure" (p. 17).

Although early test anxiety research was conducted in Europe in the early 1900's, and by C. H. Brown in the United States in the 1930's (Spielberger and Vagg, 1995), the concept of test anxiety itself was really born in 1952 when Mandler and Sarason developed the first widely used test anxiety questionnaire and found that low anxious students performed better than high anxious ones on intelligence tests (Hembree, 1988). Studies of the relationship between anxiety and school achievement were also done during this time, with similar results: anxiety was found to have a negative effect on school achievement (Sarason, Davidson, Lighthall, Waite, & Ruebush, 1960). During the 1960's, research on test anxiety was focused primarily on the emotional reactivity aspect of test anxiety (physiological arousal), and on demonstrating that test anxiety did in fact have debilitating effects; during the 1970's, research focused primarily on cognitive interpretations of the nature of test anxiety, and on developing viable interventions for this problem (Wine, 1980). Even a brief review of current research makes it clear that cognitive interpretations have in fact continued to dominate the study of test anxiety into the 1990's, and that a focus on interventions has been growing.

Components of Test Anxiety

As test anxiety research has progressed, the original unitary concept has been broken down into several different subcategories. In 1960 Alpert and Haber proposed a two dimensional theory of test anxiety, consisting of facilitating anxiety, involving task directed behaviors (e.g.: the anxiety that motivates one to work on academics) and debilitating anxiety, involving task irrelevant behaviors (e.g.: thinking about failure during a test) (Alpert & Haber, 1960). An extensive review of the research on these

dimensions has shown them to be virtually exact opposites, with the presence of one implying the absence of the other (Hembree, 1988).

In 1967, Liebert and Morris theorized that debilitating test anxiety itself was composed of two separate components: worry (cognitions involving concern about one's performance) and emotionality (autonomic reactions, such as accelerated heartbeat, or sweating) (Liebert & Morris, 1967). There has been research, however, that suggests that worry and emotionality operate together during test anxiety and are not separable, as treatments specifically designed to reduce one factor invariably also reduced the other (Sapp, 1993; Hembree, 1988). Thus, while worry and emotionality describe two theoretically separate aspects of the test anxiety experience (cognitive and physiological), they appear to be closely connected.

In 1972, Spielberger proposed that there were two separate types of anxiety, differing in etiology and duration and roughly corresponding to Liebert and Morris' worry and emotionality components: A-State (a transitory primarily physiological reaction to the situation one is in) and A-Trait (chronic anxiety and worry as a stable personality trait) (Spielberger, 1972). Research has found A-State anxiety to be closely related to A-Trait anxiety, with high A-Trait anxious individuals showing higher A-State Anxiety than non A-Trait anxious peers (Head and Knight, 1988). Studies comparing A-State, A-Trait, and test anxiety levels have also suggested that test anxiety is more closely related to A-Trait anxiety than to A-State anxiety (Tobias & Hedl, 1972; Mackenzie, 1994). However, as Devito and Kubis (1983) note, individuals with high test anxiety tend to have higher state anxiety than low anxious persons during stressful tests, suggesting that test anxiety may "be conceptualized validly as both state and trait" (p. 970).

Phillips and Endler (1982) suggest that trait anxiety is itself a multidimensional construct and that "anxiety as experienced may be a function of individual differences in response tendencies toward different kinds of anxiety arousing situations" (Phillips and Endler, 1982, p. 304). In other words, individuals may be chronically anxious about some types of situations, and have very little anxiety about others. In Phillips and Endlers' (1982) study, only trait anxiety related to social evaluation and interpersonal interactions (as opposed to anxiety about things such as physical danger) was directly related to the development of test anxiety in stressful testing situations.

Zohar (1998) takes the relationship between state and trait anxiety into more detail, proposing an additive model of test anxiety where "anxiety during testing is considered an additive or incremental function of dispositional and situational factors" (p. 4). Zohar investigates the use of self efficacy as a variable to account for situational factors, suggesting that students' self efficacy for a particular test situation will vary based on a number of factors (how proficient they believe themselves to be at that particular subject, how much they have studied for that particular test, etc.). In a study investigating the role of self efficacy as an additive variable to trait anxiety for students taking an Israeli college entrance exam preparation course, Zohar's model was validated. The level of anxiety for particular tests was shown to be "an incremental function of test anxiety (trait) and of anticipated success on a particular exam, as operationalized by self efficacy for grade attainment on that exam. Zohar also notes that Spielberger and Vagg's (1995) recently developed transactional model of test anxiety, where positive and negative experiences with particular questions during the test itself contribute to changes in anxiety levels as the situation progresses, can also be easily incorporated into his additive model.

In a more detailed look at the components that make up test anxiety Sarason (1984), developed the Reactions to Tests (RTT) scale which he factor analyzed into four component subscales: worry, test irrelevant thinking, tension, and bodily symptoms. Benson and Bandalos (1992) and Benson and El-Zahhar (1994) have confirmed these components and refined their measurement and suggest that they are unique, though interrelated components of test anxiety. The Revised Test Anxiety Scale (Benson et al., 1992) is currently viewed as the "state of the art" (Anderson & Sauser, 1995, p. 22) in test anxiety research.

Effects of Test Anxiety on Memory and Cognition

The general effects of anxiety on memory and cognitive processing are confirmed by Darke (1988). Darke's experiments indicated that anxiety impinges both on short term memory processes dependent on subvocal rehearsal, such as those used in digit span tasks, as well as on more complex cognitive processes, such as comprehension, and that this effect increases with task difficulty.

Watts and Dalgleish (1991)confirm the detrimental effects of anxiety on cognitive processes and suggest the importance of situational factors in exacerbating this effect. In their study, spider phobic subjects showed significantly worse memory for spider related words than control subjects did, and this

effect increased markedly when subjects were in the presence of a live spider. This finding is particularly relevant to the case of test anxiety, the effects of which are ultimately played out in just this "live" type of situation.

One important, more specific concern not addressed by Darke (1988) or Watts and Dalgliesh (1991) is that of exactly how, or at what point in the acquisition, comprehension, and retrieval of information anxiety causes problems. Mueller, Elser, and Rollack (1993) investigated at what point in the process of memory anxiety comes into play by assessing the differences between explicit and implicit memory in high and low anxious subjects. They found that while high anxious subjects did significantly worse than their low anxious counterparts on a (presumably) anxiety producing explicit memory test, there was no significant difference between the two groups on an implicit memory task perceived as non-evaluative. These results of course suggest that anxiety interferes significantly with memory primarily at the retrieval stage.

In terms of the acquisition stage, Wendell and Tobias (1983) investigated differences in memory between high and low (trait) anxious college students for information presented in videos immediately after viewing (initial learning, or acquisition), and one week later (long term retrieval). Wendell and Tobias found significant correlations between measures of trait anxiety and initial learning test scores, suggesting that anxiety interferes with the acquisition as well as the retrieval of information. Darke's (1988) work of course suggests that anxiety affects processing (comprehension) also.

In summary, the overall import of the studies so far reviewed is threefold. First, it is clear that anxiety has a significant effect on rote memory as well as on more complex cognitive processing tasks. Second, state anxiety seems to exacerbate the decrements in memory caused by general trait anxiety. Third, anxiety appears to affect memory/cognitive processes at acquisition, comprehension and retrieval phases.

Effects of Anxiety on Academic Tests and Performance

While test anxiety has clearly been shown to negatively affect memory and cognition on relatively artificial tests in fairly controlled settings, the more important questions involve the effects of test anxiety on students' performance in naturalistic settings. A number of studies completed on this topic show that

test anxiety has a significant debilitating effect on both IQ/aptitude tests as well as on regular classroom tests.

In his 1988 meta-analysis of existing test anxiety research, Hembree (1988) analyzed the results of 73 studies looking at the relationship between test anxiety and student performance on IQ, aptitude, and achievement tests. He found that high test anxious students in general scored 6 points lower (on a 100 point test) than low test anxious students - a significant difference. Middle test anxious students scored in between high and low test anxious students, and similar results were found for GPA comparisons of the three groups. Some of the earliest studies on test anxiety (Mandler and Sarason, 1952), as mentioned previously, also found this effect.

Several recent studies have been done looking at the connection between test anxiety and achievement in specific academic domains, confirming test anxiety's generally debilitating effects. Green (1990) investigated test anxiety and mathematics anxiety in college students enrolled in remedial mathematics classes, and found that test anxiety had a significant negative relationship to achievement. Hunsley (1987) also investigated the relationship between math anxiety, test anxiety, and mathematics achievement, and concluded that test anxiety was predictive of lower achieved exam grades. Looking at a quite different academic domain, Julkunen (1992) investigated the relationship between test anxiety and foreign language achievement and concluded that high test anxiety had a negative impact.

Effects of Test Anxiety on Test-Taking Behaviors and Related Cognitions

In addition to having a negative impact on performance, test anxiety also appears to have a number of other effects on students' behaviors and cognitions during testing. Many researchers have noted that high test anxious students tend to engage in negative self talk during testing; this "cognitive interference" (Sarason & Stoops, 1978) is considered a major factor in how test anxiety impedes performance. Beyond these negative cognitions, test anxiety can also influence exam behavior. Geen (1985) studied the effects of test anxiety on students' motivation to escape an exam situation and found that high anxious students, in a situation where they perceived escape was an option, spent significantly less time on task than low anxious students did. If high anxious students are motivated to leave a testing situation before they have done their best work, this could in part contribute to the poorer performance of

these students. Nottleman (1975) studied the relationship between test anxiety and off-task behavior in children performing an anagram task, and found that high anxious children not only exhibited worse performance than low anxious children, they were also observed to engage in significantly more off-task behavior, such as glancing away.

Test anxiety also appears to have an unpleasant emotional component, which may also prove debilitating in its own right. Rappaport (1984) found that high and low test anxious persons differed in their causal attributions after failing or succeeding in a testing situation. High anxious subjects generally attributed their failures to a general lack of ability, and believed that most tasks were difficult for them. They also tended to minimize their successes, attributing them to something they had no control over (e.g., luck). Couch (1976) studied the relationship between test anxiety and self perception, and came to the conclusion that high levels of test anxiety were related to increases in subjects' negative and disparaging thoughts about themselves.

In summary, test anxiety appears related to a variety of behaviors and cognitions which may occur during testing and negatively affect the performance and affect of the student.

Theoretical Models of how Test Anxiety Operates

There have been a number of cognitive interpretations advanced regarding the phenomenon of school test anxiety specifically, which Tobias (1985) summarizes and condenses into two competing models. The skills deficit model suggests that high anxious students are simply lacking in either study or test taking skills, and this lack of skill results in anxiety at test time because these students realize they are inadequately prepared. Anxiety in this model is a result, rather than a cause of poor academic performance. The interference model, relying on the well supported finding that anxiety impairs recall memory and cognitive processing generally, suggests that students become anxious due to the stressful nature of the test situation, and become preoccupied by worry, which interferes with their successful completion of the test.

Tobias (1985) suggests that these factors are co-contributors to decreased student test performance. Interference comes into play in that the "cognitive representation of test anxiety must absorb some of the student's processing capacity, leaving a reduced portion for task solution" (p. 138); in addition, the attentions of the anxious student are diverted to irrelevant concerns, such as preoccupation with his/her

performance, and/or negative thoughts, further limiting processing capacity. Skills come into play in that high anxious students with good skills can to some extent compensate for their limited processing capacity by organizing information efficiently, and are thus less affected by their anxiety. High anxious students with low skills, however, are much more seriously affected by their anxiety.

Paulman and Kennelly (1984) investigated the effects of test anxiety and skills deficits on information processing deficits. They found that when required to do two processing tasks concurrently, high anxious, high skilled students showed performance deficits which were not apparent when they were required to do the tasks sequentially. Low anxious, high skilled students did not show such a difference between concurrent and sequential conditions, indicating that anxiety does indeed "interfere" and limit cognitive capacity; it is not just a skills problem. Paulman and Kennelly also assessed cognitive interference, and found that both high anxiety and low skill level were associated with a significantly higher number of task irrelevant thoughts. This questionnaire, along with verbal reports by subjects at the time of debriefing, indicated that the nature of these intrusive, irrelevant thoughts included: "concerns about poor performance, ability level, embarrassment in front of experimenter, and potential receipt of failure feedback upon termination [of the experiment]" (p. 285). These findings again indicate that anxiety decreases student task performance specifically by impinging on cognitive capacity through negative, self deprecatory thoughts and support the notion that there are two types of test anxious students: 1) those with good learning skills for whom test anxiety causes problems primarily through interfering with the retrieval of information and, 2) those with poor learning skills who become anxious because they are aware of their deficits and then are further affected by this anxiety through the interference process.

Based on this idea, Naveh-Benjamin (1991) reasoned that high anxious students with good skills would experience the most anxiety reduction through an intervention specifically designed to reduce test anxiety (e.g.: systematic desensitization) as opposed to study skills training, and that students with poor study skills would experience the most anxiety reduction through the use of study skills training as opposed to an anxiety reduction strategy. This is exactly the result that was found, thus confirming that test anxious students differ significantly depending on skill level, and that both interference and skills deficits can be involved in test anxiety. In a similar study, Covington and Omelich (1987) arrived at the same conclusion.

Brown and Nelson (1983) looked at college students' cognitions, skill levels, and test anxiety levels in an attempt to determine if there were any specific types of cognitions that might lead students to be more anxious in a testing situation. It was found that in high performing, high anxious students a major source of their anxiety came from the fact that they believed that they had to know everything that could possibly be on the test before they sat down to take it (an impossible task), and thus, since this could not be accomplished, remained extremely anxious no matter how much they studied. These results again suggest that different types of students (e.g., high and low skills) may become anxious for quite different reasons.

A much more recent study by Lee (1995) also supports the cognitive capacity theory of test anxiety. Lee suggests that test anxiety triggers an associative network of worry which remains active during the entire testing period, bringing up test irrelevant information which competes with the test relevant information necessary to successfully complete the task at hand. As suggested by Paulman and Kennelly (1984) and Darke (1988), Lee found that the effects of anxiety become especially relevant (and measurable) as task demands increase.

Several studies done in naturalistic settings confirm subjects' experiences of distracting cognitions interfering with information retrieval. Couch (1979) found that students with high debilitative anxiety showed poor attention to the task at hand because they were focused on previous mistakes, self criticism, and doubts about their academic ability. Zatz and Chassin (1985) investigated the cognitions of elementary school children with different levels of test anxiety and also found that high anxious children tended to go off task during testing because they were involved in negative self evaluations. These studies confirm the results found by Sarason and Stoops (1978), Paulman and Kennelly (1984) and Lee (1995), suggesting that cognitive interference in terms of negative, off task thoughts is a major component of test anxiety.

Hembree (1988) did a meta-analysis of 137 studies of the treatment of test anxiety including behavioral, cognitive, cognitive-behavioral, study skills training, testwiseness training, and placebo therapy, and reached the conclusion that cognitive and behavioral treatments were effective, supporting an interference model of test anxiety. Study skills treatments alone were not found to be effective, thus calling the deficit model, at least taken as a unique cause of test anxiety, somewhat into question.

In summary, there is a great deal of support for the interference model of test anxiety, where anxious individuals experience distracting cognitions (often in the form of negative self evaluations) that impinge upon their limited cognitive capacity and block the retrieval of information. Study skills deficits also appear to be contributors to test anxiety for some, but not all, individuals, and the evidence suggests that such deficits are not uniquely responsible for the experience of test anxiety or the performance decrements that accompany it.

Conclusion - General Concept of Test Anxiety

Test anxiety is a multi-component construct, the negative effects of which have been amply demonstrated. The questions of who is most affected by test anxiety and why, and of what environmental factors exacerbate or mitigate test anxiety, are the subjects of the following sections of this review.

Group and Individual Differences in Test Anxiety

Significant differences in test anxiety levels have been found between students from different races, cultures, backgrounds, and special needs groups. Gender differences in test anxiety have also been found. In addition, individual differences in ability, motivation, and in test related behaviors and cognitions have been found to be related to differential levels of test anxiety in students. The nature of such differences, and theories about the possible causes of such differences, is the subject of this section of the literature review.

Gender

There has been a great deal of research done on gender differences in test anxiety. In his 1988 meta-analysis of 562 test anxiety studies, Hembree concluded that "females consistently showed higher levels of test anxiety than males" (p.60). A variety of other studies confirm Hembree's (1988) findings. For example, Dodds (1975) looked at IQ, sex, SES, and school achievement as correlates to test anxiety in seventh grade students, and found that the strongest correlate of anxiety was the sex of the student.

Gender differences in test anxiety have also been documented cross-culturally. Sharma and Sud (1990) investigated test anxiety in four Asian countries (India, Jordan, China, and Korea) and five Euro-American countries (Hungary, Turkey, Italy, Germany, and America) and found that females had higher test anxiety than males in all cases. Sharma, Parnian, and Spielberger (1983) investigated test anxiety in

Indian and Iranian seventh graders and undergraduates, El-Zahar & Hocevar (1991) investigated levels of test anxiety in males and females in Egypt, Brazil, and the United States; both studies found that females had higher test anxiety than males in all countries on all measures.

Bander and Betz (1981) investigated the effects of sex and sex role on situationally specific anxiety types. Their hypothesis was that differences in anxiety would be greater between males and females in situations that were sex role stereotyped. To investigate this topic, Bander and Betz compared levels of math anxiety (masculine stereotypic domain), general test anxiety (sex neutral domain), and two measures of trait anxiety in males and females. The results of their study confirmed that the variable most associated with sex differences was math anxiety. These results suggest that sex role socialization may play a role in determining the anxiety level of individuals, particularly in regard to sex stereotyped domains, such as mathematics. These findings also indicate the degree to which social roles/expectations might influence test anxiety generally, which could affect a number of different groups.

In summary, there appears to be a consistent correlation between gender, test anxiety, and related forms of anxiety, with females exhibiting higher levels of anxiety than males. These findings are important for future research, as gender could be a significant confound.

Cultural/Ethnic Differences

Test anxiety appears to be a universal phenomenon (El-Zahar & Hocevar, 1991), but this does not mean that it exists at equivalent levels in all cultures or in all ethnic backgrounds within American culture. El-Zahar and Hocevar (1991) compared test anxiety levels of high school students in Egypt and Brazil with those of similar students in the United States. Their hypothesis was that test anxiety levels would be higher both in Egypt and in Brazil than in the United States, because in both Egypt and Brazil students are given a high school exit examination that determines whether or not they will be able to continue on to a university. The results of the study generally confirmed that the Egyptian and Brazilian students were more anxious. Guida and Ludlow (1989) investigated levels of test anxiety in Chile and in the United States, and found that Chilean students also generally had higher levels of test anxiety than American students. To explain this finding, Guida and Ludlow suggest that in countries such as Chile, "where educational opportunities and advancement are restricted, the importance of any single test as a selection

instrument may be exacerbated. It is likely that students faced with such situations recognize the great importance placed on the result of each test and consequently experience greater levels of anxiety" (p. 188).

In an attempt to investigate how an individual's status within a particular culture might effect test anxiety levels, Bronzaft, Murgatroyd, & McNeilly (1974) looked at levels of test anxiety in Black students attending Lehman College in New York, and in Black students attending the University of the West Indies, in Trinidad. The authors note in the United States, Blacks have a minority status and many of the Black students in the Lehman College sample had had negative educational experiences in the past "associated with punishment and criticism" (p. 192). In contrast: "in Trinidad Blacks are not a minority group and should have had more positive experiences in the educational setting" (p. 192). As these authors expected, The Black students attending Lehman College had significantly higher test anxiety scores than the Black students from Trinidad.

The effects of minority status and the social problems that come with it are also suggested by Phillips (1978), who found that Mexican American children who were a minority group in a particular school had higher levels of test anxiety than non minority children, but in another school where Mexican American children were the majority, these children did not exhibit higher levels of test anxiety, instead, white children (the minority in this second school) had the higher levels of test anxiety. As Phillips Pitcher, Worsham, and Miller (1980) note: "minority status, regardless of racial-ethnic status may be an important factor in some children's stress and test anxiety" (p. 341). This idea is corroborated by Entwistle and Greenberger (1970) in their study of test anxiety in Maryland ninth graders. Entwistle and Greenberger conclude that test anxiety does not show differences by racial groups or social class per se, but more by students' relative standing in the ability distribution of their school, with students who feel comparatively less able exhibiting the highest level of test anxiety. Again it seems clear that the problems associated with minority status, particularly negative educational experiences, as opposed to anything unique about any one particular cultural group are in large part responsible for the higher levels of test anxiety minority students may experience.

Ability

As was noted in the earlier section on the effects of test anxiety, lower IQ's are often associated with higher levels of test anxiety (Hembree, 1988). A number of other studies have confirmed this finding. Gjesme (1981) found that ability was one of the factors that correlated most highly with scores on the Test Anxiety Scale for Children. Schmitt and Crocker (1984) also found significant interactions between ability and test anxiety levels. One study that sheds a bit more light on the connection between ability and test anxiety is again Entwistle and Greenberger's (1970) investigation of the relationship between test anxiety and IQ, school type (rural vs. urban), race, and social class. Entwistle and Greenberger found that "test anxiety level appears to depend much less on a student's absolute performance level than on his relative standing in his own subcultural group or school" (p. 14). As suggested by Phillips and Endler (1982) social evaluation may be a major component of test anxiety.

In a related study, DuCette and Wolk (1971) looked at test anxiety levels in high and low ability tracked ninth and twelfth graders at an all-girls Catholic high school. They found that students in the lower ability track had higher test anxiety scores at both grade levels, and a higher need to avoid failure. In a similar study done in Germany, Littig and Knapp (1978) arrived at similar results: in schools with ability grouping, students in the lower tracks experienced higher levels of test anxiety than higher ability students.

In summary, it appears that individual differences in ability are related to differences in test anxiety level, but this process appears to be mediated by social variables in terms of how the student perceives his/her ability level relative to a salient comparison group.

At-Risk Students

Sapp (1993) defines at-risk students as "students of normal intelligence whose academic background or prior performance may cause them to be perceived as candidates for future academic failure" (p. 202), and has found these students to exhibit significantly high levels of test anxiety. Hembree (1988) in a combined analysis of three studies also found that at-risk students displayed significantly higher levels of test anxiety than students who were passing. These findings seem understandable given the research of Entwistle and Greenberger (1970) and DuCette and Wolk (1971) suggesting that it is a student's

awareness of his/her marginal standing relative to other students in the school that may lead to increased levels of test anxiety.

Age/Grade Level

Children of different age groups/grade levels appear to experience different levels of test anxiety. Hembree (1988) analyzed 78 studies that overall looked at test anxiety differences between adjacent grades from 2 through 12. He found that "after increasing in the early grades, TA appeared to stabilize near grade 5, remain essentially constant through high school, and show a small decline in college" (p. 60). He did note, however that the decline in test anxiety scores in college may "reflect attrition more than developmental trends" (p. 60). This seems very possible because, as discussed, test anxiety is correlated with a number of factors such as minority status, SES, and ability, any and all of which may marginalize a student's chances of ever attending college in the first place.

A number of other studies have confirmed Hembree's findings Grierl and Bisanz (1995) investigated levels of test and math anxiety in grades 3 and 6 and found that mathematics test anxiety increased with age/grade. Dunn and Shanks (1967) in their study of elementary and middle school children also found that as children grow older they dislike school and testing more and more. Sud (1991) investigated differences in test anxiety between undergraduates and high school students in both India and in the United States, and found that in the United States both male and female high school students showed higher levels of test anxiety than male and female college students; in India, while there were no differences in anxiety between male high school and college students, Indian female high school students showed higher levels of anxiety than Indian female college students.

In summary, test anxiety appears to increase with age/grade level until the middle school years, where it remains constant throughout high school. Test anxiety appears to be lower in college students than in high school students, possibly as a result of attrition.

Students with Learning Disabilities

Some direct and quite a bit of indirect evidence indicates that students who are diagnosed as having learning disabilities will tend to exhibit significant levels of test anxiety. First, the theories about

the nature of test anxiety suggest this. The skills deficit model summarized by Tobias (1985) suggests that for low skills students, and awareness of their lack of skills may contribute to anxiety at test time. Any student who has received a diagnosis of a learning disability was almost certainly placed in this position as a result of academic problems (e.g., low skills). If one's awareness of past and current academic problems causes anxiety, clearly this is a position in which many students with learning disabilities might find themselves. A recent study by Geisthardt and Munsch (1996) on school stress in adolescents with and without learning disabilities confirms this possibility. These researchers found that learning disabled students were significantly more likely to have failed a class than their non learning disabled peers by an almost two to one margin. The above mentioned research indicating that at-risk students exhibit high levels of test anxiety (Sapp,1993; Hembree, 1988) also supports the idea that students with learning disabilities might be more test anxious. Sapp notes that "at-risk" has also been defined by criteria including a student's being "one or more years behind his/her age or grade level group in mathematics or reading skill levels" (p. 202). Clearly these descriptions might have applied to many students with learning disabilities at some point in their academic career. The evidence thus suggests that in many cases negative academic experiences may predispose many students with learning disabilities to react anxiously to evaluation. That testing in particular is a major issue for students with learning disabilities is also indicated by the fact that the most commonly provided accommodation for college students with learning disabilities is untimed tests (Hill, 1996; Silver, 1995).

The work by Entwistle and Greenberger (1970) suggesting that a student's perception of his/her ability as inferior relative to a salient reference group contributes to test anxiety also has implications for the student with learning disabilities. Many students with learning disabilities are consistently singled out for special services, and so may compare themselves unfavorably with the majority of their classmates. Many studies confirm this notion. Cosden and McNamara (1997) examined the self perceptions of college students with and without learning disabilities and found that students with disabilities had lower grades, test scores, and perceptions of their scholastic and intellectual competence than did their non learning disabled peers. Renick and Harter (1989) investigated third through eight grade students with learning disabilities in terms of their self perceptions of scholastic and athletic competence, social acceptance, and

feelings of global self worth, and found that when these students compared themselves with normally achieving students in their regular classes, their perceptions of academic competence were lower than when they simply assessed themselves, and that these comparative perceptions became more negative as the students' grade level increased. This finding suggests that the longer students have been singled out as academically problematic in some way, the more likely they are to have negative self perceptions regarding their academic ability. This finding may have some fairly serious implications for the population of college students with learning disabilities, many of whom may have suffered from the effects of negative social comparison for many years. Swanson and Howell (1996) found a significant negative correlation between academic self concept and test anxiety in students with learning disabilities. If perception of oneself as less able relative to a salient reference group is really as critical a factor in promoting test anxiety as research has shown it to be, it would seem that students with learning disabilities are very likely to be at greater risk for such anxiety than their normally achieving peers.

Research on students diagnosed as learning disabled also suggests that a connection may exist between learning disabilities and anxiety generally (Lyon, 1996). Bruck (1986) has concluded that children with learning disabilities are more likely to show increased levels of anxiety as compared to their non learning disabled peers, and suggests that many of the emotional problems these children face may reflect adjustment difficulties due to academic failure.

In dealing with the more specific phenomenon of test anxiety in students with learning disabilities, Bryan, Sonnefeld, and Grabowski (1983), assessed levels of test anxiety in 3rd through 8th grade students both with and without learning disabilities and found anxiety levels to be significantly higher in the learning disabled students. Unfortunately, little work has been done on test anxiety with older, particularly postsecondary, students with learning disabilities, so it is uncertain whether this situation continues in the higher grades.

Wood, Miederhoff, and Ulschmid (1989) have investigated the effects of testing on children with a variety of mild handicaps (behavioral, physical, sensory), including learning disabilities, who are mainstreamed into the regular classroom. They note that "many mildly handicapped children see tests as nightmares that elicit memories of previous failures" (p. 46), an idea that is consistent with much of the

previous research. They give the example of a student with fine motor problems who may have trouble writing out essay answers on tests and thus finds herself unable to complete them; being reluctant to ask for special assistance, she often fails and regards herself as a failure. Students with a variety of mild physical and sensory handicaps, as well as with learning disabilities may find themselves in similar situations in the mainstream classroom and hence develop high levels of test anxiety, further compounding the difficulties they are already facing.

In summary, there is both direct and indirect evidence to suggest that students with learning and other disabilities may exhibit higher levels of test anxiety than their non disabled peers, and that this effect may in fact increase the longer students are aware of their difficulties relative to a salient reference group of nondisabled students.

Differences in Classroom Personality Measures

Strom, Hocevar, & Zimmer (1987) have introduced two new personality constructs specifically related to educational phenomena. These constructs are: 1) preference for course difficulty, which involves a student's attitude toward the amount of effort that a particular class requires, and 2) preference for course structure, which involves a student's attitude toward the amount of control imposed by an instructor or method of instruction. Strom et al. investigated the relationship of these two classroom personality constructs to test anxiety, and found that preference for course difficulty showed a significant negative correlation with test anxiety levels, with students who enjoy difficult courses showing lower levels of test anxiety. This suggests that high levels of test anxiety may cause students to avoid courses they fear will be difficult.

Self-Concept Variables, Success/Failure Attributions, and Learned Helplessness

Self-concept variables include self-esteem, self-efficacy, and the nature of the causal attributions one makes about one's performance following failure or success. Dykeman (1994) investigated the effects of self-efficacy, motivational orientation, and feedback on test anxiety in graduate students and found that task-oriented, high self-efficacy students showed the least amount of test anxiety. Comunain (1989) examined the relationship between depression, anxiety, and self-efficacy in Italian high school students and found that anxiety correlated negatively with self-efficacy and positively with depression. Bandalos,

Yates, and Thorndike Christ (1995) also investigated the relationship between self-efficacy and test anxiety, and also found that self-efficacy correlated negatively with test anxiety. After analyzing 58 studies relating test anxiety to various measures of self-concept, Hembree (1988) concluded that: " a strong inverse relationship appeared between self-esteem and test anxiety. High test anxiety students were inclined to an external locus of control and were prone to feel unprotected" (p. 56). Zohar's (1998) additive model of test anxiety also found self-efficacy (for performance in particular subject areas) to be related to test anxiety. These findings continue to suggest, as noted earlier, that students with learning disabilities, who have been found to consistently score lower on measures of self- esteem than non learning disabled students (Cosden & McNamara, 1997; Bear, Clever, & Proctor, 1991), will tend to be more test anxious than their non learning disabled peers.

As has been discussed, it has been found that the task irrelevant thoughts of high test anxious students in a testing situation often include negative self statements involving their ability (Paulman and Kennelly, 1984), strengthening the theory that they may be attributing failure experiences to lack of ability (Bandalos, Yates, & Thorndike-Christ, 1995). Bandalos et al. note that several researchers have found that high test anxious students tend to attribute failure to stable, internal causes such as lack of ability, and in their own study on statistics test anxiety they arrived at exactly the same result. The ultimate effect of such stable internal attributions regarding failure may be related to the idea of learned helplessness, which is defined as " the perception of independence between one's responses and the occurrence or termination of an aversive stimulus (in this case, failure)" (Phillips et al. 1980, p. 338). This relates to Hembree's (1988) conclusion that high test anxious individuals are inclined to an external locus of control. Given the previous research describing the situation many students with learning disabilities are in, many might ultimately find themselves in just this position. These individuals may have both the anxiety component and in many cases the repeated experiences of failure that could lead them to a sense of resignation and helplessness regarding their academic performance. Given this possibility, further investigation into the levels of test anxiety and its related (and damaging) correlates for such students seems particularly important.

In summary, self-concept variables such as self-efficacy/self-esteem are negatively correlated with test anxiety. The attributions an individual makes regarding their success or failure at tasks are also related to test anxiety, with high test anxious persons tending to attribute poor performance on tests to stable internal causes, such as low ability, over which they have no control. Through this process, some test anxious individuals may become resigned to poor performance and decrease their academic efforts.

Conclusion - Group and Individual Differences

In conclusion, it appears that a large variety of individual and group difference factors may be related to test anxiety. Doubtless many of these factors are intercorrelated, so making definitive statements about the effects of any one unique contributor to a student's test anxiety is difficult. Overall, however, several common threads emerge.

First, it seems clear that students with a difficult academic history, for whatever reason - at-risk students, students with learning disabilities, minority students, low ability students - exhibit higher levels of test anxiety. This "difficult academic history" will in most cases be related to low self-efficacy, low skills levels, and tracking in low ability groups - all of which correlate with higher test anxiety levels.

Beyond this, it appears that *social* comparison and evaluation play a major role in exacerbating the test anxiety of marginalized students. It seems that academic difficulties or marginal status socially and/or academically alone do not cause test anxiety per se, as much as the student's perception of this status relative to a salient reference group. As Phillips and Endler (1982) discovered, the social evaluation component of testing appears to be what leads to the most anxiety for students.

Gender differences in test anxiety are also a consistent finding, perhaps for similar reasons. Women are well aware of the fact that they have traditionally had a marginalized role in academics, and still do today, to some extent, although this is slowly changing.

Environmental Variables Contributing to Test Anxiety

Anxiety generally does not develop in a vacuum. In any given situation there will be factors that contribute to the anxiety of particular individuals, as well as factors that mitigate this anxiety. The testing situation is no exception. From the nature of the test itself - the type of questions used, the way instructions are given, etc. - to the way the examiner interacts with students, to the testing conditions - open versus

closed book, timed versus untimed - the testing environment is full of factors that may substantially increase or decrease an examinee's anxiety level. Such environmental factors are the subject of this section of the literature review.

Curriculum

One of the most blatant environmental factors contributing to test anxiety is the nature of the curriculum itself. While it seems intuitively obvious that different subject areas might engender different levels of anxiety in students, this theory has only recently been investigated empirically. Everson, Tobias, Hartman, & Gourgey (1993) compared students' self reported anxiety in four standard curriculum areas: English, Mathematics, Physical Science, and Social Science. The subjects used in the study were first year college students. The results indicated that in general, students have higher test anxiety for subjects like Mathematics and Physical Science, and less for English and Social Science. Physical Science was found to elicit the highest reported test anxiety, significantly higher even than Mathematics. It was also found that student's perceptions of the difficulty of a subject contributed to test anxiety: "in general, the more firmly students held the view that a particular subject was complex and difficult to master, the more test anxiety they reported" (p. 6). This fact, however, did not account for all of the differences between curriculum areas in terms of test anxiety levels. Even when perceptions of difficulty and test demands were controlled for statistically, "test anxiety levels still varied across subjects, with Physical Science evoking the highest adjusted mean levels of reported test anxiety" (p. 6). The authors suggest that this finding indicates that other factors such as classroom context, and the way that courses are "packaged and presented by science faculty" (p. 6), may elicit test anxiety also. Everson et al. note that college level introductory science courses are often perceived by students as "offputting ... a place designed to select them out" (p. 7), and suggest that this factor is critical in contributing to the high levels of test anxiety these subjects engender in students.

The findings of Everson et al. (1993) are easily assimilated into the additive model of test anxiety proposed by Zohar (1998) in which "the dispositional or trait component [of anxiety] is augmented by situation dependent harm appraisal variables...[the model] assumes that individuals develop stable dispositions towards anxiety in some situations, but not necessarily in others" (p. 20). Zohar's investigation

focused on the variable of perceived self efficacy for a particular exam, a concept which can be seen to clearly align with Everson et al.'s findings involving students' particular trepidation about the physical sciences. If students perceive a particular class as generally threatening and aimed at "weeding out" less able students, this would be likely to decrease their perceptions of self-efficacy for grade attainment on any given exam in that class, and contribute to increased test anxiety through the model Zohar presents. Zohar himself indicates that his model accounts for curriculum based differences in test anxiety: "In test anxiety, the assumption would be of stable differential dispositions to experiencing anxiety in some tests but not in others (e.g. mathematics and physics, but not humanities)" (p. 20).

In summary, different subject areas do appear to engender different levels of test anxiety in students.

Test Construction Factors

Types of Questions

Several researchers have investigated the effects of test type (multiple choice, matching, true false, essay, etc.) and test focus (specific factual details, general concepts, application of knowledge) on students' test anxiety levels. Weare (1984) surveyed 134 adult students on their testing preferences in terms of question type. She found that the test type most preferred was multiple choice, followed by (in descending order) true-false, matching, fill-in-the-blank, and essay. In general, confusing questions led to the most anxiety. Examples of these include: essay questions which were vaguely worded, leading to uncertainty about an appropriate response; True-false items that were considered to be "tricky" - one small detail causing the difference between true and false; and multiple choice questions which were perceived to contain a trick (e.g. pick the "best" answer). Interestingly, Weare notes that the same types of questions that may prove anxiety provoking for one, or even a majority of students may not prove anxiety producing for others with different skills or likes/dislikes. In general, the results of Weare's qualitative analysis suggest that the tendency for a particular type of test to provoke anxiety in a student is somewhat dependent on that student's own self perceived strengths and weaknesses. This is again consistent with Zohar's (1998) additive model of test anxiety.

Computer and Self Adaptive Testing and Perceived Control

With the advent of Item Response Theory (IRT) it is possible to compare the test performance of examinees on the same scale of measurement even if they are administered different sets of test items (Wise, Plake, Johnson, & Roos, 1992). Two applications of this feature of IRT are computerized adaptive testing (CAT) "in which a computer algorithm is used to match the difficulty levels of the items administered to the ability level of each examinee" (Wise et al., 1992, p. 329), and self adapted testing (SAT) in which the examinee may choose the difficulty level of each test item to be administered from one of several available levels. Rocklin and O'Donnell explain the difference between CAT and SAT : "instead of being tailored to the examinee's estimated ability level, a self adapted test is tailored to the examinee's self-perceived ability as well as to his or her current motivational and affective characteristics" (Rocklin and O'Donnell as cited in Wise et al., 1992, p.330).

Rocklin (1989) investigated individual differences in item selection on SAT's and found that most subjects adopted a flexible strategy, choosing harder items following success, and easier items following failure. He also found that subjects of differing levels of test anxiety used different item selection strategies, validating that SAT's are valuable in accommodating individual differences in examinees beyond simply the ability differences accommodated by CAT's.

Wise et al. (1992) investigated differences in test anxiety and performance in undergraduate and graduate introductory statistics students taking a basic algebra skills test in either a computerized adaptive test condition or a self adapted test condition. In both the CAT and SAT conditions, feedback was given after each item was administered, allowing the student in the SAT condition to choose the difficulty level of his next item based on some indication of how he was doing; feedback was given in the CAT condition to eliminate the possibility that feedback might become a variable that would confound the results of the study. Wise et al. found that the mean ability score for students taking the SAT was significantly higher than for those taking the CAT, and that those taking the SAT had significantly lower levels of test anxiety than those taking the CAT. Wise et al. note that this finding that students taking the SAT had higher scores than those taking the CAT suggests that the IRT model may not fit when SAT is used. Items appeared to be easier for students in the SAT condition, which violates an assumption of IRT. Wise et al. suggest the

problem is that the IRT model is based solely on ability, and that it is likely that "an examinee's success in passing an item is not simply a function of ability but that his or her success is also influenced by psychological factors, such as anxiety or motivation. The greater the influence of psychological factors on examinee test performance, the less complete are models based solely on ability (e.g., IRT)" (p.337).

In a related study, Wise, Roos, Plake, & Nebelsick-Gullett (1993) investigated the effect of not only SAT and CAT on test anxiety levels, they also looked at the effect of giving students a *choice* between these two types of tests. Wise et al. (1993) theorized that students given a choice between types of test would perceive that they had more control over the testing situation and hence have lower levels of anxiety. Wise et al. (1993) again looked at undergraduate and graduate students in an introductory statistics class, and again used a basic algebra skills test. Three test-taking conditions were arranged: CAT, SAT, and a "choice" condition where students were allowed to choose between CAT and SAT conditions. Subjects were also divided into three anxiety levels (low, moderate, and high) based on a pretest anxiety measure. The results of the study indicated that high anxiety students in the "choice" condition showed significantly better performance than high anxiety students in either of the other two conditions. It was also found in the choice condition that while low anxiety students tended to choose the CAT, the majority of high anxiety students chose the SAT. In terms of anxiety levels, as found in earlier studies, students in the SAT condition exhibited significantly lower levels of post-test anxiety than students in the CAT condition. These results indicate that high anxious subjects tend to reap the greatest benefit from having control over their testing situation as compared to subjects of low or moderate anxiety. The results also confirm the finding that SAT reduces test anxiety as compared to CAT. Wise et al. (1993) note that if a SAT reduces the influence of test anxiety on examinee performance, the resulting scores should be more valid measures of examinee proficiency than scores obtained using a CAT.

Although it seems clear that a SAT is less anxiety producing than a CAT, both types of test still require computer administration. Vogel (1994) found that computer experience was negatively correlated with test anxiety in computerized testing situation. However, although it appears that subjects with limited computer experience are more anxious in a computer testing situation, their test performance is not affected.

In summary, it appears that self adapted testing (SAT) is less anxiety producing than computerized adaptive testing (CAT), probably because the examinee perceives that he/she has more control over the testing situation. Computerized testing in general may cause higher levels of test anxiety in some students. It seems likely that the effect of computer testing on anxiety level is again a function of individual differences, in this case involving computer comfort and experience.

Presence of Defects on Tests

One of the most important aspects of test construction is accuracy: that the tests produced are free of defects. At least two studies cite the presence of defects in the test as particularly anxiety producing for students. Weare (1984) in her survey of adult learners returning to school, notes that "poor test construction ... coupled with poor scoring and grading practices, causes anxiety" (p. 2). Weare defines several factors which indicate poor test construction including vaguely worded essay questions and "items not used to measure understanding ... the emphasis is placed on small details which are trivia" (p.2). Madsen and Murray (1984) in a qualitative study of test anxiety in ESL students listed a number of exam defects which these students had cited as being anxiety producing for them. These included: unclear essay instructions, inadequate space to write responses, numbering errors on the test, and poor sound quality on audio tapes used on listening sections of language tests.

In summary, exam defects, particularly those that contribute to the confusion of the students are a source of anxiety in testing situations.

Constructing Tests for Students with Disabilities

Wood, Miederhoff, and Ulschmid (1989) suggest a variety of guidelines for adapting test construction to facilitate performance and minimize test anxiety in students with handicaps and learning disabilities. Test directions which may be difficult for disabled students should be modified. For example, the use of oral directions exclusively should be avoided, unfamiliar words should be defined, and examples of appropriate responses should be given. These recommendations echo the concerns of Madsen and Murray's (1984) non-disabled ESL students regarding badly constructed tests. When a student finds test directions difficult to understand for whatever reason, it is anxiety producing. The choice and construction of test items should be undertaken with a view to the unique problems of the disabled student

who will be taking the test. Examples of problematic item construction techniques include: giving a very large number of answer choices, arranging items or answer choices in a visually confusing manner, using complex, wordy statements, stating questions in the negative, and having students select a letter coded response from a group of possible responses as opposed to circling correct answers. Any of these situations may confuse a student depending upon his/her particular disability, and this will tend to increase test anxiety to the detriment of the student's concentration and performance. Again, students with disabilities may be viewed as a group of individuals who are particularly illustrative of the effects of a specific test anxiety correlate, in this case, poorly constructed test items.

General Testing Parameters and Conditions

Take Home and Open Book Conditions

Several other aspects of test administration which affect students' anxiety levels have been uncovered by Zoller and Ben-Chaim (1988). These researchers investigated the effects of exam type on student anxiety and performance in undergraduate science education majors using a questionnaire to assess types of preferred examinations, such as oral versus written, group vs. individual, and open vs. closed book. Zoller and Ben-Chaim found that students most preferred exams where 1) time was not limited and 2) the use of supporting material (notes, books, etc.) was permitted. Thus, time pressure and memorization pressure were seen by these students as the largest contributors to test anxiety. Another finding was that the idea of group examinations, where one is examined in the presence of an audience, was very unpleasant to these students, corroborating the findings of Phillips and Endler (1982) that social evaluation anxiety is an important component of test anxiety. Zoller and Ben-Chaim also found that finals were more anxiety producing than midterms, presumably because they were perceived to be of greater importance in the students' final grade.

Weber, McBee, & Krebs (1983) studied anxiety, performance, and tendency to cheat in take-home, open book (in class), and closed book (in class) examinations in college undergraduates. They found that 3/4 of the students worried more before taking a closed book exam and stated that, overall, students spent "considerably (four to seven times as much) more time worrying, preparing, and memorizing for closed book tests than for the other two types" (p. 481). Students also were certain that the

content of the closed book exam was more difficult than that of the open book exam, when in fact all three of the different exam types were matched to be of identical difficulty; again indicating that closed book exams were more anxiety producing. Weber et al. were understandably concerned about the possibility of cheating on the take-home exam, and investigated this (albeit indirectly) by statistically investigating the probability of similar response items for pairs of students. Using this method, they found very little evidence of cheating, and concluded that this was not a major problem in take-home testing.

In summary the results of Zoller & Ben-Chaim (1988) and Weber et al. (1983) support the use of take-home testing as a way to reduce test anxiety and facilitate performance.

Untimed Testing

Time urgency, another factor found by Zoller and Ben-Chaim (1988) to contribute to test anxiety, has also been investigated by several other researchers. Friend (1982) investigated the effects of time urgency, subjective workload, and state anxiety on test performance in adults taking a management-training seminar. Friend found that the most significant correlation between all of his variables was a positive one between time urgency and level of test anxiety. Madsen & Murray (1984), in their qualitative investigation of test anxiety in adolescent and adult ESL students, found that the stressor most frequently mentioned by high anxiety students was awareness of time constraints; this was the case for both the graduate and pre-college students.

In summary, time constraints appear to be an important aspect of examination conditions that contribute to students' test anxiety levels.

Scheduled and Unscheduled (Surprise) Testing

Another aspect of testing conditions which may contribute to test anxiety in students is surprise or unscheduled testing. It seems intuitively obvious that a class designed with "pop" quizzes as part of the assessment structure would be more anxiety producing than a class where all assessments are announced in advance, and there is empirical evidence to support this. Saigh (1985) compared the effects of unscheduled vs. scheduled assessment on test anxiety in two undergraduate human development courses. Saigh found that at the end of a five week period, students in the class with unscheduled assessments scored significantly higher on measures of situation specific anxiety, but not on measures of trait anxiety,

indicating that the unscheduled assessments were more anxiety producing for that situation, but did not increase the overall trait anxiety of the students. It was also found that the content of students' course evaluations was significantly more negative in every instance in the class with unscheduled testing conditions.

In summary, it appears that unscheduled or "pop" quizzes/exams significantly increase the anxiety of students and contribute to an overall negative impression of a class.

Frequency of Testing

An issue related to the scheduling of exams is that of how often testing is conducted. Marso (1970) investigated the effects of more frequent testing and immediate feedback (giving out answer sheets after the test) on the performance of high and low anxiety undergraduates in four educational psychology classes. Although Marso found that all students performed better in the more frequent testing condition and in the feedback condition, he did not find the expected differences in performance between high and low test anxious students. Unfortunately the focus of Marso's study was primarily performance, so it is difficult to be sure of the effects of the differential testing procedures on anxiety itself. Based on a questionnaire given to the participants at the culmination of the study, however, Marso did find that high anxiety students favored the more frequent testing procedures significantly more strongly than did low anxiety students, suggesting that this procedure did mitigate anxiety for high anxiety these subjects.

Hembree (1988) in a meta-analysis of three studies dealing with the effects of more frequent testing on performance in high and low anxiety students found that "high test anxiety students appeared to be better served by more frequent testing, but the mean effect (0.36) was not significant. Adjusting the frequency of tests did not effect the low test anxious subjects" (p. 65). The implication that more frequent testing may lower levels of test anxiety is also strengthened by Zoller & Ben-Chaim's (1989) finding that state anxiety levels were higher for finals than they were for midterms in undergraduate science students. Students perceive finals to be of higher weight in determining the final course grade, and hence the consequences for success or failure are greater. Relating this to exam frequency, it seems likely that the fewer exams a course has, the greater the consequences of each exam on the final grade are, hence the more anxiety producing each exam is likely to be, but this has yet to be investigated specifically.

Presence of Distractions

Although little information is available on this topic, Hembree (1988) looked at three studies that investigated the effects of the presence of distractions on the performance of high and low test anxious students and found that high test anxious students are significantly more distractible than low test anxious students. Nottleman (1975) found that high anxious children performing an anagram task engaged in significantly more off task behavior and glancing away from the task than did low anxious children. Of note, Providing a distraction free testing environment is an accommodation commonly requested by and provided to students with learning disabilities (P. Silver, personal communication, November 24, 1997), a group who are likely to share many features with the typical high anxious student.

Penalties for Guessing

Another aspect of testing conditions which have been found to relate to students' anxiety levels is whether or not scoring procedures include penalties for guessing. Sherriffs and Boomer (1954) found that high anxious students performed significantly more poorly under conditions where they were penalized for guessing than under conditions where they were not. High anxious students in the penalty condition skipped more items than low anxious students did, and when given the chance to do these items later, got many of them correct, indicating that they skipped questions that would have contributed positively to their scores. As Phillips et al. (1980) note, instructions about such things as guessing "are a source of information about the testing environment" (p. 333) and such information may differentially affect test taking strategies and hence performance in high versus low test anxious students, affecting test validity.

Classroom Structure

Another classroom environmental factor that has been related to test anxiety is that of classroom structure. Morrison (1979) observed the social climate of fourth, fifth, and sixth grade classrooms and found that highly structured classrooms had the most work involvement, and that test anxiety levels were higher in classrooms where teachers had relatively less control over their students. Schonwetter, Struthers, and Perry (1995) found that, among college students, high structured classrooms increased the motivation of high test anxious students to return to class. Helmke (1988) found that low structure classrooms increased the negative effects of test anxiety on performance for high test anxious students. Stanton (as

cited in Phillips et al., 1980) found "considerably lower [test anxiety] scores among children in conventional classrooms than in open classrooms ... as a result of the greater noise level, more unstructured nature, and the lack of individual attention in open classrooms" (p.334). In general, then, it appears that a more structured, conventional classroom is beneficial in reducing test anxiety in students, perhaps because of the "familiarity, and thereby anxiety reducing quality, of conventional classrooms" (Phillips et al.).

Effect of Support Systems on Test Anxiety Levels

Goldsmith and Albrecht (1993) studied the effects of supportive communication networks on test anxiety and performance in college undergraduates. Goldsmith and Albrecht looked at the factors of both peer (other students in the same class) support and outside (family, romantic partners, friends not in the class) support in terms of 1) how many supports (people) students had, and 2) how much they used these supports. Goldsmith and Albrecht found that the majority of students found outside support to be more helpful than peer support, and turned to these sources more often than they turned to peers. High anxiety students received outside support significantly more frequently than low anxiety students, and they also perceived this support to be significantly more important in coping with their anxiety than low anxiety students did. For high anxiety students, outside (non-peer) support was related to higher exam grades, while peer support was related to lower exam grades. For low anxiety students, exactly the reverse was true. Goldsmith and Albrecht speculate that peer support may be detrimental to high anxiety students because interaction with peers may provide occasion for social comparison and fuel increased anxiety in these students. This idea is consistent with much of the research already reviewed. Outside sources of support, who know and care about the student but who cannot be perceived as competitors, appear to be better sources of support for high anxiety students. High anxiety students appear to be quite aware of this situation, in that, as noted, they use outside support much more frequently than low anxiety students do.

In summary, it appears that supportive communication networks are perceived by students as important and can be helpful in reducing test anxiety.

Conclusion - Environmental Factors

In conclusion, it is apparent that there are many factors involved in the testing environment that effect student test anxiety levels and contribute to performance differences between high and low test

anxious students. Many of the investigations of environmental factors contributing to test anxiety have focused on isolated aspects of the testing situation; investigations focusing more generally on overarching factors that might begin to integrate the myriad of individual environmental factors covered in this review have been lacking. From the content of this review, however, some general themes do emerge. Factors which in any way contribute to the perception on the part of students that the environment is competitive (hence involving social comparison) or in some way threatening (including the nature of the curriculum, and penalties that are levied for guessing) appear to exacerbate anxiety; factors that contribute to student confusion relative to exam content, or details of administration (including an unstructured environment, and poorly constructed tests) appear to exacerbate anxiety; and factors that heighten exam importance (such as tests which contribute to a large percentage of students' final grades) appear to exacerbate anxiety. Many of these factors appear to "pressurize" the exam situation indirectly, and some additional factors, such as timed tests, and "surprise" tests, do so directly. In contrast, factors that increase student control over testing (such as choice of test questions or testing conditions - e.g. SAT vs. CAT) and their ability to prepare adequately for tests (such as take home tests, and open note tests) appear to mitigate anxiety.

Overview of Reviewed Research and Statement of the Current Research Problem, Questions, and Hypotheses

The previous literature review suggests that while much serious study has been devoted to the phenomenon of test anxiety, many important questions remain unanswered, or with only partial answers. The purpose of this concluding section of the review is to assess the implications of the literature reviewed, and to clarify the research questions to which they lead.

One of the major hypotheses investigated in the literature review was that individual differences in students' learning histories, and academic areas of competency and weakness contribute to differences in the nature and amount of test anxiety they experience. The literature reviewed pertaining to this assertion appears in general to validate it. Zohar's (in press) additive model is based on this idea and his supporting research validates it; many of the studies reviewed suggest that individual differences in ability (Hembree, 1988; Entwistle and Greenberger, 1970), in academic history (Bronzaft et al., 1974; Sapp, 1993), and in self perception (Comunain, 1989; Hembree, 1988) are related to differences in test anxiety levels. All of

these studies (excepting the meta-analyses), however, deal only with particular age groups, mostly at the elementary and secondary levels, and reach conclusions based on limited samples. Replication and extension of these studies is needed, particularly at the postsecondary level. It is important to note, for example, that test anxiety differences between students with and without learning disabilities have only been investigated in one published study (Bryan et al., 1983), and the participants in this study were elementary and middle school students . This example, however, is indicative of the nature of the situation. More, and more detailed, studies are needed to provide a convergence of evidence regarding the relative levels of test anxiety of particular groups, and to allow more definite conclusions regarding such groups to be drawn.

Another related question that does not really appear to have been researched at all is that of differences in the *nature* of test anxiety between different groups of students. Do different groups of students, or do individual students with different academic and personal histories find very different things about the testing situation anxiety producing? Is the nature of the anxiety itself different (e.g., primarily worry oriented vs. primarily physiologically oriented) between such different students? Such information may ultimately help us to understand and thus better serve such students, but this area has not yet been investigated.

A second hypothesis implicit in this review was that specific factors in the learning environment, particularly the way assessments are structured and conducted, contribute significantly to students' test anxiety. In general the research reviewed confirms that this is in fact the case; again, however, this conclusion must be drawn on the basis of a limited number of studies of uneven quality. In general, there have been few studies that really carefully investigated the effects of specific environmental manipulations in terms of how testing is conducted (e.g., final grade divided between a greater number of tests, open note tests, etc.) for their effects on anxiety. There have also been few studies that elicited student opinion about the specific testing procedures/arrangements that they found anxiety producing or reducing. Specific environmental factors discussed for which further study is particularly indicated include the following: 1) The level of importance of the exam. Cross cultural studies finding higher test anxiety in countries where national exams serve a gatekeeping function for higher education (El-Zahar and Hocevar, 1991; Guida and

Ludlow, 1989) point to this as an important factor effecting test anxiety, as do the findings that finals are viewed as more anxiety producing than any other type of exam (Zoller and Ben-Chaim, 1988), but little research directed specifically at this phenomenon has been done. 2) The effects of increasing student control over the testing environment. The work on computer and self adapted testing (Wise et al., 1993) suggests that this is an important way to decrease test anxiety. Further investigation of the effects of increased student control over testing, and how it can best be implemented, is indicated. 3) The effects of untimed testing on test anxiety levels. Students report time pressure as a major contributor to test anxiety (Friend, 1982; Madsen and Murray, 1984), but little research has been done on untimed testing as an intervention for the test anxious. 4) The effects of providing a support system for students to help them deal with their anxiety issues. Goldsmith and Albrecht's 1993 study suggests that support systems are helpful to the test anxious student, however this was informal support. The effects of formal support as a part of the students' environment (as opposed to as a prescribed intervention) have not yet been investigated.

Finally, it is important to note that one of the main contentions of this author is that test anxiety is problematic for students both in terms of how it effects performance as well as in terms of its function as an unpleasant affective experience that may have important consequences for later academic decisions and behavior. Given this belief, one of the major and generalized problems with much of the research concerning test anxiety is that it tends to focus exclusively on the performance aspect of test anxiety and to ignore its emotional effects. The affective experience of test anxiety is important in its own right, and may have other important long-term effects. For example, it is possible that some individuals may find the experience of test anxiety so unpleasant that they may avoid situations where they will have to deal with it (e.g., test oriented subjects like the sciences and mathematics). This effect is suggested by the findings of Strom et al. (1987) that high levels of test anxiety correlate negatively with measures of preference for course difficulty. Hence, even though anxiety may not affect performance directly in some cases, it may affect academic choices, and may affect progress in other ways as yet undiscovered. This possibility has yet to be investigated.

Statement of the Problem

The primary intent of this study was to investigate differences in beliefs about, reactions to, and perceived control over testing at the postsecondary level between students with and without learning disabilities. Additionally, the effect of testing accommodations and support services provided specifically to students with learning disabilities on their beliefs about, reactions to, and perceived control over testing was also investigated. This study was designed to address some of the most salient questions posed by the above review of the literature. Its goals were the following: 1) To more definitively resolve the question of whether students with learning disabilities experience higher levels of test anxiety than their non learning disabled peers. 2) To investigate the effects of a history of academic difficulties on the test anxiety levels of students at the postsecondary level, using students with learning disabilities as an exemplar of a group generally united by such a common history. 3) To investigate the question of whether or not groups of students with different academic histories find different aspects of the testing environment anxiety producing, and if such different groups experience different manifestations of anxiety. As previously noted, it was hoped that this information would ultimately prove useful in working with different types of students around anxiety issues. 4) To revisit the concept of perceived control, and look at whether or not students who believe they have more control over their test situation in fact experience lower levels of test anxiety than students who do not, as well as the degree to which control over testing is perceived as desirable and helpful by highly anxious students. 5) Related to issues of control over the test situation, this study was designed to assess the usefulness of testing accommodations for alleviating test anxiety in learning disabled students, and thus provide the important beginnings of an answer to the question of whether or not environmental manipulations related to the test situation may be useful as a way of intervening in the problem of test anxiety. 6) A final goal was to investigate the possible long term consequences of the affective effects of test anxiety, such as avoidance of particular areas of study, and to investigate whether or not there were differences in such consequences between students with and without learning disabilities.

Specific Research Questions and Corresponding Hypotheses

Given the above areas of interest, the following specific research questions were indicated. Each question is followed by the specific directional hypothesis(es) developed to investigate the question in the context of the current study.

1. Are there differences in the level and nature of test anxiety between students with and without learning disabilities at the postsecondary level, and if so, are these differences effected by the use of testing accommodations by students with learning disabilities?

Hypothesis 1: Postsecondary students with learning disabilities will show significantly higher levels of test anxiety than their non learning disabled peers, and the differences in anxiety levels between the two groups will increase significantly in this direction when the effects of the use of testing accommodations by the students with learning disabilities is considered.

Hypothesis 2: Postsecondary students with and without learning disabilities will differ significantly on the dimensions of test anxiety (e.g., worry, tension, bodily symptoms, test irrelevant thoughts) that are most salient for them.

2. Are there differences between postsecondary students with and without learning disabilities in terms of the specific aspects of the testing situation that are found to be anxiety producing?

Hypothesis 3: Postsecondary students with and without learning disabilities will differ significantly in their rating of how anxiety producing they find particular testing conditions or aspects of the testing situation to be; for example, students with learning disabilities may find confusing and disorganized exam administrations more anxiety producing than do their non learning disabled peers.

3. Do postsecondary students with and without learning disabilities differ in the types of modifications to the testing situation that they would find most helpful in reducing anxiety?

Hypothesis 4: Postsecondary students with and without learning disabilities will differ significantly in their ratings of how desirable they would find particular modifications to the testing environment to be; for example, learning disabled students may find choice of test format a more desirable accommodation than their non learning disabled peers.

4. Is the nature of a student's learning disability (e.g., language, auditory processing, visual processing, mathematics) related to the curriculum areas where they find testing to be the most anxiety producing at the postsecondary level?

Hypothesis 5: Differences in postsecondary students with learning disabilities' anxiety levels for testing in different subject areas will be related to the specific nature of their learning disability; for example, students with language disabilities will be more anxious about testing in foreign language classes.

5. What is the relationship between testing accommodations, perceived control, and test anxiety?

Hypothesis 6: Higher levels of perceived control over testing and grading will correlate negatively with test anxiety at the postsecondary level.

Hypothesis 7: The degree to which postsecondary students with learning disabilities utilize test accommodations/support services will correlate positively with the level of control they perceive they have over testing,

Hypothesis 8: The degree to which postsecondary students with leaning disabilities utilize testing accommodations/support services will correlate negatively with test anxiety.

6. Are high levels of test anxiety differentially associated with the avoidance of particular classes or fields of study known to be testing intensive between postsecondary students with and without learning disabilities?

Hypothesis 9: High levels of test anxiety will be correlated significantly with reported avoidance of testing intensive classes or major areas at the postsecondary level. This relationship will be significantly more powerful for students with learning disabilities than for their non learning disabled peers.

Hypothesis 10: There will be a significant relationship between test anxiety level and academic major choice at the postsecondary level, with higher levels of test anxiety associated with non testing intensive majors (e.g., humanities) and lower levels of test anxiety associated with testing intensive majors (e.g., mathematics and physical/biological sciences). This relationship will be significantly more powerful for students with learning disabilities than for their non learning disabled peers.

All analyses also considered the effects of salient demographs (e.g., gender).

CHAPTER 2

METHODS

Design

The study used a between subjects causal comparative research design where students with and without learning disabilities were compared on a variety of dimensions involving reactions to and beliefs about testing. The sample of students with learning disabilities was further analyzed through a series of correlational and regression analyses to determine the effects of support services on their reactions to and beliefs about testing.

Independent and Dependent Variables

The following independent variables were considered in the study (C = continuous variable, D = discreet variable).

- Academic major (D)
- Age diagnosed as learning disabled (students with learning disabilities only) (D)
- ALOCS total score (C)
- Failures (C)
- GPA (self report) (C)
- Grade Level (D)
- LD status (Y/N) (D)
- Overall general support (students with learning disabilities only, others scored 0) (C)
- Overall testing support (students with learning disabilities only, others scored 0) (C)
- Overall use of support services (students with learning disabilities only, others scored 0) (C)
- PCOT factor 1: "Actions Taken" (C)
- PCOT factor 2: "Persuasion Beliefs" (C)
- PCOT factor 3: "General LOC" (C)
- RTA total score (C)
- Sex (D)

- Study skills deficit (Y/N, students with learning disabilities only) (D)
- Type of learning disability (D)
- Withdrawals (C)

The following dependent variables were considered in the study:

- ALOCS total score (C)
- Failures (C)
- GPA (self report) (C)
- PCOT factor 1: "Actions Taken" (C)
- RTA total score (C)
    - RTA factor 1: "Worry"
    - RTA factor 2: "Tension"
    - RTA factor 3: "Test Irrelevant Thinking"
    - RTA factor 4: "Bodily Symptoms"
- Subject area anxiety ratings
- TAM factor 1: "Admissions Test Avoidance"
- TAM factor 2: "Class Avoidance"
- TAM total score
- TMRS ratings
- TSRS ratings
- Withdrawals

Participants

180 undergraduate and 2 graduate students at the University of Massachusetts, Amherst participated in the study. 90 of these individuals (41 males, 49 females) were students with learning disabilities, as defined by their receiving services from the office of Learning Disabilities Support Services (LDSS) at the University. The "Admissions and Eligibility" subsection of the LDSS "Policies and Procedures" pamphlet specifies: "To be eligible [to receive services], all students must provide one or more of the following types of documentation:

- An individualized educational plan *which indicates the existence of a learning disability* from elementary or secondary school
- A report from a state certified assessment center *which indicates a learning disability*
- Psychoeducational test results to be interpreted in our [LDSS] office.

...Also, students whose predominant disability is a form of Attention Deficit/Hyperactivity Disorder do not receive services through LDSS.." ("Policies and Procedures, 1997).

67 of the 92 non learning disabled students (17 males and 50 females) constituting the other half of the total sample were taken from a large undergraduate psychology class (Psychology of Women) which could be used to fulfill a necessary graduation requirement at the university. In addition, because this initial sample was primarily female, 25 additional male subjects were taken from an introductory level undergraduate chemistry laboratory, which also could be used to fulfill a necessary graduation requirement at the university.

Demographic data for each group, as well as for the total sample, is provided in tables 1, 2, 3, and 4. Additional relevant data on the students with learning disabilities is provided in table 5.

Table 1. Sample demographic data - categorical - as a function of LD status.

	Non LD		LD		Total Sample	
	n	%	n	%	N	%
Gender						
Males	42	45.7	41	45.6	83	45.6
Females	50	54.3	49	54.4	99	54.4
Grade Level						
Freshmen	15	16.3	16	17.8	31	17.0
Sophomores	19	20.7	24	26.7	43	23.6
Juniors	21	22.8	27	30.0	48	26.4
Seniors	36	39.1	22	24.4	58	31.9
Graduate	1	1.1	1	1.1	2	1.1
Major						
Mathematics	13	14.1	6	6.7	19	10.4
Hard Sciences	28	30.4	13	14.4	41	22.5
Social Sciences	36	39.1	54	60.0	90	49.5
Humanities	15	16.3	11	12.2	26	14.3
Other	0	0	6	6.7	6	3.3

Table 2. Sample demographic data - categorical - as a function of sex.

	Males		Females	
	n	%	n	%
Grade Level				
Freshmen	22	26.5	9	9.1
Sophomores	26	31.3	17	17.2
Juniors	18	21.7	30	30.3
Seniors	16	19.3	42	42.4
Graduate	1	1.2	1	1.0
Major				
Mathematics	17	20.5	2	2.0
Hard Sciences	19	22.9	22	22.2
Social Sciences	31	37.3	59	59.6
Humanities	11	13.3	15	15.2
Other	5	6.0	1	1.0

Table 3. Sample demographic data - means - as a function of LD status

	Non LD			LD			Total sample		
	Mean	SD	n	Mean	SD	n	Mean	SD	n
Age	20.53	1.69	92	20.70	2.62	90	20.62	2.19	182
Cum GPA	3.05	0.61	92	2.72	0.62	90	2.89	0.64	182
Failures	0.51	1.11	92	0.84	1.25	90	0.68	1.19	182
W/drawls	0.50	0.87	92	0.94	1.28	90	0.72	1.11	182

Table 4. Sample demographic information - means - as a function of sex.

	Males			Females		
	Mean	SD	n	Mean	SD	n
Age	20.40	2.21	83	20.80	2.17	99
Cum GPA	2.80	0.70	83	2.96	0.57	99
Failures	0.71	1.14	83	0.65	1.24	99
W/drawls	0.58	1.12	83	0.84	1.09	99

Table 5. Additional demographic data for students with learning disabilities for the total LD sample, and as a function of sex.

	Students with Learning disabilities					
	Males		Females		Total sample	
	N	%	n	%	n	%
Age diagnosed with LD						
Elementary School	18	43.9	25	51.0	43	47.8
Middle School	10	24.4	4	8.2	14	15.6
Secondary School	7	17.1	7	14.3	14	15.6
College or later	6	14.6	13	26.5	19	21.1

Continued next page

Table 5, continued.

Number of semesters at LDSS						
0	3	7.3	1	2.0	4	4.4
1	14	34.1	11	22.4	25	27.8
2	1	2.4	9	18.4	10	11.1
3	12	29.3	10	20.4	22	24.4
4	2	4.9	3	6.1	5	5.6
5	4	9.8	11	22.4	15	16.7
6	1	2.4	0	0	1	1.1
7 or more	4	9.8	4	8.2	8	8.9
Nature of learning disability						
Primarily language/verbal	22	53.7	30	61.2	52	57.8
Primarily math/visual	12	29.3	10	20.4	22	24.4
Primarily cognitive (attention, memory, organization)	1	2.4	1	2.0	2	2.2
Combination (language/math)	6	14.6	8	16.3	14	15.6
Double classification						
yes	10	24.4	11	22.4	21	23.3
no	31	75.6	38	77.6	69	76.7
Study skills need noted						
yes	11	26.8	11	22.4	22	24.4
no	30	73.2	38	77.6	68	75.6

Notes: 1) Because data was collected at the middle of the spring semester, and only full semesters at LDSS were taken into consideration, some students who had just matriculated at the beginning of spring semester were labeled as having "0" semesters at LDSS. This also explains why there is a much higher percentage of students in the odd semester brackets, as most students started at LDSS in a fall semester, and so when their number of full semesters was counted in the middle of Spring semester, an odd number resulted. 2) "Double classification" refers to students who were classified as having both a verbal or nonverbal or combination disability *as well as* a problem with memory, attention, or organization.

Subjects in both samples were recruited on a voluntary basis. For the non learning disabled sample this took place during a regular class meeting; the sample of students with leaning disabilities was

taken at the LDSS office, with students' case managers eliciting their voluntary participation during scheduled appointment times.

Instruments

Test Anxiety

The test anxiety construct was measured using the Revised Test Anxiety Scale (RTA, Benson et al., 1994), a self report measure of test anxiety as a four component construct. The RTA is a 20 item, four point Likert rating scale (1 = almost never to 4 = almost always). It yields four factorially derived subtest scores: Worry, Tension, Test Irrelevant Thinking, and Bodily Symptoms.

Benson et al. (1994) Report an overall scale reliability of .89 for the RTA. The subscale reliabilities are: Worry, .71; Tension, .84; Test Irrelevant Thinking, .74; and Bodily Symptoms, .78. Three cross validation studies were done on the RTA by Benson et al. on American, Egyptian, and randomly mixed samples. The results of these multinational factor analyses and cross validation procedures indicated that the RTA is a stable and precise measure of both the general construct of test anxiety as well as of the four component dimensions. The complete RTA is reproduced in Appendix A1 (p.131).

Perceived Control

Two instruments were used to measure students' perceived control over testing. The first of these was the Academic Locus of Control Scale (Trice, 1985), a 28 item, true false format self report measure of beliefs in personal control over academic outcomes, with higher scores indicating a more external locus of control. Trice reported test-retest reliability coefficients of ALOCS scores for undergraduate Psychology students of .92, and KR-20 internal consistency of .70. The ALOCS correlated significantly with the Rotter (1966) I-E scale (.50) and with the Smith (1973) Achievement Motivation Checklist (-.31). Significant correlations were also demonstrated between ALOCS scores and amount of extra credit students in the validation sample earned (-.38), final exam grades (-.32), and attendance (-.30) (negative correlations suggest that high levels of personal control result in better attendance and more work done). These findings suggest the scale has acceptable construct and some limited predictive validity. The complete ALOCS is reproduced in Appendix A2 (p.133).

The second measure of perceived control over testing was a scale developed by the author to measure more specifically students' perceptions of control over testing and grading. Perceived Control Over Testing (PCOT) is a 17 item, five point Likert scale (1 = never to 5 = always). In developing this scale, 30 items were written by the author, consistent with the locus of control concept, which covered a variety of aspects of the testing/grading situation. The scale items were reviewed for construct validity and revised by four graduate students in school psychology, two faculty members (Psychology and Education), and four undergraduate students. Items were deleted and rewritten on the basis of this input, resulting in the final scale of 17 items. The coefficient alpha reliability for the total scale was .81 for the total sample (LD and non LD). For the total sample, PCOT total score showed significant correlations with the ALOCS (-.30), and with students use of testing support (.41) and general support services (.35). These correlations indicate that while the construct measured by PCOT total score is, as expected, related to academic locus of control, it is also unique, and more closely allied with specific beliefs and behaviors surrounding testing/grading, as it was intended to be.

Factor analysis of the PCOT revealed a 3 factor structure. Factor 1 accounted for 26.9% of the variance in student scores and consisted of items 1, 2, 12, 15, and 16. These items all relate to actions students actually take to get needs met in testing/grading situations (e.g., "I ask for extra time to complete assignments when I need it"), and hence PCOT factor 1 was labeled "Actions Taken." PCOT factor 1 had a coefficient alpha reliability of .81 for the total sample (LD and non LD). For the total sample, PCOT factor 1 showed significant correlations with the ALOCS total score (-.16), the RTA total score (.25), and with students use of testing support (.48) and general support services (.42). These correlations indicate that while the construct measured by PCOT factor 1 is, as expected, slightly related to academic locus of control, it is also unique, and more closely allied with specific beliefs and behaviors surrounding testing/grading, as it was intended to be. It does appear to reflect the amount which students use support services (i.e., "take action").

PCOT factor 2 accounted for 11.4% of the variance in student scores and consisted of items 4, 5, 6, and 10. These items all relate to beliefs students have regarding their ability to convince professors to change something about testing/grading procedures (e.g., "I'm sure I can convince a professor to change a

test grade if I discuss it with him/her"), and hence PCOT factor 2 was labeled "Persuasion Beliefs." PCOT factor 2 had a coefficient alpha reliability of .62 for the total sample (LD and non LD). For the total sample PCOT factor 2 showed significant correlations with the ALOCS (-.19), and with students' use of testing support (.27) and general support services (.23). These correlations indicate that while the construct measured by PCOT factor 2 is, as expected, slightly related to academic locus of control, it is also unique, and more closely allied with specific beliefs and behaviors surrounding testing/grading, as it was intended to be. PCOT factor 2 does appear to have some limited construct validity, as it does reflect students' use of support services where self advocacy and interacting with ("persuading") professors are recommended; however, this factor appears to be of limited value due to its low reliability and fairly low correlations with published measures.

PCOT factor 3 accounted for 8.1% of the variance in student scores and consisted of items 7, 8, 9, 13, and 17. These items are all reflective of more general academic locus of control issues (e.g., "How well I do on tests depends on things I can't control"), and hence PCOT factor 3 was labeled "General LOC." PCOT factor 3 had a coefficient alpha reliability of .61for the total sample (LD and non LD). For the total sample, PCOT factor 3 showed significant correlations with the ALOCS (-.34) and with course withdrawals (-.15). These correlations indicate that PCOT factor 3 has some construct validity as a measure of generalized academic locus of control, though again this factor appears to be of limited value due to its low reliability and fairly low correlations with published measures.

Items 3, 11, and 14 were not included in any of the 3 major factors. The complete PCOT is reproduced in Appendix A3 (p. 135).

Rating of Test Situations

The Test Situations Rating Survey (TSRS) was created by the author and consists of a list of 20 possible features of test situations (e.g., oral presentation, a crowded exam room) which respondents are to rate on a five point Likert scale (1 = not at all, to 5 = very much) as to how much these specific situations increase anxiety about testing/grading. As with the PCOT, a pool of possible items constructed by the author was reviewed, by the same group of faculty, graduate, and undergraduate students, for clarity and completeness in terms of potential situations covered. Items were added, deleted, and rewritten on the

basis of this input, resulting in the final survey of 20 items. The coefficient alpha reliability for the total scale score for the total sample (LD and non LD) for the TSRS was .91. Factor analysis revealed a unidimensional factor structure. The total scale score for the TSRS correlated significantly with both the ALOCS total score (.20) and with the RTA total score (.71), indicating a relatively high level of construct validity as a measure of anxiety for testing situations. The complete TSRS is reproduced in Appendix A4 (p. 137).

Rating of Testing Modifications/Accommodations

The Test Modifications Rating Survey (TMRS) was created by the author and consists of a list of 18 possible modifications that may be made to a "typical" test situation to (theoretically) lessen student anxiety about testing. Each modification presented is to be rated on a five point Likert scale in terms of its anxiety reduction potential (1 = not at all, to 5 = very much). As with the TSRS, a pool of possible items constructed by the author was reviewed, by the same group of faculty, graduate, and undergraduate students, for clarity and completeness in terms of potential modifications/accommodations covered. Items were added, deleted, and rewritten on the basis of this input, resulting in the final survey of 18 items. The coefficient alpha reliability for the total scale score for the total sample (LD and non LD) for the TMRS was .90. Factor analysis of the TMRS revealed a unidimensional factor structure. The total scale score for the TMRS correlated significantly with both the ALOCS total score (.16) and with the RTA total score (.54), indicating that the TMRS had acceptable construct validity as a measure of testing modifications in terms of their anxiety reduction value. The complete TMRS is reproduced in Appendix A5 (p. 139).

Course and Subject Area Avoidance

Participants' tendencies to avoid particular courses or subject areas due to testing requirements was assessed using the Testing Avoidance Measure (TAM) a four item, five point Likert scale (1 = never, to 5 = always, for questions one and two, which deal with avoidance of particular courses or subject areas; 1 = strongly disagree, to 5 = strongly agree, for questions three and four, which deal with the degree to which subjects will avoid graduate school entrance examinations or not) created by the author. The four questions comprising the TAM were appended to the PCOT as items numbered 18-21. As with the PCOT, the TAM items were reviewed for construct validity and revised by the same group of faculty, graduate,

and undergraduate students. Items were deleted and rewritten on the basis of this input, resulting in the final scale of four items. The coefficient alpha reliability for the total scale score for the total sample (LD and non LD) for the TAM was .74. For the total sample, TAM total score showed significant correlations with the ALOCS total score (.28), the RTA total score (.50), and number of courses failed (.17). While these correlations indicate that the TAM total score is related to academic locus of control, test anxiety, and course failures in the manner which would be expected to establish construct validity, their fairly moderate nature indicates that this scale appears to be measuring a unique construct, as intended.

Factor analysis of the TAM revealed a 2 factor structure. Factor 1 accounted for 56.6% of the variance in student scores, and consisted of items 3 and 4 (numbered 20 and 21 as appended to the PCOT). These items both relate to avoidance of graduate school admissions tests (e.g., "Having to take the GRE will stop me from applying to graduate school"), and hence TAM factor 1 was labeled "Admissions Test Avoidance." TAM factor 1 had a coefficient alpha reliability of .82 for the total sample (LD and non LD). TAM factor 1 correlated significantly with the ALOCS total score (.22), the RTA total score (.38), and with students' use of testing support (.21) and general support services (.23). While these correlations indicate that TAM factor 1 is related to academic locus of control, test anxiety, and use of support services in the manner which would be expected to establish construct validity, their fairly moderate nature indicates that this factor appears to be measuring a unique construct, as intended.

TAM factor 2 accounted for 25.3% of the variance in student scores and consisted of items 1 and 2 (numbered 18 and 19 as appended to the PCOT). These items both relate to avoidance of testing intensive classes or subject areas (e.g., "I avoid classes when I know that the course grade is based only on rigorous testing"), and hence TAM factor 2 was labeled "Class Avoidance." Tam factor 2 had a coefficient alpha reliability of .72 for the total sample (LD and non LD). TAM factor 2 correlated significantly with the ALOCS total score (.23), the RTA total score (.45), and with course failures (.17). While these correlations indicate that TAM factor 2 is related to academic locus of control, test anxiety, and course failures in the manner which would be expected to establish construct validity, their fairly moderate nature indicates that this factor appears to be measuring a unique construct, as intended.

As noted above, the four questions comprising the TAM were appended to the PCOT as items numbered 18-21, and are reproduced in their entirety in Appendix A3 (p. 135).

Subject Area Ratings

Participants' beliefs about how anxiety producing testing in particular subject areas is was assessed using the Subject Area Rating Scale (SARS) a six item list of major subject areas (Mathematics, Physical/Biological Sciences, Social Sciences, Humanities, Fine Arts, and Foreign Languages) to be rated on a five point Likert scale (1 = not at all, to 5 = very much) in terms of the amount of test anxiety they engendered in respondents. Original subject area divisions created by the author were reviewed by the same group of faculty, graduate, and undergraduate students to assure that all major subject areas were represented. As this scale was not designed to yield any overall or composite scores (comparisons were made between students with and without learning disabilities, and between males and females, on individual subject areas separately), there were no reliability assessments to be made on it. The six item list of subject areas to be rated was appended to the TSRS, and is reproduced in its entirety in Appendix A4 (p. 137).

Demographs

Demographic characteristics were gathered from the students with and without learning disabilities using the data sheets reproduced in Appendix A6 (p. 141) and A7 (p. 142). The data sheets for the two groups are essentially identical, except for one extra question (age when diagnosed with a learning disability) added to the data sheet for students with learning disabilities. Other information gathered by both sheets includes: name, sex, year in school, current overall GPA, academic major or intended major, number of courses failed, and number of courses withdrawn from due to fear of failure.

In terms of academic major, students were given five general areas to choose from (Mathematics, Physical/Biological Sciences, Social Sciences, Humanities, and "Other"), with some examples of specific majors given for each (e.g., "Social Sciences" includes Business, Economics, Psychology, Consumer Studies, etc.). Students who were unsure of how to classify their major could choose the "Other" category, and list their specific major, which was classified by the researcher (for example "Classics" was classified as "Humanities") using the alphabetical list of possible majors and the categories they fall into reproduced

in Appendix C (p. 146). If a major did not clearly fit any of the more specific categories (e.g., "Landscape contracting" and related majors in the School of Agriculture) it was placed in the "Other" category.

Students with Learning Disabilities Support Data

Data on students with learning disabilities' diagnoses, use of support services, and use of testing/grading accommodations was gathered from students' case folders at LDSS using the data worksheet reproduced in Appendix A8 (p. 143). This worksheet was designed to yield 3 scores: 1) use of general support services (e.g., case management, counseling, tutoring); 2) use of testing accommodations (e.g., proctored tests, untimed tests); and 3) total use of services (this is simply a combined score for measures 1 and 2).

To derive the above scores, the following pieces of data were collected for each LDSS student participating in the survey, from their LDSS file:

1. Number of semesters at LDSS. Student survey data was collected for the study during the first 6 weeks of the Spring semester, 1998. LDSS data from this semester was not included in the study, as the semester was only half completed when the LDSS data was collected. Only full semesters of attendance at LDSS were included in the study. Thus, in a few cases (i.e. students who had just matriculated in January 1998), no scores for any of the LDSS data categories are registered, though they are students with learning disabilities.
2. Average number of office contacts per semester. Each time a case manager at LDSS has an appointment with or talks on the phone with a student, or talks on the phone with a professor, staff member, parent, etc. about a student, a "contact sheet" is filled out and placed in the student's file. The total count of contact sheets in each student's file was divided by the number of semesters the student had been receiving services at LDSS.
3. Average number of tutor visits per semester. A record is kept (i.e., an "end of semester tutor report" is placed in the student's LDSS file at the close of each semester during which a student received tutoring) of the number of semesters a student receives tutoring. For the purposes of this study, it was determined, through discussion with the tutor office, that the average student receiving tutoring attends approximately 10 tutoring sessions per semester.

Given this, each semester a student attended tutoring was counted as 10 visits. To arrive at the average number of tutor visits, then, the number of semesters a student had tutoring was multiplied by 10, and then divided by the total number of semesters the student had been receiving services at LDSS.

4. Number of academic memos. When a student is in danger of being suspended from the university for academic reasons, a memo is sent by the student's case manager at LDSS to the student's academic dean to explain the student's situation and request reinstatement if this is appropriate. A record of this memo is kept in the student's file. The total number of these memos was counted for each student.

5. Special letters. Occasionally, students' case managers write special letters for students to request more involved accommodations from the university administration (e.g., special housing requests, requests to withdraw late from a class without penalty). A copy of each of these letters is kept in the student's file. The total number of these letters was counted for each student. Because such letters are infrequent, and represent an involved accommodation, no average was computed for this measure. This resulted in such letters having a larger impact on the student's support score. This is appropriate, as such letters represent quite an involved process, and (usually) a good deal of student initiative.

6. Average number of tests proctored per semester. Each time an LDSS student has a test proctored specially by LDSS, a "proctor form" must be filled out; these are ultimately placed in the student's file. The total count of proctor forms in the student's file was divided by the number of semesters the student had been receiving services at LDSS.

7. Average number of accommodation sheets per semester. For every class in which a student requests testing accommodations a request sheet is sent to the student's professor with a carbon copy remaining in the student's file. The total count of accommodations request sheets in the student's file was divided by the number of semesters the student had been receiving services at LDSS.

8. Special or alternative tests requested per semester. On the accommodation request sheet sent by LDSS to professors (a copy of which is kept in the student's file, as noted above) one possible request is for an alternate type of test (e.g., essay instead of multiple choice). The number of times this modification (or any other specific testing modification, such as a reader for the test) was requested was summed, and the result divided by the number of semesters the student had been receiving services at LDSS.

To derive the general support, testing support, and overall use of services scores, the above data were combined for each student in the following manner:

The general support score was the sum of average contact sheets per semester, average number of tutor visits per semester, total number of special letters, and total number of academic memos. The testing support score was the sum of average number of tests proctored per semester, average number of accommodation sheets per semester, and average number of special or alternative tests per semester. The overall use of services score, as noted previously, was simply the sum of the general support and testing support scores.

In addition to the above scores, the students' diagnostic data were reviewed and on the basis of this the student was placed into one of four categories of learing disability:

1. Primarily verbal/auditory/writing/language.
2. Primarily non-verbal/visual/math.
3. Primarily cognitive: memory/attention/organization.
4. Combination verbal/non-verbal.

A student could receive a "double classification" if in addition to having a verbal, nonverbal, or combination learning disability, they were also noted to have memory, attentional, or organizational issues.

Finally, it was also noted on the LDSS data collection sheet if the student was noted in his/her documentation as having a study skills problem or was recommended for a study skills improvement course.

Procedure

Students in both the learning disabled and non learning disabled groups completed the survey/scale packets during the first half of the spring semester, 1998.

The students composing the non-learning disabled group were taken from two separate undergraduate classes: Psychology of Women, and Introductory Chemistry Laboratory. Both of these classes fulfill a necessary graduation requirement at the university. In Psychology of Women, the researcher came to class and gave a brief presentation on gender differences in anxiety, and then explained the current research project and requested students' voluntary participation. Students were also informed that if they chose to participate they would receive one additional point added to their final grade in the course. Students wishing to participate were then asked to read and sign an informed consent form, a copy of which is reproduced in Appendix B1 (p. 144). Crucial aspects of the consent form were then verbally reinforced, such as the voluntary nature of participation, the fact that names would not be used, and the fact that students could review the results of the study when it was completed if they so desired. It was explained that the informed consent form containing their signature would be removed from their survey packet as they turned this in, thus completely guaranteeing their anonymity. An overhead transparency was projected providing the researcher's name, phone number, and office address so that these could be copied down if students wished to contact the researcher at a later date regarding study results or regarding any questions or concerns they might have had about their participation. Students were given approximately 20 minutes to complete the packet, which they left with the researcher on their way out of the classroom. Students needing more time were instructed to leave the packet with their professor the next time they returned to class, or to bring the completed packet to the collection box at the LDSS offices at their convenience; however, all of the students completed the packet within the allotted class time.

117 students in Psychology of Women completed the survey packets; however, the sample obtained consisted of 100 females and 17 males. To obtain a more gender balanced sample, student participation was again elicited in another class, Introduction to Chemistry Laboratory. In this class the researcher briefly presented on the nature of the study, the survey, and the essential elements of the informed consent form at the beginning of the laboratory period. As no grade related incentive was

possible in this class, students were told they would be given one dollar for their effort when they turned in the completed survey. Only the males in the class were specifically asked to participate in the survey; however, females were told that they could also participate if they chose, and so earn the 1 dollar incentive. Students completed the survey packets after finishing their class assignment, and turned them in to their class teaching assistant, who gave each participating student a dollar, and later returned the completed surveys to the researcher. 25 males and 1 female from Introduction to Chemistry Laboratory participated in the survey.

To develop a fairly gender balanced non learning disabled sample from the 143 collected surveys, all 42 male responses were used, and of the 100 available female responses, 50 were chosen randomly to make up the remainder of the actual sample used in the study. This resulted in a non-learning disabled sample of 92 (42 males, 50 females).

The students with learning disabilities participating in the study were given the survey/scale packets on an individual basis when they came in to LDSS for a scheduled visit with their case manager. Individual case managers elicited students' voluntary participation in the study using the following script:

> One of the case managers here is doing a study on student beliefs about and reactions to testing in students with and without learning disabilities here at UMASS. Participation is completely voluntary, and filling out the surveys in the packet should take about 15 to 20 minutes of your time. Would you be interested in participating?

If the student was willing to participate, the case manager reviewed the informed consent form, again highlighting the voluntary nature of participation, the fact that names would not be used, and the fact that students could review the results of the study when it was completed if they so desired. It was explained that they were being requested to put their names on the packet for tracking purposes, so that their surveys could be matched with the information in their LDSS file, so that in the event that they decided withdraw from participation in the study at a later date it would be possible to identify their survey, or so that in the unlikely event that clarification of one of their responses was needed, this could be obtained. The case manager then obtained the student's signature and telephone number. A copy of the informed consent form for students with learning disabilities is reproduced in Appendix B2 (p. 145). Students were given

the option of completing the packet at LDSS in their case manager's office or in the waiting area, or of completing the packet at home and bringing it back to LDSS at the time of their next appointment. If students chose to take the packet home with them, the consent form was removed and given to the researcher so that he could contact students who had not returned surveys later, if this became necessary, to increase response rate. A box was provided in the reception area at the LDSS office to collect the completed packets from the students.

After the first two weeks of data collection it became apparent that many of the LDSS students were taking the surveys home to fill out and not returning them. to increase response rate, a raffle was instituted, where all LDSS students who handed in a completed survey had their name entered in a drawing, to take place at the end of the semester, for a 25.00 gift certificate to a local restaurant and 2 movie passes. This increased response rate appreciably, and the final sample of students with learning disabilities consisted of 90 students (41 males and 49 females).

Once the surveys were collected and the process of scoring them and compiling the results began, the researcher found that occasionally, though they had been specifically instructed not to do so, students had skipped questions, put N/A as an answer, or answered a question ambiguously (e.g., put "T/F" as their answer for a true-false question). As a single missing or ambiguous response in general meant that a whole scale score was lost, and as such missing or ambiguous responses were a fairly infrequent occurrence, consistent rules were developed to fill in missing responses, deal with ambiguous responses, and so complete any missing data. These rules were as follows:

1. For N/A responses or skipped questions the middle score of the scale was used ("3" on a scale of 1-5; "2" on a scale of 0-4; and "2" on the RTA, which goes from 1-4).
2. For true-false questions, the response "T/F" was scored as "true."

It is important to make clear that these rules were used to deal only with cases of an occasional missing or ambiguous response. If students left whole sections of the survey blank, these were not scored; if students did not answer or ambiguously answered more than 1/10 of the questions on any given scale, this scale was not scored for this student.

Missing demographic information was left blank unless a student could be contacted after the fact (only students with learning disabilities were in this position); however, missing demographic data was very rare, so this was not really an issue.

When entering the data into the statistical database, all of the variables that applied to students with learning disabilities only (e.g., number of LDSS contact sheets, total use of support services score, etc.) were coded as 0's (as opposed to missing values) for the non learning disabled students, so full sample analyses could still be run taking these variables into account if desired.

CHAPTER 3

RESULTS

Results are reported for each hypothesis separately. An alpha level of .05 was used for all statistical tests; however, p values less than .01 and .001 are noted, and p values between .10 and .05 were considered marginally significant, and are mentioned as such.

General Academic Success

Initially, although not directly in response to the actual research questions of the study, students with and without learning disabilities and male and female students were compared on a number of continuous demographic variables of relevance to the theoretical base of the main hypotheses of the study. The idea was to answer for *this sample* of students if the students with LD actually were an exemplar of a group who had a troubled academic history relative to the "average" student ("average" students being represented by the non-LD sample in this case). In the course of these comparisons, it was found that students with learning disabilities had experienced significantly less academic success than their non learning disabled peers. This can be seen in Table 6, where the means and standard deviations, as well as the F values for, and effect sizes of, comparisons between students with and without learning disabilities in terms of cumulative GPA's, course failures, and course withdrawals are presented. For the sample used in this study, students with learning disabilities, compared to their non learning disabled peers, had significantly lower GPA's, $F(1, 180) = 13.60$, $p < .001$); significantly more withdrawals from class due to fear of failure, $F(1, 180) = 7.57$, $p < .01$; and had also failed more classes (this difference was only marginally significant, $F(1, 180) = 3.60$, $p < .10$).

Table 6. Continuous demographic information - comparison of means as function of LD status.

	Non LD			LD			Comparison	
	Mean	SD	n	Mean	SD	n	f	ETA sq.
Age	20.53	1.69	92	20.70	2.62	90	0.26	0.001
Cum GPA	3.05	0.61	92	2.72	0.62	90	13.60***	0.070
Failures	0.51	1.11	92	0.84	1.25	90	3.60(M)	0.020
W/drawls	0.50	0.87	92	0.94	1.28	90	7.57**	0.040

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

As it was hypothesized that use of support services by students with LD might mitigate some of the differences between students with and without LD on measures of academic success, a second analysis was performed comparing the GPA's (the best overall indicator of success) of students with and without LD, and using students' "use of testing support services" score as a covariate (recall that all students without learning disabilities received 0's for these use of services scores, while students' with LD scores on these variables were computed from their LDSS files). It was found that controlling for the use of testing support services increased the significance of the difference in mean GPA between students with and without LD, indicating that absent the presence of support services, the academic performance of students with LD would be even more discrepant from that of their non-LD peers. Analysis of Covariance (ANCOVA) results for GPA as a function on LD status and use of testing support are presented in Table 7.

Table 7. ANCOVA results for GPA.

Source	df	Mean Square	F	ETA sq.
LD Status	1	6.16	16.50***	.084
Covariate (total test suppt.)	1	1.75	4.69*	.026
Within Group Error	179	.37		
Model	2	3.47	9.28***	.094

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

There were no significant differences between males an females on any of these measures, as shown in Table 8, where the means, standard deviations, F values, and effect size comparisons for these measures are shown as a function of gender.

Table 8. Continuous demographic information - comparison of means as a function of sex.

	Males			Females			Comparison	
	Mean	SD	n	Mean	SD	n	f	ETA sq.
Age	20.40	2.21	83	20.80	2.17	99	1.51	0.008
Cum GPA	2.80	0.70	83	2.96	0.57	99	2.68	0.015
Failures	0.71	1.14	83	0.65	1.24	99	0.13	0.001
W/drawls	0.58	1.12	83	0.84	1.09	99	2.50	0.014

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Hypothesis One

Hypothesis one was that postsecondary students with learning disabilities would show significantly higher levels of test anxiety than their non-learning disabled peers, and that the significance of this difference in anxiety levels between the two groups would increase when the effect of the use of testing accommodations by the students with learning disabilities was considered.

To test this hypothesis initially, a 2x2 analysis of variance (ANOVA) with LD status and sex as the independent variables, and RTA total score as the dependent variable was used. It was found that students with learning disabilities reported significantly higher test anxiety levels than their non-LD peers, $F(3, 178) = 14.12$, $p < .001$, and that females reported significantly higher test anxiety than males, $F(3, 178) = 8.51$, $p < .01$. There was no significant interaction between sex and LD status. Effect size measures for these analyses indicated that LD status accounted for 7.4% of the variance in students' RTA scores, and sex accounted for 4.6% of the variance in students' RTA scores.

One potential problem with the ANOVA performed for hypothesis one was that tests for homogeneity of variance indicated that the variances of the groups compared were significantly different. ANOVA is robust with regard to the assumptions of homogeneity of variance when sample sizes are equal or nearly equal (Cohen & Cohen, 1975; Howell, 1995), as was the case here for the groups of students with

and without LD. However, in the interest of caution, and because the total sample was not as equally balanced between males and females (83 males, 99 females), separate nonparametric Kruskal-Wallis one way ANOVA's were performed on RTA total score for the factors of LD status and sex. Significant differences in RTA scores were again found for both factors, corroborating the findings of the original ANOVA procedures.

Means and standard deviations for students with and without learning disabilities on all scales, including the RTA, are provided in Table 9; means and standard deviations for males and females on all scales, including the RTA, are provided in Table 10. ANOVA results, including effect size measures, are provided in Table 11. Results of the Kruskal-Wallis one way ANOVA's are presented in Table 12.

Table 9. Means and standard deviations for study measures as a function of LD status. "Scale" refers to means that have been converted to the scale used in individual test questions (e.g., on a scale of 1-5, etc.)

	Non LD			LD		
	Mean	SD	n	Mean	SD	n
RTA Total	40.41	9.00	92	46.06	12.23	90
RTA Total (scale 1-4)	2.01	0.45	92	2.30	0.61	90
Worry (scale 1-4)	2.11	0.53	92	2.37	0.74	90
Tension (scale 1-4)	2.68	0.71	92	2.87	0.74	90
Irrelevant Thinking (scale 1-4)	1.74	0.69	92	2.24	0.86	90
Bodily Symptoms (scale 1-4)	1.41	0.49	92	1.71	0.70	90
PCOT Total	31.68	7.84	92	38.88	9.20	90
PCOT Total (scale 0-4)	1.86	0.46	92	2.29	0.54	90
TAM Total	4.99	3.14	92	6.64	3.57	90
TAM Total (scale 0-4)	1.25	0.78	92	1.66	0.89	90
TAM Classes	2.82	1.86	92	3.20	2.24	90
TAM Classes (scale 0-4)	1.41	0.93	92	1.60	1.12	90
TAM Grad School	2.21	1.93	92	3.46	2.06	90
TAM Grad School (scale 0-4)	1.10	0.97	92	1.73	1.03	90
ALOCS Total	12.63	3.66	92	12.31	3.79	89

Table 10. Means and standard deviations for study measures as a function of sex. "Scale" refers to means that have been converted to the scale used in individual test questions (e.g., on a scale of 1-5, etc.)

	Males			Females		
	Mean	SD	n	Mean	SD	n
RTA Total	40.58	10.23	83	45.15	11.40	99
RTA Total (scale)	2.03	0.51	83	2.26	0.57	99
Worry (scale)	2.15	0.60	83	2.31	0.70	99
Tension (scale)	2.55	0.73	83	2.97	0.68	99
Irrelevant Thinking (scale)	1.94	0.75	83	2.04	0.87	99
Bodily Symptoms (scale)	1.43	0.56	83	1.67	0.65	99
PCOT Total	33.86	8.07	83	36.40	10.03	99
PCOT Total (scale)	1.99	0.47	83	2.14	0.59	99
TAM Total	5.42	3.30	83	6.13	3.56	99
TAM Total (scale)	1.36	0.82	83	1.53	0.89	99
TAM Classes	2.65	1.91	83	3.30	2.15	99
TAM Classes (scale)	1.33	0.95	83	1.65	1.07	99
TAM Grad School	2.83	2.02	83	2.82	2.15	99
TAM Grad School (scale)	1.42	1.01	83	1.41	1.08	99
ALOCS Total	12.77	3.73	81	12.23	3.71	99

Table 11. ANOVA results for hypothesis one.

Source	df	Mean Square	F	ETA sq.
Sex	1	942.83	8.51**	.046
LD Status	1	1565.62	14.12***	.074
Sex by LD Status	1	2.51	.02	.000
Within Group Error	178	110.85		
Model	3	845.23	7.62***	.114

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Table 12. Results of Kruskal-Wallis one way ANOVA's for LD status and sex. Dependent variable is RTA total score.

Factor = LD status:

Category	Mean Rank	n of Cases
LD	104.23	90
Non-LD	79.04	92

Chi-Square	DF
10.413**	1

Factor = sex:

Category	Mean Rank	n of Cases
Male	80.25	83
Female	100.93	99

Chi-Square	DF
6.963**	1

(M)= p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

To test the second part of hypothesis one, that statistically controlling for the effect of the use of testing accommodations by students with learning disabilities would increase the significance of the

difference in test anxiety between the two groups, a multiple regression analysis was used, with LD status, sex, use of general support services, and use of testing support services (recall that all students without learning disabilities received 0's for these use of services scores, while students with learning disabilities' scores on these variables were computed from their LDSS file) as independent variables, and RTA total score as the dependent variable. Categorical variables (e.g., LD status and sex), each with *k* groups, were recoded into a series of *k*-1 dummy variables, thus meaningful regression coefficients for these categorical variables as a whole were not available, though their unique contribution to the overall R squared (Rsq), over and above the combined effects of the other variables in the equation, was tested. The overall regression was significant, $F(4, 177) = 6.43$, $p < .001$, with an overall Rsq of .13. The results of the hypothesis tests (significance of Rsq change) for each variable indicated that use of testing support services and use of general support services did not have a significant effect on student's test anxiety scores, with each making a unique contribution of less than 1% of the total Rsq. Regression data is presented in Table 13.

Table 13. Hypothesis one, multiple regression. Dependent variable is RTA total score. Rsq Change gives the amount of Rsq contributed by the variable over and above the effect of the other variables. Categorical variables (each with k groups) were recoded into a series of k-1 dummy variables; thus meaningful regression coefficients for these variables as a whole are not available.

	Regression			Hypothesis tests	
Variable	**B**	**SE B**	**Beta**	**Rsq Change**	**F**
LD Status				.064	12.897***
Sex				.046	9.305**
Use of General Support	-.054	.151	-.040	.001	.126
Use of Testing Support	-.515	.417	-.152	.008	1.528

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Analysis of variance:

Source	**df**	**Mean Square**	**F**	**ETA sq. (R sq.)**
Regression	4	706.231	6.429***	.127
Residual	177	109.843		

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Hypothesis Two

Hypothesis two was that postsecondary students with and without learning disabilities would differ significantly on the dimensions of test anxiety (worry, tension, test irrelevant thoughts, and bodily symptoms) that were most salient for them. To test this hypothesis, a 2 factor (LD status x sex) multivariate analysis of variance (MANOVA) was performed, with the 4 separate RTA factor scores as dependent variables. Significant main effects were found for both LD status, $F(4, 175) = 5.56$, $p < .001$, with an overall multivariate effect size of .11, and sex, $F(4, 175) = 4.72$, $p < .01$, with an overall multivariate effect size of .10. The interaction of LD status x sex was not significant. Means and standard deviations for the 4 RTA factor scores are presented as a function of LD status in Table 9, and as a function of sex in Table 10. MANOVA results for the effects of LD status, sex, and LD status x sex are presented in Table 14.

Table 14. MANOVA results for RTA factor scores as a function of LD status, sex, and LD status x sex.

MANOVA, dependent = RTA factors, effect = LD Status.

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.113	5.560***	4	175
Hotellings	.127	5.560***	4	175
Wilks	.887	5.560***	4	175
Roys	.113			

Overall Multivariate Effect Size = .113

MANOVA, dependent = RTA factors, effect = sex.

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.097	4.716**	4	175
Hotellings	.108	4.716**	4	175
Wilks	.903	4.716**	4	175
Roys	.097			

Overall Multivariate Effect Size = .097

Hypothesis 2 - MANOVA, dependent = RTA factors, effect = LD status x Sex

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.012	.543	4	175
Hotellings	.012	.543	4	175
Wilks	.988	.543	4	175
Roys	.012			

Overall Multivariate Effect Size = .012
(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Separate univariate F tests were performed on each of the RTA factor scores for each independent variable found to have a significant main effect. Results of the univariate F tests for LD status indicated that students with LD had significantly more test irrelevant thinking, bodily symptoms, and worry than their non-LD peers. LD students also showed more tension than their non-LD peers, but this difference

was only marginally significant. Results of the univariate F tests for each of the RTA factor scores as a function of LD status, including effect size measures, are presented in Table 15.

Table 15. Univariate F tests for RTA factor scores as a function of LD status.

Variable	Hypothesis MS	Error MS	F	ETA sq.
Worry (scale)	2.723	.412	6.610*	.036
Tension (scale)	1.664	.492	3.382(M)	.019
Irrelevant Thinking (scale)	11.200	.609	18.377***	.094
Bodily Symptoms (scale)	4.051	.354	11.435**	.060

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Results of the univariate F tests for sex indicated that females had significantly more tension and bodily symptoms than males, but did not differ significantly from males on worry or test irrelevant thinking. Results of the univariate F tests for each of the RTA factor scores as a function of sex, including effect size measures, are presented in Table 16.

Table 16. Univariate F tests for RTA factor scores as a function of sex.

Variable	Hypothesis MS	Error MS	F	ETA sq.
Worry (scale)	1.095	.412	2.659	.015
Tension (scale)	7.717	.492	15.683***	.081
Irrelevant Thinking (scale)	.433	.609	.711	.004
Bodily Symptoms (scale)	2.439	.354	6.884**	.037

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

As with the tests performed for hypothesis one, a potential problem with the MANOVA and univariate F tests performed for hypothesis two was that tests for homogeneity of variance indicated significant differences in the variances of the groups compared for several of the RTA factors. Again, although these differences in variance were relatively small, Kruskal-Wallis one way ANOVA's were performed on each of the RTA factor scores for the factors of LD status and sex. As with hypothesis one,

results of these nonparametric tests mirrored those of the original MANOVA and F tests, corroborating the accuracy of these original tests. Results of the Kruskal-Wallis one way ANOVA's for each of the RTA factor scores as a function of LD status and sex are presented in Tables 17-20.

Table 17. Results of Kruskal-Wallis one way ANOVA's for LD status and sex. Dependent variable is RTA "Worry" scale score.

Factor = LD status:

Category	Mean Rank	n of Cases
LD	100.34	90
Non-LD	82.85	92
Chi-Square	**DF**	
5.048*	1	

Factor = sex:

Category	Mean Rank	n of Cases
Male	85.52	83
Female	96.51	99
Chi-Square	**DF**	
1.978	1	

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 18. Results of Kruskal-Wallis one way ANOVA's for LD status and sex. Dependent variable is RTA "Tension" scale score.

Factor = LD status:

Category	Mean Rank	n of Cases
LD	98.01	90
Non-LD	85.13	92

Chi-Square	DF
2.743(M)	1

Factor = sex:

Category	Mean Rank	n of Cases
Male	75.81	83
Female	104.66	99

Chi-Square	DF
13.653***	1

(M)= $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 19. Results of Kruskal-Wallis one way ANOVA's for LD status and sex. Dependent variable is RTA "Test Irrelevant Thinking" scale score.

Factor = LD status:

Category	Mean Rank	n of Cases
LD	107.24	90
Non-LD	76.10	92
Chi-Square	**DF**	
16.098***	1	

Factor = sex:

Category	Mean Rank	n of Cases
Male	89.51	83
Female	93.17	99
Chi-Square	**DF**	
.221	1	

(M)= $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 20. Results of Kruskal-Wallis one way ANOVA's for LD status and sex. Dependent variable is RTA "Bodily Symptoms" scale score.

Factor = LD status:

Category	Mean Rank	n of Cases
LD	103.49	90
Non-LD	79.77	92
Chi-Square	**DF**	
9.575**	1	

Factor = sex:

Category	Mean Rank	n of Cases
Male	79.56	83
Female	101.51	99
Chi-Square	**DF**	
8.131**	1	

(M)= $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Hypothesis Three

Hypothesis three was that postsecondary students with and without learning disabilities would differ significantly in their rating of how anxiety producing they found particular testing conditions or aspects of the testing situation to be. To test this hypothesis, a 2 factor (LD status x sex) MANOVA was performed with the 20 testing situations rated in the TSRS as dependent variables. Significant main effects were found for both LD status, $F(20, 158) = 3.98$, $p < .001$, with an overall multivariate effect size of .34, and sex, $F(20, 158) = 2.71$, $p < .001$, with an overall multivariate effect size of .26. The interaction of LD status x sex was not significant. Means, standard deviations, and rank ordering from most to least anxiety producing for the 20 TSRS situations are presented as a function of LD status in Table 21, as a function of sex in Table 22, and for the total sample in Table 23. MANOVA results for TSRS situations for the effects of LD status, sex, and LD status x sex are presented in Table 24.

Table 21. TSRS ratings means, standard deviations, and rank order from most to least anxiety producing, presented as a function of LD status.

	Non LD				LD			
	Rank	Mean	SD	n	Rank	Mean	SD	n
1. Pop quiz	4	3.82	1.16	92	5	3.90	1.11	89
2. Timed tests	8	3.14	1.25	92	6	3.87	1.28	89
3. Essay tests	10	2.91	1.25	92	13	2.91	1.23	89
4. Multiple choice tests	14	2.32	1.15	92	16	2.73	1.21	89
5. Short answer tests	11	2.57	1.11	92	14	2.80	1.09	89
6. Oral Presentations	2	3.85	1.32	92	9	3.55	1.50	89
7. Closed book tests	18	2.22	1.07	92	12	2.92	1.36	89
8. Cumulative final	3	3.82	1.19	92	1	4.28	1.02	89
9. Crowded exam room	13	2.41	1.38	92	10	3.53	1.49	89
10. Exam starts late	12	2.43	1.37	92	15	2.75	1.49	89
11. Unclear Questions	6	3.68	1.09	92	3	4.16	1.06	89
12. Outside of class time	16	2.29	1.32	92	20	2.10	1.19	89
13. Counts for 30%+	5	3.68	1.25	92	4	4.07	1.00	89
14. Distractions	9	3.08	1.29	92	7	3.76	1.22	89
15. Lack of review session	15	2.30	1.09	92	11	3.31	1.28	89
16. Bubble answer sheet	20	1.79	1.11	92	17	2.56	1.47	89
17. Computerized admin.	19	2.18	1.25	92	18	2.54	1.42	89
18. Projects/portfolios	17	2.24	1.07	92	19	2.29	1.12	89
19. Two tests on one day	1	3.92	1.04	92	2	4.26	0.97	89
20. Penalties for guessing	7	3.32	1.29	92	8	3.61	1.23	89

Table 22. TSRS ratings means, standard deviations, and rank order from most to least anxiety producing, presented as a function of sex.

	Males				Females			
	Rank	Mean	SD	n	Rank	Mean	SD	n
1. Pop quiz	6	3.43	1.16	82	3	4.21	0.98	99
2. Timed tests	7	3.27	1.32	82	8	3.69	1.29	99
3. Essay tests	9	2.91	1.24	82	12	2.91	1.25	99
4. Multiple choice tests	16	2.26	1.13	82	16	2.74	1.21	99
5. Short answer tests	13	2.50	1.00	82	15	2.83	1.17	99
6. Oral Presentations	4	3.59	1.46	82	7	3.80	1.38	99
7. Closed book tests	17	2.24	1.18	82	14	2.83	1.28	99
8. Cumulative final	2	3.74	1.27	82	1	4.29	0.94	99
9. Crowded exam room	12	2.55	1.47	82	10	3.30	1.51	99
10. Exam starts late	15	2.28	1.36	82	13	2.85	1.45	99
11. Unclear Questions	3	3.62	1.17	82	4	4.16	0.98	99
12. Outside of class time	19	2.09	1.20	82	18	2.29	1.30	99
13. Counts for 30%+	5	3.57	1.24	82	5	4.12	1.00	99
14. Distractions	10	2.90	1.28	82	6	3.84	1.17	99
15. Lack of review session	11	2.59	1.20	82	11	2.98	1.34	99
16. Bubble answer sheet	18	2.10	1.33	82	20	2.23	1.38	99
17. Computerized admin.	20	2.06	1.28	82	17	2.61	1.35	99
18. Projects/portfolios	14	2.29	1.12	82	19	2.24	1.08	99
19. Two tests on one day	1	3.87	1.00	82	2	4.27	1.00	99
20. Penalties for guessing	8	3.24	1.25	82	9	3.64	1.26	99

Table 23. TSRS ratings means, standard deviations, and rank order from most to least anxiety producing (situations are also listed in this rank order) for the total sample.

	Total Sample			
	Rank	Mean	SD	n
Two tests on one day	1	4.09	1.02	181
Cumulative final	2	4.04	1.13	181
Unclear Questions	3	3.92	1.10	181
Counts for 30%+	4	3.87	1.15	181
Pop quiz	5	3.86	1.13	181
Oral Presentations	6	3.70	1.41	181
Timed tests	7	3.50	1.31	181
Penalties for guessing	8	3.46	1.27	181
Distractions	9	3.41	1.30	181
Crowded exam room	10	2.96	1.54	181
Essay tests	11	2.91	1.24	181
Lack of review session	12	2.80	1.29	181
Short answer tests	13	2.68	1.10	181
Exam starts late	14	2.59	1.44	181
Closed book tests	15	2.56	1.27	181
Multiple choice tests	16	2.52	1.20	181
Computerized admin.	17	2.36	1.35	181
Projects/portfolios	18	2.27	1.09	181
Outside of class time	19	2.20	1.26	181
Bubble answer sheet	20	2.17	1.35	181

Table 24. MANOVA results for the 20 TSRS ratings as function of LD status, sex, and LD status x sex.

MANOVA, dependent = TSRS questions, effect = LD Status

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.335	3.977***	20	158
Hotellings	.503	3.977***	20	158
Wilks	.665	3.977***	20	158
Roys	.335			

Overall Multivariate Effect Size = .335

MANOVA, dependent = TSRS questions, effect = Sex

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.256	2.712***	20	158
Hotellings	.343	2.712***	20	158
Wilks	.744	2.712***	20	158
Roys	.256			

Overall Multivariate Effect Size = .256

MANOVA, dependent = TSRS questions, effect = Sex by LD Status

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.081	.701	20	158
Hotellings	.089	.701	20	158
Wilks	.919	.701	20	158
Roys	.081			

Overall Multivariate Effect Size = .081
(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Separate univariate F tests were performed on each of the TSRS ratings for each independent variable found to have a significant main effect. Results of these univariate F tests for LD status indicated that students with LD had significantly more anxiety than their non-LD peers about 11 of the 20 situations on the TSRS. These were (presented in descending order of magnitude of effect size): 1) lack of review

sessions, 2) crowded exam room, 3) timed tests, 4) closed book (no notes can be used) tests, 5) computer scan ("bubble") answer sheets, 6) distractions, 7) cumulative final exams, 8) unclear test questions, 9) tests counting for more that 30% of final course grade, 10) multiple choice tests, and 11) two tests on one day. Marginally significant differences in anxiety levels between the two groups (again, LD students more anxious) were found for 1) tests admistered on computer, and 2) penalties for guessing. Results of the univariate F tests for TSRS ratings as function of LD status, including effect size measures, are presented in Table 25.

Table 25. Univariate F tests for TSRS ratings as a function of LD status.

Variable	Hypothesis MS	Error MS	F	ETA Sq.
1. Pop quiz	.346	1.140	.304	.002
2. Timed tests	24.819	1.566	15.849***	.082
3. Essay tests	.001	1.562	.001	.000
4. Multiple choice tests	7.342	1.350	5.440*	.030
5. Short answer tests	2.065	1.192	1.733	.010
6. Oral Presentations	3.596	1.992	1.805	.010
7. Closed book tests	21.935	1.418	15.465***	.080
8. Cumulative final	10.412	1.155	9.014**	.048
9. Crowded exam room	54.098	1.937	27.928***	.136
10. Exam starts late	4.344	1.993	2.180	.012
11. Unclear Questions	9.590	1.099	8.725**	.047
12. Outside of class time	1.503	1.585	.948	.005
13. Counts for 30%+	6.766	1.218	5.554*	.030
14. Distractions	21.057	1.387	15.178***	.079
15. Lack of review session	43.984	1.381	31.844***	.152
16. Bubble answer sheet	25.936	1.706	15.201***	.079
17. Computerized admin.	5.302	1.732	3.061(M)	.017
18. Projects/portfolios	.112	1.215	.092	.001
19. Two tests on one day	5.130	.983	5.219*	.029
20. Penalties for guessing	4.340	1.558	2.786(M)	.016

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Results of the univariate F tests for each of the TSRS ratings as a function of sex indicated that females had more anxiety than males about 15 of the 20 TSRS situations. These were (presented in descending order of magnitude of effect size): 1) distractions, 2) "pop" or surprise quizzes, 3) a crowded

exam room, 4) unclear test questions, 5) cumulative final exams, 6) tests counting for more than 30% of final course grade, 7) closed book tests, 8) tests administered on a computer, 9) multiple choice tests, 10) two tests on one day, 11) tests starting late, 12) lack of review sessions, 13) timed tests, 14) penalties for guessing, and 15) short answer tests. The results of the univariate F tests for TSRS ratings as a function of sex, including effect size measures, are presented in table 26.

Table 26. Univariate F tests for TSRS ratings as a function of sex.

Variable	Hypothesis MS	Error MS	F	ETA Sq.
1. Pop quiz	27.478	1.140	24.096***	.120
2. Timed tests	7.501	1.566	4.789*	.026
3. Essay tests	.001	1.562	.001	.000
4. Multiple choice tests	10.316	1.350	7.644**	.041
5. Short answer tests	4.871	1.192	4.087*	.023
6. Oral Presentations	2.011	1.992	1.009	.006
7. Closed book tests	15.054	1.418	10.614**	.057
8. Cumulative final	13.166	1.155	11.399**	.061
9. Crowded exam room	25.116	1.937	12.966***	.068
10. Exam starts late	14.377	1.993	7.213**	.039
11. Unclear Questions	12.953	1.099	11.784**	.062
12. Outside of class time	1.919	1.585	1.211	.007
13. Counts for 30%+	13.243	1.218	10.870**	.058
14. Distractions	38.804	1.387	27.971***	.136
15. Lack of review session	6.835	1.381	4.949*	.027
16. Bubble answer sheet	.764	1.706	.448	.003
17. Computerized admin.	13.262	1.732	7.658**	.041
18. Projects/portfolios	.112	1.215	.092	.001
19. Two tests on one day	7.290	.983	7.418**	.040
20. Penalties for guessing	6.685	1.558	4.291*	.024

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Another aspect of the testing environment investigated as a part of hypothesis 3 was that of the subject matter being tested. To investigate differences between students with and without learning disabilities' anxiety levels for testing in different subject areas, a two factor (LD status x sex) MANOVA was performed with the six subject areas rated for testing anxiety using the Subject Area Rating Scale

(SARS) as dependent variables. Significant main effects were found for both LD status, $F(6, 172) = 7.67$, $p < .001$, with an overall multivariate effect size of .21, and sex, $F(6, 172) = 2.31$, $p < .05$, with an overall multivariate effect size of .08. The interaction of LD status x sex was not significant. Means, standard deviations, and rank ordering from most to least anxiety producing for the six subject areas are presented as a function of LD status in Table 27, as a function of sex in Table 28, and for the total sample in Table 29. MANOVA results for the subject area ratings for the effects of LD status, sex, and LD status x sex are presented in Table 30.

Table 27. Subject area test anxiety ratings: means, standard deviations, and rank order from most to least anxiety producing, presented as a function of LD status.

	Non LD				LD			
	rank	mean	SD	n	rank	mean	SD	n
Mathematics	1	3.35	1.29	92	3	3.53	1.31	89
Physical/Bio Sciences	2	3.15	1.10	92	2	3.58	1.07	89
Social Sciences	5	2.26	0.99	92	5	2.75	1.05	89
Humanities	4	2.46	1.13	92	4	2.98	1.21	89
Fine Arts	6	2.16	1.08	92	6	2.26	1.22	89
Foreign Language	3	2.79	1.23	92	1	3.93	1.22	89

Table 28. Subject area test anxiety ratings: means, standard deviations, and rank order from most to least anxiety producing, presented as a function of sex.

	Males				Females			
	rank	mean	SD	n	rank	mean	SD	n
Mathematics	3	3.11	1.25	82	1	3.71	1.28	99
Physical/Bio Sciences	2	3.11	1.10	82	2	3.58	1.07	99
Social Sciences	5	2.39	1.04	82	5	2.60	1.05	99
Humanities	4	2.60	1.15	82	4	2.81	1.23	99
Fine Arts	6	2.16	1.21	82	6	2.25	1.10	99
Foreign Language	1	3.37	1.32	82	3	3.34	1.38	99

Table 29. Subject area test anxiety ratings: means, standard deviations, and rank order from most to least anxiety producing (subject areas are also listed in this rank order) for the total sample.

	Total Sample			
	rank	mean	SD	n
Mathematics	1	3.44	1.30	181
Physical/Bio Sciences	2	3.36	1.11	181
Foreign Language	3	3.35	1.35	181
Humanities	4	2.71	1.20	181
Social Sciences	5	2.50	1.05	181
Fine Arts	6	2.21	1.15	181

Table 30. MANOVA results for the six subject area test anxiety ratings as a function of LD status, sex, and LD status x sex.

MANOVA, dependent = Subject area test anxieties, effect = LD Status

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.211	7.670***	6	172
Hotellings	.268	7.670***	6	172
Wilks	.789	7.670***	6	172
Roys	.211			

Overall Multivariate Effect Size = .211

MANOVA, dependent = Subject area test anxieties, effect = Sex

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.075	2.312*	6	172
Hotellings	.081	2.312*	6	172
Wilks	.925	2.312*	6	172
Roys	.075			

Overall Multivariate Effect Size = .075

MANOVA, dependent = Subject area test anxieties, effect = LD Status by Sex

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.024	.697	6	172
Hotellings	.024	.697	6	172
Wilks	.976	.697	6	172
Roys	.024			

Overall Multivariate Effect Size = .024
(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Separate univariate F tests were performed on each of the subject area test anxiety ratings for each independent variable found to have a significant main effect. Results of these univariate F tests for LD status indicated that students with learning disabilities reported significantly more test anxiety than their

non-LD peers for classes in foreign language, social science, humanities, and hard science. There were no significant differences between the two groups on test anxiety in mathematics or fine arts classes. Results of the univariate F tests for subject area test anxiety ratings as a function of LD status, including effect size measures, are presented in Table 31.

Table 31. Univariate F tests for subject area test anxiety ratings as a function of LD status.

Variable	Hypothesis MS	Error MS	F	ETA sq.
Fine Arts Anxiety	.428	1.340	.320	.002
Humanities Anxiety	11.801	1.371	8.608**	.046
Foreign Language Anxiety	56.503	1.510	37.427***	.175
Math Anxiety	1.741	1.598	1.089	.006
Science Anxiety	8.874	1.133	7.831**	.042
Social Science Anxiety	11.413	1.037	11.010**	.059

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Results of the univariate F tests for sex indicated that females reported significantly more test anxiety than males for classes in mathematics and the hard sciences; there were no significant differences between males and females in test anxiety for classes in social sciences, foreign language, humanities, or fine arts. Results of the univariate F tests for subject area test anxiety ratings as a function of sex, including effect size measures, are presented in Table 32.

Table 32. Univariate F tests for subject area test anxiety ratings as a function of sex.

Variable	Hypothesis MS	Error MS	F	ETA sq.
Fine Arts Anxiety	.386	1.340	.288	.002
Humanities Anxiety	1.941	1.371	1.416	.008
Foreign Language Anxiety	.034	1.510	.022	.000
Math Anxiety	15.716	1.598	9.833**	.053
Science Anxiety	9.482	1.133	8.368**	.045
Social Science Anxiety	1.785	1.037	1.722	.010

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Hypothesis Four

Hypothesis four was that postsecondary students with and without learning disabilities would differ significantly in their ratings of how desirable they would find particular modifications to the testing environment to be. To test this hypothesis, a two factor (LD status x sex) MANOVA was performed with the 18 testing modifications rated in the TMRS as dependent variables. Significant main effects were found for both LD status, $F(18, 160) = 2.60$, $p < .01$, with an overall multivariate effect size of .23, and sex, $F(18, 160) = 2.06$. $p < .01$, with an overall multivariate effect size of .19. A significant interaction between LD status and sex, $F(18, 160) = 1.78$, $p < .05$, with an overall multivariate effect size of .17 was also found. Means, standard deviations, and rank ordering from most to least anxiety relieving for the 18 TMRS situations are presented as a function of LD status in Table 33, as a function of sex in Table 34, and for the combined sample in Table 35. MANOVA results for the TMRS modifications for the effects of LD status, sex, and LD status x sex are presented in Table 36.

Table 33. TMRS ratings: means, standard deviations, and rank order from most to least anxiety relieving, as a function of LD status.

	Non LD				LD			
	Rank	Mean	SD	n	Rank	Mean	SD	n
1. No time limits	13	3.39	1.30	92	9	4.01	1.12	89
2. Open note/book	8	3.88	1.22	92	7	4.10	1.10	89
3. Take home	7	3.93	1.15	92	5	4.11	1.05	89
4. Choice of format	10	3.77	1.07	92	12	3.80	1.07	89
5. Private test conditions	18	2.65	1.30	92	14	3.63	1.39	89
6. Flexible scheduling	17	2.88	1.36	92	17	3.36	1.38	89
7. Option to retake	2	4.33	1.04	92	2	4.30	1.04	89
8. Extra Credit	4	4.14	1.01	92	4	4.16	1.04	89
9. Free weekly tutoring	11	3.57	1.23	92	11	3.81	1.22	89
10. Partial credit	5	4.01	0.95	92	8	4.09	1.12	89
11. Discuss results w/prof.	14	3.24	1.37	92	15	3.62	1.26	89
12. Final papers not tests	16	2.89	1.49	92	18	3.30	1.46	89
13. Choice of questions	9	3.87	0.94	92	10	3.83	1.16	89
14. Drop lowest test grade	1	4.42	0.80	92	3	4.18	1.11	89
15. Campus advocate	15	3.08	1.35	92	13	3.63	1.21	89
16. More, shorter tests	12	3.14	1.31	92	16	3.54	1.17	89
17. Outline in advance	3	4.25	1.05	92	1	4.39	1.00	89
18. Practice tests/old tests	6	3.99	1.09	92	6	4.11	1.13	89

Table 34. TMRS ratings: means, standard deviations, and rank order from most to least anxiety relieving, as a function of sex.

	Males				Females			
	Rank	Mean	SD	n	Rank	Mean	SD	n
1. No time limits	11	3.60	1.38	82	12	3.78	1.14	99
2. Open note/book	7	3.93	1.20	82	7	4.04	1.13	99
3. Take home	3	4.09	1.10	82	8	3.97	1.10	99
4. Choice of format	10	3.77	1.01	82	11	3.80	1.12	99
5. Private test conditions	17	2.95	1.49	82	17	3.28	1.37	99
6. Flexible scheduling	16	3.00	1.41	82	18	3.21	1.37	99
7. Option to retake	1	4.20	1.15	82	3	4.41	0.93	99
8. Extra Credit	6	3.95	1.09	82	4	4.31	0.94	99
9. Free weekly tutoring	12	3.46	1.33	82	10	3.87	1.11	99
10. Partial credit	8	3.80	1.08	82	5	4.25	0.96	99
11. Discuss results w/prof.	14	3.22	1.42	82	14	3.60	1.22	99
12. Final papers not tests	18	2.73	1.48	82	16	3.39	1.43	99
13. Choice of questions	9	3.78	1.03	82	9	3.91	1.07	99
14. Drop lowest test grade	2	4.15	1.07	82	2	4.43	0.87	99
15. Campus advocate	15	3.17	1.28	82	15	3.49	1.32	99
16. More, shorter tests	13	3.27	1.24	82	13	3.65	1.22	99
17. Outline in advance	4	4.04	1.19	82	1	4.56	0.80	99
18. Practice tests/old tests	5	4.00	1.10	82	6	4.09	1.13	99

Table 35. TMRS ratings: means, standard deviations, and rank order from most to least anxiety relieving (modifications are also listed in this rank order) for the total sample.

	Total Sample			
	Rank	Mean	SD	n
Outline in advance	1	4.32	1.03	181
Option to retake	2	4.31	1.04	181
Drop lowest test grade	3	4.30	0.97	181
Extra Credit	4	4.15	1.02	181
Partial credit	5	4.05	1.04	181
Practice tests/old tests	6	4.05	1.11	181
Take home	7	4.02	1.10	181
Open note/book	8	3.99	1.16	181
Choice of questions	9	3.85	1.05	181
Choice of format	10	3.78	1.07	181
No time limits	11	3.70	1.25	181
Free weekly tutoring	12	3.69	1.23	181
More, shorter tests	13	3.48	1.24	181
Discuss results w/prof.	14	3.43	1.33	181
Campus advocate	15	3.35	1.31	181
Private test conditions	16	3.13	1.43	181
Flexible scheduling	17	3.12	1.39	181
Final papers not tests	18	3.09	1.49	181

Table 36. MANOVA results for TMRS ratings as a function of LD status, sex, and LD status x sex.

MANOVA, dependent = TMRS ratings, effect = LD Status

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.226	2.595**	18	160
Hotellings	.292	2.595**	18	160
Wilks	.774	2.595**	18	160
Roys	.226			

Overall Multivariate Effect Size = .226

MANOVA, dependent = TMRS ratings, effect = Sex.

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.188	2.061**	18	160
Hotellings	.232	2.061**	18	160
Wilks	.812	2.061**	18	160
Roys	.188			

Overall Multivariate Effect Size = .188

MANOVA, dependent = TMRS ratings, effect = LD Status by Sex

Test Name	Value	Exact F	Hypothesis df	Error df
Pillais	.168	1.780*	18	160
Hotellings	.202	1.780*	18	160
Wilks	.832	1.780*	18	160
Roys	.168			

Overall Multivariate Effect Size = .168
(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Separate univariate F tests were performed on each of the 18 TMRS modifications for each independent variable found to have a significant main effect, and for the significant interaction found between these two variables. Results of the univariate F tests for LD status indicated four testing modifications that students with learning disabilities found significantly more desirable than did their non-

LD peers. These were (presented in descending order of magnitude of effect size): 1) private testing conditions, 2) absence of time limits, 3) presence of an advocate on campus to whom they could go for help about testing and grades, and 4) flexible scheduling of test times. Marginally significant differences between students with and without learning disabilities were found for: 1) final papers instead of tests (students with LD found this more desirable than did non-LD students), 2) chance to discuss test results with a professor (again, students with LD found this more desirable), and 3) the option to drop one's lowest test grade in a class (non-LD students found this more desirable than students with LD). Results of the univariate F tests for TMRS ratings as a function of LD status, including effect size measures, are presented in Table 37.

Table 37. Univariate F tests for TMRS ratings as a function of LD status.

Variable	Hypothesis MS	Error MS	F	ETA Sq.
1. No time limits	17.260	1.489	11.594**	.061
2. Open note/book	2.461	1.357	1.813	.010
3. Take home	1.228	1.215	1.011	.006
4. Choice of format	.049	1.154	.043	.000
5. Private test conditions	41.496	1.808	22.946***	.115
6. Flexible scheduling	10.267	1.888	5.437*	.030
7. Option to retake	.013	1.077	.012	.000
8. Extra Credit	.027	1.031	.026	.000
9. Free weekly tutoring	3.029	1.465	2.068	.012
10. Partial credit	.467	1.027	.455	.003
11. Discuss results w/prof.	5.998	1.711	3.504(M)	.019
12. Final papers not tests	7.501	2.092	3.586(M)	.020
13. Choice of questions	.060	1.119	.054	.000
14. Drop lowest test grade	2.608	.925	2.820(M)	.016
15. Campus advocate	12.365	1.623	7.618**	.041
16. More, shorter tests	.818	1.522	.538	.003
17. Outline in advance	1.389	.959	1.449	.008
18. Practice tests/old tests	.606	1.250	.485	.003

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Results of the univariate F tests for sex indicated seven testing modifications that females found significantly more desirable than did males. These were (presented in descending order of magnitude of effect size): 1) getting an outline of the test to study from in advance, 2) final papers instead of tests, 3) partial credit for showing work, 4) extra credit assignments available to raise one's grade, 5) free weekly tutoring sessions, 6) more, shorter tests that each count as a smaller percentage of final course grade, and 7)

the option to drop one's lowest test grade. Marginally significant differences between males and females (again with females rating the modifications as more desirable) were found for: 1) chance to discuss test results with a professor, and 2) presence of an advocate on campus to whom they could go for help about testing and grades. Results of the univariate F tests for TMRS ratings as a function of sex, including effect size measures, are presented in Table 38.

Table 38. Univariate F tests for TMRS ratings as a function of sex.

Variable	Hypothesis MS	Error MS	F	ETA Sq.
1. No time limits	1.380	1.489	.927	.005
2. Open note/book	.535	1.357	.395	.002
3. Take home	.588	1.215	.484	.003
4. Choice of format	.035	1.154	.031	.000
5. Private test conditions	4.796	1.808	2.652	.015
6. Flexible scheduling	1.950	1.888	1.033	.006
7. Option to retake	2.128	1.077	1.976	.011
8. Extra Credit	5.800	1.031	5.627*	.031
9. Free weekly tutoring	7.171	1.465	4.896*	.027
10. Partial credit	8.763	1.027	8.531**	.046
11. Discuss results w/prof.	6.330	1.711	3.699(M)	.020
12. Final papers not tests	19.471	2.092	9.309**	.050
13. Choice of questions	.739	1.119	.661	.004
14. Drop lowest test grade	3.740	.925	4.044*	.022
15. Campus advocate	4.741	1.623	2.921(M)	.016
16. More, shorter tests	6.308	1.522	4.145*	.023
17. Outline in advance	11.709	.959	12.210**	.065
18. Practice tests/old tests	.373	1.250	.299	.002

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Results of the univariate F tests for the interaction between LD status and sex indicated a significant interaction for TMRS item 17, "getting an outline of exactly what will be on the test, to study from." While male students with learning disabilities found this a more desirable modification than male non-LD students, the opposite was true for female students: non-LD females found this a more desirable modification than females with learning disablities. A graphic representation of this interaction is presented in figure 1.

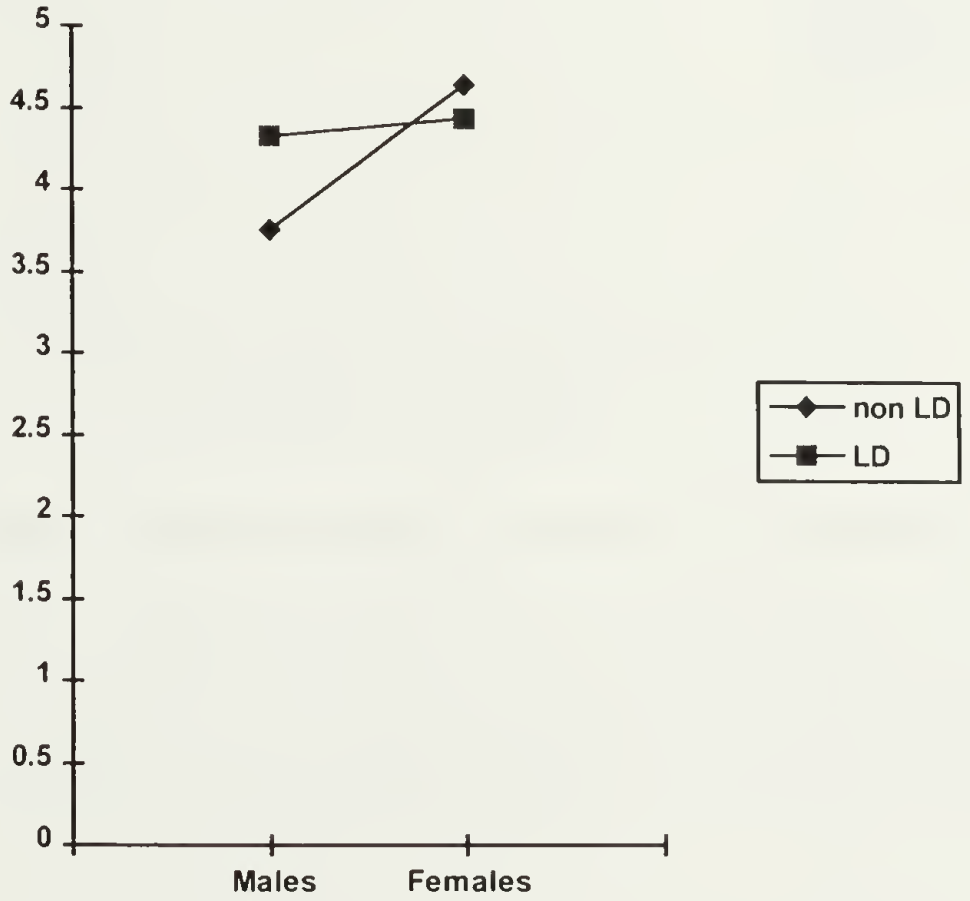

Figure 1. Interaction between sex and LD status - TMRS 17: Outline of test in advance.

A marginally significant interaction between LD status and sex was found for TMRS item 10, "partial credit given for the process of solving problems (showing work), even if answer wrong." Again, as with TMRS 17, while male students with learning disabilities found this a more desirable modification than non-LD males, the opposite was true for female students: non-LD females found this a more desirable

modification than females with learning disabilities. A graphic representation of this interaction is presented in figure 2.

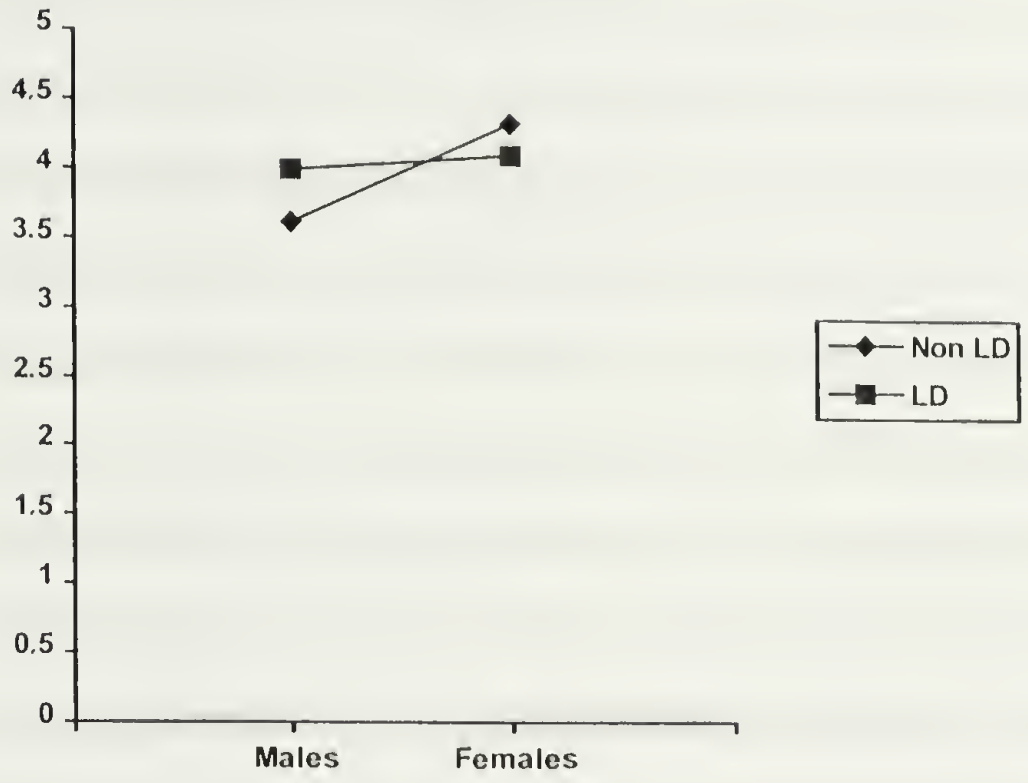

Figure 2. Interaction between sex and LD status - TMRS 10: Partial credit for showing work.

Results of the univariate F tests for TMRS ratings as a function of the interaction between LD status and sex, including effect size measures, are presented in Table 39.

Table 39. Univariate F tests for TMRS ratings as a function of the interaction between LD status and sex.

Variable	Hypothesis MS	Error MS	F	ETA Sq.
1. No time limits	.016	1.489	.011	.000
2. Open note/book	1.045	1.357	.770	.004
3. Take home	.841	1.215	.692	.004
4. Choice of format	.270	1.154	.234	.001
5. Private test conditions	.813	1.808	.450	.003
6. Flexible scheduling	.004	1.888	.002	.000
7. Option to retake	.256	1.077	.237	.001
8. Extra Credit	.639	1.031	.620	.003
9. Free weekly tutoring	1.829	1.465	1.249	.007
10. Partial credit	3.486	1.027	3.394(M)	.019
11. Discuss results w/prof.	.552	1.711	.323	.002
12. Final papers not tests	.013	2.092	.006	.000
13. Choice of questions	.030	1.119	.027	.000
14. Drop lowest test grade	.126	.925	.137	.001
15. Campus advocate	3.336	1.623	2.055	.011
16. More, shorter tests	.668	1.522	.439	.002
17. Outline in advance	6.717	.959	7.004**	.038
18. Practice tests/old tests	.204	1.250	.163	.001

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Hypothesis Five

Hypothesis five was that differences in postsecondary students with learning disabilities' anxiety levels for testing in different subject areas would be related to the specific nature of their learning disability (e.g., students with language based learning disabilities would show more anxiety about language based classes, such as humanities classes, while students with math related disabilities would show more anxiety

about math based classes). To test this hypothesis, separate univariate ANOVA's using nature of learning disability as the independent variable were performed on test anxiety ratings for each subject area listed in the SARS. Four diagnostic groupings of learning disability were used: 1) primarily verbal/auditory/writing/language, 2) primarily non-verbal/visual/math, 3) primarily cognitive: memory/attention/organization, and 4) combination verbal and non-verbal. As noted earlier, each student with a learning disability was placed in one of these categories based on a review of the diagnostic information in his/her LDSS file.

It was found that, for each subject area, the relationships between the mean anxiety scores for the different diagnostic groups were in the direction expected (e.g., students with primarily language based learning disabilities showed more test anxiety for language oriented classes than students with primarily non-verbal learning disabilities; students with primarily non-verbal learning disabilities showed more test anxiety for math and science classes than did students with primarily language based learning disabilities); however, this effect did not reach significance for any of the six subject areas considered. Means and standard deviations for fine arts test anxiety as a function of nature of learning disability are presented in Table 40, ANOVA results for fine arts test anxiety as a function of nature of learning disability, including effect size measures, are presented in Table 41. Means and standard deviations for humanities test anxiety as a function of nature of learning disability are presented in Table 42, ANOVA results for humanities test anxiety as a function of nature of learning disability, including effect size measures, are presented in Table 43. Means and standard deviations for foreign language test anxiety as a function of nature of learning disability are presented in Table 44, ANOVA results for foreign language test anxiety as a function of nature of learning disability, including effect size measures, are presented in Table 45. Means and standard deviations for mathematics test anxiety as a function of nature of learning disability are presented in Table 46, ANOVA results for mathematics test anxiety as a function of nature of learning disability, including effect size measures, are presented in Table 47. Means and standard deviations for hard science test anxiety as a function of nature of learning disability are presented in Table 48, ANOVA results for hard science test anxiety as a function of nature of learning disability, including effect size measures, are presented in Table 49. Means and standard deviations for social sciences test anxiety as a function of

nature of learning disability are presented in Table 50, ANOVA results for social sciences test anxiety as a function of nature of learning disability, including effect size measures, are presented in Table 51.

Table 40. Means and standard deviations for fine arts test anxiety as a function of nature of LD (sample is students with LD only).

Nature of Learning Disability	Mean	SD	N
Primarily Language	2.192	1.172	52
Primarily Math	2.091	1.151	22
Cognitive (Memory, Attention, Organization)	3.500	2.121	2
Combination Language/Math	2.615	1.387	13

Table 41. ANOVA results for fine arts test anxiety as a function of nature of LD (sample is students with LD only).

Source	df	Mean Square	F	ETA sq.
Type of LD	3	1.86	1.26	.043
Within group error	85	1.48		

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 42. Means and standard deviations for humanities test anxiety as a function of nature of LD (sample is students with LD only).

Nature of Learning Disability	Mean	SD	N
Primarily Language	3.038	1.204	52
Primarily Math	2.727	1.279	22
Cognitive (Memory, Attention, Organization)	2.500	.707	2
Combination Language/Math	3.231	1.166	13

Table 43. ANOVA results for humanities test anxiety as a function of nature of LD (sample is students with LD only).

Source	df	Mean Square	F	ETA sq.
Type of LD	3	.950	.650	.022
Within group error	85	1.47		

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Table 44. Means and standard deviations for foreign language test anxiety as a function of nature of LD (sample is students with LD only).

Nature of Learning Disability	Mean	SD	N
Primarily Language	4.000	1.237	52
Primarily Math	3.864	1.320	22
Cognitive (Memory, Attention, Organization)	3.500	.707	2
Combination Language/Math	3.846	1.144	13

Table 45. ANOVA results for foreign language test anxiety as a function of nature of LD (sample is students with LD only).

Source	df	Mean Square	F	ETA sq.
Type of LD	3	.270	.180	.006
Within group error	85	1.540		

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Table 46. Means and standard deviations for mathematics test anxiety as a function of nature of LD (sample is students with LD only).

Nature of Learning Disability	Mean	SD	N
Primarily Language	3.385	1.286	52
Primarily Math	3.727	1.352	22
Cognitive (Memory, Attention, Organization)	3.500	2.121	2
Combination Language/Math	3.769	1.301	13

Table 47. ANOVA results for mathematics test anxiety as a function of nature of LD (sample is students with LD only).

Source	df	Mean Square	F	ETA sq.
Type of LD	3	.900	.52	.018
Within group error	85	1.74		

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Table 48. Means and standard deviations for hard science test anxiety as a function of nature of LD (sample is students with LD only).

Nature of Learning Disability	Mean	SD	N
Primarily Language	3.500	1.076	52
Primarily Math	3.682	1.041	22
Cognitive (Memory, Attention, Organization)	3.000	1.414	2
Combination Language/Math	3.846	1.144	13

Table 49. ANOVA results for hard science test anxiety as a function of nature of LD (sample is students with LD only).

Source	df	Mean Square	F	ETA sq.
Type of LD	3	.720	.610	.021
Within group error	85	1.170		

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Table 50. Means and standard deviations for social sciences test anxiety as a function of nature of LD (sample is students with LD only).

Nature of Learning Disability	Mean	SD	N
Primarily Language	2.904	1.125	52
Primarily Math	2.364	.727	22
Cognitive (Memory, Attention, Organization)	2.000	NC	2
Combination Language/Math	2.923	1.115	13

Table 51. ANOVA results for social sciences test anxiety as a function of nature of LD (sample is students with LD only).

Source	df	Mean Square	F	ETA sq.
Type of LD	3	2.01	1.89	.062
Within group error	85	1.07		

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

Hypothesis Six

Hypothesis six was that levels of perceived control over testing would correlate negatively with test anxiety. To test this hypothesis, both correlational and multiple regression analyses were used. Initially correlations between all of the continuous measures in the study, for the total sample (n = 182), were computed. The complete correlation matrix for the total sample is presented in Table 52. It was found that the primary anxiety measure used in the study, RTA total score, showed significant positive correlations with ALOCS total score (.34, p < .001), with PCOT factor 1, "Actions Taken," (.25, p < .01), and a marginally significant negative correlation with PCOT factor 3, "General LOC," (-.14, p < .10). These correlations make sense when one remembers that a high score on the ALOCS suggests a more *external* locus of control (i.e., lower perceived control over testing), and a high score on PCOT factor 3, "General LOC," suggests a more internal locus of control (i.e., higher perceived control over testing). The positive correlation with PCOT factor 1, "Actions Taken," which appears to measure how much control students *actually take* over testing and grading, may suggest that more anxious students engage in more behaviors aimed at getting control over their environment, and that PCOT factor 1 is less a measure of *perceived* control than of actual behaviors involved in getting more control; the implications of these correlations are discussed in more detail later.

Table 52. Correlation matrix for all continuous measures in the study, for the total sample (n = 182).

	ALOCS	Failures	PCOT F1	PCOT F2	PCOT F3	RTA total
ALOCS	1.000					
Failures	.096	1.000				
PCOT F1	-.156*	-.004	1.000			
PCOT F2	-.185*	-.124(M)	.548***	1.000		
PCOT F3	-.340***	-.088	.221**	.218**	1.000	
RTA total	.340***	.120	.250**	.096	-.140(M)	1.000
GPA	-.271***	-.536***	-.009	.061	.074	-.164*
TAM 1	.226**	.112	.075	-.068	-.184*	.310***
TAM 2	.181*	.193**	.177*	.078	-.158*	.477***
TAM 3	.228**	.075	.202**	.107	-.086	.314***
TAM 4	.203**	.128(M)	.241	.216**	-.147*	.391***
TAM class	.229**	.174*	.144(M)	.008	-.193**	.447***
TAM grad	.221**	.106	.243**	.175*	-.128(M)	.379***
TAM total	.276***	.174*	.226**	.114	-.192**	.498***
Total suppt	-.021	.109	.424***	.232**	.045	.152*
Total test	-.166*	.055	.482***	.266**	.040	.141(M)
W/drawals	.221**	.252**	.124(M)	.031	-.150*	.252**

Continued next page

Table 52, continued.

	GPA	TAM 1	TAM 2	TAM 3	TAM 4	TAM class
GPA	1.000					
TAM 1	-.031	1.000				
TAM 2	-.106	.568***	1.000			
TAM 3	-.141(M)	.280***	.322***	1.000		
TAM 4	-.130(M)	.288***	.358***	.705***	1.000	
TAM class	-.079	.880***	.891***	.341***	.366***	1.000
TAM grad	-.135(M)	.308***	.369***	.912***	.928***	.383***
TAM total	-.136(M)	.708***	.757***	.753***	.783***	.828***
Total suppt	-.239**	.020	.072	.236**	.198**	.053
Total test	-.102	.032	.075	.206**	.180*	.061
W/drawals	-.113	.078	.094	.055	.166*	.097

	Tam grad.	Tam total	Total suppt.	Total test	W/drawals
Tam grad	1.000				
Tam total	.830***	1.000			
Total suppt.	.234**	.176*	1.000		
Total test	.212**	.165*	.758***	1.000	
W/drawals	.124(M)	.136(M)	.125(M)	.093	1.000

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

To better assess the strength and nature of the relationship between perceived control (and control taking) over testing/grading and test anxiety, a multiple regression analysis was used to determine the amount of unique (over and above the effects of the other variables) R squared (Rsq) change each of the above mentioned variables contributed to a regression equation with RTA total score as the dependent variable. 13 variables were entered into the regression equation, each of which was hypothesized to possibly affect individual's test anxiety levels. These were: 1) ALOCS total score, 2) LD status, 3)

academic major, 4) use of testing support services, 5) use of general support services, 6) sex, 7) PCOT factor 1, 8) PCOT factor 2, 9) PCOT factor 3, 10) grade level, 11) GPA, 12) number of courses failed in college, and 13) number of courses withdrawn from due to fear of failure. Categorical variables (e.g., sex, grade, LD status), each with *k* groups, were recoded into a series *k*-1 dummy variables, thus meaningful regression coefficients for these categorical variables as a whole were not available, though their unique contribution to the overall Rsq of the regression was tested. The overall regression was significant, $F(16, 161) = 4.79$, $p < .001$, with an overall Rsq of .36.

The results of the hypothesis tests for each variable indicated that (listed in decreasing order of magnitude of effect size) ALOCS total score, sex, and PCOT factor 1, "Actions Taken," significantly increased the Rsq of the regression over and above the combined effects of the other variables in the equation. Marginally significant increases in Rsq were found for (listed in decreasing order of magnitude of effect size) grade level, LD status, and PCOT factor 3 "General LOC." Regression data for hypothesis six is presented in Table 53.

Table 53. Hypothesis six multiple regression. Dependent variable is RTA total score; n = 181 (whole sample). Categorical variables (each with k groups) were recoded into a series of k-1 dummy variables; thus meaningful regression coefficients for these variables as a whole are not available.

	Regression			Hypothesis tests	
Variable	**B**	**SE B**	**Beta**	**Rsq Change**	**F**
ALOCS Total	.049	.011	.325	.073	18.449***
LD Status (Y/N)				.014	3.446(M)
Academic Major (1-5)				.008	.509
Total testing support	-.011	.020	-.065	.001	.299
Total non testing support	-.010	.007	-.150	.008	1.924
Sex (M/F)				.055	13.958***
PCOT factor 1 (actions)	.186	.052	.314	.051	12.733***
PCOT factor 2 (beliefs)	-.037	.062	-.048	.001	.362
PCOT factor 3 (general)	-.122	.071	-.130	.012	2.922(M)
Grade Level (1-5)				.037	2.311(M)
GPA	-.028	.075	-.032	.001	.136
Failures	.029	.038	.063	.002	.587
Withdrawals	.048	.037	.010	.007	1.859

Analysis of variance:

Source	**df**	**Mean Square**	**F**	**ETA sq. (R sq.)**
Regression	19	1.057	4.786***	.361
Residual	161	.221		

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Hypothesis Seven

Hypothesis seven was that the degree to which students with learning disabilities utilize testing accommodations/support services would correlate positively with the level of control they perceived they

had over testing. To test this hypothesis, again both correlational and regression analyses were used. Initially, correlations between all of the continuous measures in the study, for the sample of students with learning disabilities only (n = 90), were computed. The complete correlation matrix for the sample of students with learning disabilities is presented in Table 54. It was found that of the two primary measures of the use of learning disabilities support services (use of general support services and use of testing support services) only use of testing support services showed any significant correlations with measures of perceived control. Use of testing support services score correlated significantly with ALOCS total score (-.29, $p < .01$; again it must be remembered that high scores on the ALOCS are indicative of a more *external* locus of control, hence the negative correlation), and PCOT factor 1, "Actions Taken" (.26, $p < .05$). These correlations are as expected, as one way of exercising control and "taking action" is to use the testing support services available. A marginally significant correlation was found between use of testing support services and PCOT factor 3, "General LOC" (.20, $P< .10$). This supports the conceptualization of PCOT factor 3 as a weaker measure of the general academic locus of control measured by the ALOCS. A marginally significant correlation was also found between the use of *general* support services and PCOT factor 3 (.19, $p< .10$).

Table 54. Correlation matrix for all continuous measures in the study, for students with LD only (n = 90).

	ALOCS	Failures	LDSS time	PCOT F1	PCOT F2	PCOT F3
ALOCS	1.000					
Failures	.175	1.000				
LDSS time	.083	.225*	1.000			
PCOT F1	-.235*	-.015	.099	1.000		
PCOT F2	-.135	-.269*	-.005	.407***	1.000	
PCOT F3	-.468***	-.054	-.145	.342**	.398***	1.000
RTA total	.426***	.088	.031	.142	-.001	-.146
GPA	-.450***	-.479***	.062	.234*	.196(M)	.157
TAM 1	.246*	.088	.035	.124	-.113	-.129
TAM 2	.187(M)	.207(M)	-.190(M)	.194(M)	.013	-.052
TAM 3	.109	-.044	-.052	.022	-.010	-.056
TAM 4	.153	-.057	-.005	.064	.126	-.153
TAM class	.246*	.167	-.088	.180(M)	-.069	-.102
TAM grad	.124	-.068	-.017	.053	.059	-.117
TAM total	.238*	.073	-.073	.141	-.005	-.131
Total suppt	.020	.018	.158	.166	.013	.188(M)
Total test	-.291**	-.108	.079	.263*	.054	.200(M)
W/drawals	.144	.163	.267*	.119	.024	-.110

Continued next page

Table 54, continued.

	RTA total	GPA	TAM 1	TAM 2	TAM 3	TAM 4
RTA total	1.000					
GPA	-.159	1.000				
TAM 1	.371***	-.027	1.000			
TAM 2	.500***	-.138	.557***	1.000		
TAM 3	.307**	.041	.283**	.330**	1.000	
TAM 4	.358**	.038	.296**	.324**	.631***	1.000
TAM class	.493***	-.093	.883***	.882***	.347**	.351**
TAM grad	.358**	.067	.320**	.360***	.898***	.896***
TAM total	.521***	-.034	.738***	.761***	.732***	.740***
Total suppt	-.070	-.106	.037	-.083	.093	-.010
Total test	-.126	.226*	.063	-.101	.007	-.086
W/drawals	.242*	-.092	.106	.025	-.053	.105

	TAM class	TAM grad	TAM total	Total suppt.	Total test	W/drawals
TAM class	1.000					
TAM grad	.386***	1.000				
TAM total	.849***	.811***	1.000			
Total suppt	-.026	.041	.009	1.000		
Total test	-.022	-.036	-.039	.474***	1.000	
W/drawals	.075	.031	.065	-.032	-.116	1.000

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

To better assess the relationship between use of support services and perceived control over testing, a multiple regression analysis was performed using PCOT factor 1, "Actions Taken," as the dependent variable. Although initially considered as potential additional dependent variables, PCOT factors 2 and 3 were not used because of their relatively weak psychometric properties and their lack of

significant correlation with the independent variables of interest (use of testing support and use of general support services). The regression analysis was used to determine the unique amount of Rsq each of these variables of interest contributed to the regression equation. Seven variables, including the variables of primary interest were used in the regression equation, each of which was hypothesized to potentially relate to individual's control taking over testing/grading situations. These were: 1) sex, 2) study skills deficits (Y/N), 3) use of testing support services, 4) use of general support services, 5) grade level, 6) age diagnosed as learning disabled, and 7) ALOCS total score. Categorical variables (e.g., sex, grade level), each with *k* groups, were recoded into a series of *k*-1 dummy variables, thus meaningful regression coefficients for these categorical variables as a whole were not available, though their unique contributions to the overall Rsq of the regression were tested. The overall regression for PCOT factor 1, "Actions Taken," was significant, $F(12, 76) = 1.96$, $p < .05$, with an overall Rsq of .24.

The results of the hypothesis tests for each variable indicated that no one variable made a significant unique contribution to the overall regression, over and above the combined effects of the other variables in the equation. Students' grade level (freshman through graduate) resulted in a marginally significant unique increase in Rsq. The variables of interest, use of testing support and use of general support services, made non-significant contributions to the overall Rsq when the effects of the other variables were also considered. Regression data for hypothesis seven is presented in Table55.

Table 55. Hypothesis seven multiple regression. Dependent variable is PCOT factor 1 (Actions Taken) ; sample is students with learning disabilities only (n = 89). Categorical variables (each with *k* groups) were recoded into a series of *k*-1 dummy variables; thus meaningful regression coefficients for the variables as a whole are not available.

	Regression			Hypothesis tests	
Variable	**B**	**SE B**	**Beta**	**Rsq Change**	**F**
Sex (M/F)				.004	.364
Study Skills Need (Y/N)				.012	1.145
Testing Support	.187	.169	.138	.012	1.227
Non Testing Support	.050	.060	.101	.007	.697
Grade (1-5)				.099	2.453(M)
Age Diagnosed LD (1-4)				.016	.516
ALOCS	-.190	.118	-.175	.026	2.615

Analysis of variance:

Source	**Df**	**Mean Square**	**F**	**ETA sq. (R sq.)**
Regression	12	29.432	1.956*	.236
Residual	76	15.047		

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Hypothesis Eight

Hypothesis eight was that the degree to which postsecondary students with learning disabilities utilized support services and testing accommodations would correlate negatively with test anxiety. To test this hypothesis, again both correlational and regression analyses were used. The correlations between the salient variables appear in the correlation matrix for the sample of students with learning disabilites, presented in Table 54. Although measures of both use of testing support and use of general support services did correlate negatively with test anxiety, both of these correlations were non-significant.

To better assess the relationship between test anxiety and use of support services in students with learning disabilities, a multiple regression analysis with RTA total score as the dependent variable was

performed on the sample of students with learning disabilities only. 11 variables hypothesized to be predictive of test anxiety, including the two measures of use of support services, were entered into the regression equation, and the unique amount of Rsq change accounted for by each variable over and above the combined effects of the other variables in the equation was tested. Categorical variables (e.g., sex, grade level), each with *k* groups, were recoded into a series of *k*-1 dummy variables, thus meaningful regression coefficients for these categorical variables as a whole were not available, though their unique contributions to the overall Rsq of the regression were tested. The overall regression was significant, $F(14, 74) = 2.90$, $p < .01$, with an overall Rsq of .35.

The results of the hypothesis tests (significance of Rsq change) for each variable indicated that ALOCS total score, PCOT factor 1(Actions Taken), and sex significantly increased the Rsq over and above the combined effects of the other variables in the equation. None of the other variables in the equation, including the two measures of use of support services, were significant. Regression data for hypothesis eight is presented in Table 56.

Table 56. Hypothesis eight multiple regression. Dependent variable is RTA total score; sample is students with learning disabilities only (n = 89). Categorical variables (each with *k* groups) were recoded into a series of *k*-1 dummy variables; thus meaningful regression coefficients for the variables as a whole are not available.

	Regression			Hypothesis tests	
Variable	**B**	**SE B**	**Beta**	**Rsq Change**	**F**
Testing Support	-.006	.024	-.030	.001	.062
Non Testing Support	-.010	.008	-.140	.013	1.498
Sex (M/F)				.035	3.961*
ALOCS	.070	.020	.432	.109	12.471***
PCOT F1 (Actions)	.245	.088	.330	.067	7.703**
PCOT F2 (Beliefs)	-.072	.098	-.084	.004	.530
PCOT F3 (General)	-.081	.132	-.078	.003	.375
Grade				.035	1.003
GPA	-.026	.128	-.027	.001	.042
Failures	-.002	.059	-.004	.001	.977
Withdrawals	.077	.050	.161	.021	2.383

Analysis of variance:

Source	**df**	**Mean Square**	**F**	**ETA sq. (R sq.)**
Regression	14	.838	2.897**	.354
Residual	74	.289		

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Hypothesis Nine

Hypothesis nine was that high levels of test anxiety in postsecondary settings would correlate significantly with reported avoidance of testing intensive classes or major areas, and that this relationship would be significantly more powerful for students with learning disabilities than for their non-learning disabled peers. To test this hypothesis, again both correlational and multiple regression analyses were

used. In terms of correlations, the relationship between RTA total score, TAM factor 1 (Admissions Test Avoidance), TAM factor 2 (Class Avoidance), and TAM total score were investigated. Correlations between these variables for the total sample (n = 182) appear in Table 52. As predicted, significant correlations were found between RTA total score and TAM factor 1, "Admissions Test Avoidance," (.38, $p < .001$), RTA total score and TAM factor 2, "Class Avoidance," (.45, $p < .001$), and RTA total score and TAM total score (.50, $p < .001$).

To better assess the relationship between test anxiety and testing avoidance, and to investigate the nature of the interaction between LD status and test anxiety as it relates to testing avoidance, three multiple regression analyses, the first using TAM factor 1 as the dependent variable, the second using TAM factor 2 as the dependent variable, and the third using TAM total score as the dependent variable, were performed using the total sample (n = 182). Independent variables were RTA total score, LD status, and the interaction between RTA total score and LD status. As LD status is a categorical variable it was recoded into a dummy variable, thus no meaningful regression coefficients were available for this variable, but its unique contribution to the overall Rsq over and above the combined effect of the other variables was tested.

For TAM factor 1, "Admissions Test Avoidance," the overall regression was significant, $F(3, 178) = 13.56$, $p > .001$, with an overall Rsq of .19. The results of the hypothesis tests (significance of Rsq change) for each variable indicated that only RTA total score made a significant unique contribution to the overall Rsq over and above the combined effects of the other variables. Regression data for hypothesis nine, regression 1 (TAM factor 1) is presented in Table 57.

Table 57. Hypothesis nine, multiple regression one. Dependent variable is TAM factor 1 (Admissions Test Avoidance) score; n = 182 (full sample). Categorical variables (each with k groups) were recoded into a series of k-1 dummy variables; thus meaningful regression coefficients for the variables as a whole are not available.

	Regression			Hypothesis tests	
Variable	**B**	**SE B**	**Beta**	**Rsq Change**	**F**
LD Status (Y/N)				.003	.575
RTA total score	.606	.138	.322	.088	19.313***
Interaction (LD status x RTA)				.000	.000

Analysis of variance:

Source	**Df**	**Mean Square**	**F**	**ETA sq. (R sq.)**
Regression	3	12.223	13.562***	.186
Residual	178	.901		

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

For TAM factor 2, "Class Avoidance," the overall regression was significant, F(3, 178) = 15.02, p > .001, with an overall Rsq of .20. The results of the hypothesis tests (significance of Rsq change) for each variable again indicated that only RTA total score made a significant unique contribution to the overall Rsq over and above the combined effects of the other variables. Regression data for hypothesis nine, regression 2 (TAM factor 2) is presented in Table 58.

Table 58. Hypothesis nine, multiple regression two. Dependent variable is TAM factor 2 (Class Avoidance) score; n = 182 (full sample). Categorical variables (each with k groups) were recoded into a series of k-1 dummy variables; thus meaningful regression coefficients for the variables as a whole are not available.

	Regression			Hypothesis tests	
Variable	**B**	**SE B**	**Beta**	**Rsq Change**	**F**
LD Status (Y/N)				.002	.525
RTA total score	.819	.135	.441	.165	36.893***
Interaction (LD status x RTA)				.002	.418

Analysis of variance:

Source	**df**	**Mean Square**	**F**	**ETA sq. (R sq.)**
Regression	3	12.946	15.021***	.202
Residual	178	.862		

(M) = p < .10 (marginal significance), * = p < .05, ** = p < .01, *** = p < .001

For TAM total score, the overall regression was significant, F(3, 178) = 20.92, p > .001, with an overall Rsq of .26. The results of the hypothesis tests (significance of Rsq change) for each variable again indicated that only RTA total score made a significant unique contribution to the overall Rsq over and above the combined effects of the other variables. Regression data for hypothesis nine, regression 3 (TAM total score) is presented in Table 59.

Table 59. Hypothesis nine, multiple regression three. Dependent variable is TAM total score; n = 182 (full sample). Categorical variables (each with k groups) were recoded into a series of k-1 dummy variables; thus meaningful regression coefficients for the variables as a whole are not available.

	Regression			Hypothesis tests	
Variable	**B**	**SE B**	**Beta**	**Rsq Change**	**F**
LD Status (Y/N)				.001	.273
RTA total score	.727	.104	.467	.202	48.744***
Interaction (LD status x RTA)				.000	.032

Analysis of variance:

Source	**df**	**Mean Square**	**F**	**ETA sq. (R sq.)**
Regression	3	11.719	20.916***	.261
Residual	178	.560		

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

As a final check on the strenght of RTA total score as a predictor of class/subject area avoidance, a final multiple regression was preformed using TAM total score as the dependent measure. 10 independent variables, including RTA total score, all hypothesized to be predictors of testing avoidance, were selected. These were: 1) LD status, 2) sex, 3) RTA total score, 4) course withdrawals, 5) course failures, 6) GPA, 7) PCOT factor 1, "Actions Taken," 8) PCOT factor 2, "Persuasion Beliefs," 9) PCOT factor 3, "General LOC," and 10) ALOCS total score. Again, the unique amount of Rsq change contributed by each variable to the regression over and above the combined effects of the other variables was tested. Categorical variables, each with *k* groups, were recoded into a series of *k*-1 dummy variables, thus meaningful regression coefficients for these categorical variables as a whole were not available, though their unique contributions to the overall Rsq were tested. The overall regression was significant, $F(10, 170) = 7.93$, $p < .001$, with an overall Rsq of .32.

The results of the hypothesis tests (significance of Rsq change) for each variable indicated significant unique contributions to the overall Rsq by (listed in descending order by magnitude of effect size): RTA total score, ALOCS total score, and number of courses failed. PCOT factor 3, "General LOC," made a marginally significant unique contribution to the overall Rsq. Of note, RTA total score made a

unique contribution of .10 to the overall Rsq, while the next best predictor, ALOCS total score, made a unique contribution of only .02. Regression data for hypothesis nine, regression 4 is presented in Table 60.

Table 60. Hypothesis nine, multiple regression four. Dependent variable is TAM total score; n = 182 (full sample). Categorical variables (each with k groups) were recoded into a series of k-1 dummy variables; thus meaningful regression coefficients for the variables as a whole are not available.

	Regression			Hypothesis tests	
Variable	**B**	**SE B**	**Beta**	**Rsq Change**	**F**
LD Status (Y/N)				.003	.696
Sex (M/F)				.002	.383
RTA total score	.582	.117	.374	.099	24.616***
Withdrawals	-.064	.054	-.082	.005	1.369
Failures	.112	.057	.156	.016	3.946*
GPA	.086	.111	.064	.002	.440
PCOT F1 (actions)	.118	.080	.128	.009	2.165
PCOT F2 (beliefs)	.070	.095	.057	.002	.538
PCOT F3 (general)	-.179	.104	-.123	.012	2.949(M)
ALOCS	.038	.018	.164	.018	4.520*

Analysis of variance:

Source	**Df**	**Mean Square**	**F**	**ETA sq. (R sq.)**
Regression	10	4.281	7.930***	.318
Residual	170	.540		

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Hypothesis Ten

Hypothesis ten was that there would be a significant relationship between test anxiety and academic major choice in postsecondary students, with students having relatively high levels of test anxiety choosing majors generally assumed to be non testing intensive. It was further hypothesized that this effect

would be significantly more powerful for students with learning disabilities than for their non-disabled peers. To test this hypothesis, a 2 x 4 (LD status x major area) ANOVA was performed, with RTA total score as the dependent variable. Major area was determined by the students' response on their demographic data sheet, and was confined to one of four categories: mathematics, physical/biological sciences, social sciences, and humanities. There were six students who fell into the "Other" category for academic major, but these were all students with learning disabilities; as there were no non-LD students at all in this category, the six students in the "other" category were simply excluded from the analysis. Means and standard deviations for the four major categories as a function of LD status are presented in Table 61.

Table 61. Means and standard deviations of RTA scores for each major area as a function of LD status.

Major Area	LD			Non LD		
	Mean	SD	n	Mean	SD	n
Mathematics	43.833	11.444	6	37.231	9.356	13
Hard Sciences	41.615	12.128	13	41.143	6.927	28
Social Sciences	48.453	11.912	53	39.167	8.888	36
Humanities	40.909	11.819	11	43.133	11.819	15
Other	49.667	11.860	6	--	--	0

The results of the ANOVA indicated that while the main effects (major area and LD status) were non-significant, the interaction of LD status and major area was significant, $F(3, 168) = 3.15$, $p < .05$, as was the overall ANOVA, $F(7, 168) = 3.60$, $P < .01$. ANOVA results are presented in Table 62.

Table 62. Hypothesis ten ANOVA results. Dependent variable is RTA total score.

Source	Df	Mean Square	F	ETA sq.
Major	3	108.71	.99	.017
LD Status	1	302.20	2.74	.016
Major x LD Status	3	346.78	3.15*	.053
Within Group Error	168	110.23		
Model	7	396.40	3.60**	.130

(M) = $p < .10$ (marginal significance), * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Looking in more detail at the interaction, it appears that the relationship between test anxiety and academic major area is different for students with and without learning disabilities. For students with learning disabilities, major choices as a function of anxiety were, in order of major with highest mean anxiety to major with lowest mean anxiety: social sciences, math, hard sciences, and humanities. For non-LD students, major choices as a function of anxiety were, in order of major with highest mean anxiety to major with lowest mean anxiety: humanities, hard sciences, social sciences, and math. A graphic representation of this interaction is presented in figure 3.

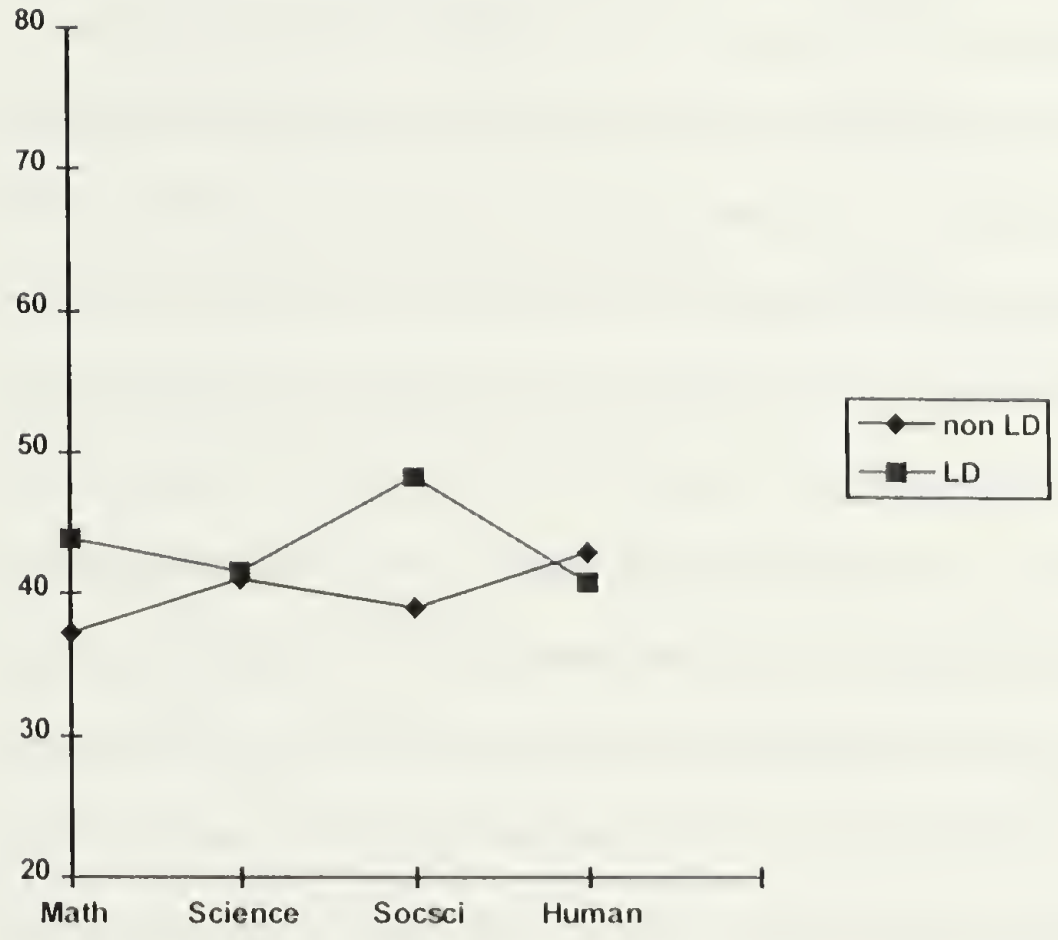

Figure 3. Interaction of LD status and major choice. Dependent variable is RTA total score.

CHAPTER 4

DISCUSSION

Study findings will first be discussed separately for each research question and its corresponding hypothesis(es), followed by a general discussion of the overall implications and limitations of the study.

A major contention behind the choice of students with learning disabilities as a focus of the current study was that this group of students was an exemplar of a group who had experienced a history of academic difficulties and marginalized academic status. The initial analyses performed on the demographic variables related to academic success supported this contention. As expected, students with learning disabilities had experienced a more difficult academic history than their non-learning disabled peers, showing lower GPA's and more course failures and withdrawals. These findings mirror those of Geisthardt and Munsch (1996) and Cosden and MacNamara (1997). Although many of the students with disablities participating in the study (almost 80%) had been diagnosed and receiving support services for many years, they were still experiencing academic difficulties relative to their non-disabled peers. This suggests that many students with disabilities do have a history of academic difficulty that is both long standing and on going. As such, their choice as a group for study was well justified. It is important to note, however, that the differences between students with and without learning disabilities on measures on academic success though significant, were quite small. One possible reason for this is attrition. It may be that only the highest achieving students with learning disabilities choose to progress to the university level. This possibility suggests that differences in academic success between students with and without learning disabilities, and their side effects, such as negative self image (Renick & Harter, 1989; Swanson & Howell, 1996), may be much more pronounced at the high school and middle school levels. This possibility is important to keep in mind when reviewing study findings. As noted in the review of the literature, existing research (Hembree, 1988) suggests that test anxiety is lower at the college than at the high school level, probably for reasons of attrition; it seems likely that the same situation occurs relative to academic performance problems.

Research Question One

Research Question one concerned differences in the level and nature of test anxiety between students with and without learning disablities at the postsecondary level, as well as the effect of testing accommodations used by students with learning disabilities on these differences. Hypothesis one, that students with learning disabilities would show higher levels of test anxiety than non-disabled students, and that this effect would increase in significance when the effects of the testing accommodations available to students with learning disabilities were considered, was partially supported. Students with learning disabilities did show higher levels of test anxiety as expected, but the use of testing accommodations had no effect on this relationship. This finding mirrors those of Bryan, Sonnefeld, and Grabowski (1983) who found, working at the middle school level, that students with LD reported higher levels of test anxiety than their non-LD peers. Given the demographic analyses performed in the current study indicating that the students with disabilities did in fact experience a more difficult academic history than the non-disabled students, this finding of higher anxiety in the students with LD also lends support to the large body of research suggesting that a long standing history of academic difficulty is one of the factors that unites groups of students traditionally found to be high in test anxiety (e.g., LD, at risk, minority).

It is important to mention that the effect size of the difference in test anxiety between the students with and without learning disabilities was quite small; as noted previously this may be to some extent a function of attrition, with lower performing students (who are more likely to be both LD and highly anxious) at the high school level choosing not to go on to a traditional four year university such as the University of Massachusetts. It was originally thought that the fairly small size of the difference in anxiety between students with and without learning disabilities might be a function of the use of support services (which would presumably mitigate anxiety) by the students with learning disabilities, but this possibility was not supported. It appears that the support services offered to students with LD at UMASS have little effect on test anxiety. Possible reasons for this finding will be discussed in more detail later, when the effects of the use of support services are considered more extensively.

While hypothesis one considered differences in the level of test anxiety between students with and without LD, hypothesis two considered differences in the nature of test anxiety between these groups,

suggesting that students with and without learning disabilities would differ significantly on the dimensions of test anxiety that were most salient for them. This did in fact turn out to be the case. While students with LD were higher on all measures of test anxiety than non-LD students, this difference was particularly great for the "test irrelevant thinking" dimension. In contrast, between males and females, where there was also a significant difference in test anxiety levels, "tension" was the factor on which differences were greatest. Although this is speculation not directly supported by study data, this finding may make sense in the context of the frequent complaints of attentional problems by students with LD and the common comorbidity of LD and ADHD (Barkley, 1990; Shelton and Barkley, 1994). This possible connection between LD and ADHD suggests that a high "test irrelevant thinking" subscale score may be unique to students with LD and not simply a function of a difficult academic history generally; however, RTA subscale comparisons would need to be made between LD students and those of other academically disadvantaged groups, such as "at risk" and minority students, to see if real differences in subscale profiles exist. That females were significantly higher on the "tension" subscale than males is probably reflective of the fact that the "tension" items on the RTA are those that measure test anxiety generally rather than dealing with specific manifestations of it (e.g., "I am anxious about tests"); previous research indicates that females experience higher anxiety ("trait" anxiety) generally than males (Bander and Betz, 1981). Between students with and without LD, "tension" was the RTA scale with the least difference, supporting the idea that differences in test anxiety between students with and without LD are more a function of something unique to being LD than of an underlying predisposition to be more anxious generally.

Certainly these findings are preliminary, and further research could be done, possibly with an LD sample that had a clearly identified sub-group of students with a comorbid diagnosis of ADHD. Beyond this, as mentioned previously, RTA subscale profiles for different groups of academically marginalized students (including students with LD) might be compared. The current findings do indicate, however, that the nature of test anxiety may be variable as a function of the background and abilities of a given student.

Research Question Two

Research question two concerned differences between students with and without LD in terms of the specific aspects of the testing situation they found to be anxiety producing. This research question was

investigated via hypothesis three, that students with and without LD would differ significantly in their (TSRS) rating of how anxiety producing they found particular aspects of testing situations to be. This hypothesis was supported. In general, students with LD rated almost all situations of the TSRS as more anxiety producing than did non-LD students, and females rated almost all situations more anxiety producing than males. This finding was expected, in that the TSRS correlates at .71 with the RTA, and thus functions overall as a general measure of test anxiety. Between students with and without LD in particular, however, differences in ratings for some situations were much greater than differences in ratings for others. The 11 situations that showed significant differences in ratings between students with and without LD should be looked at more carefully, to determine if effecting changes in these areas might prove helpful to students with LD. For example, the largest differences in anxiety ratings between the groups were on "lack of review sessions" and "crowded exam room." These are situations that are fairly easy to modify, and doing so might prove very beneficial to students with disabilities.

Given that students with LD rated almost all (18 of 20) of the TSRS situations as more anxiety producing than did their non-LD peers, it seems important to look at the two situations that non-LD students showed more concern about. These were "oral presentations," and "tests given outside of class time." Perhaps because oral presentations are an alternative evaluation format in which students generally have more control over how they demonstrate their knowledge, students with LD (who rated this ninth out of 20 in terms of anxiety) feel at less of a disadvantage than they might in a traditional test, and this takes away some of the anxiety occasioned by the presentation itself (this presentation anxiety appears to be quite high for non-LD students, who rated this situation second out of 20 in terms of anxiety). In terms of "tests given outside of class time," students with LD may show less anxiety on tests scheduled outside of class than non-LD students as a result of, due to their special needs, more experiences with alternatively scheduled tests.

It is also important to remember that students with LD were defined for this study on the basis of their receipt of support services from LDSS. These students were thus already receiving, or eligible to receive, a variety of test accommodations, including untimed tests in private quarters, alternative forms of tests (e.g., essay vs. multiple choice), and rescheduling of multiple tests on one day; students with learning

disabilities were also regularly encouraged to see professors and TA's for extra help. To some extent the situations students with LD rated on the TSRS as most anxiety producing (e.g., timed tests, crowded exam room) reflected the *absence* of these accommodations which were generally available to them. This suggests that possibly the students with LD in the study had come to expect these common accommodations and found the prospect of not having them quite anxiety producing. This possibility, of course, operates in concert with the fact that provided accommodations (such as untimed tests) reflect real disability based needs, and test situations disregarding these needs would be likely to cause anxiety whether one had grown to expect the accommodation or not. The connection between common LDSS accommodations and students' with LD TSRS ratings, then, is probably reflective of an interplay between habituated expectations and real learning needs.

TSRS Differences between males and females, as noted, were also reflective of the tendency of the TSRS to mirror overall RTA results. Females were significantly more anxious than males about most of the TSRS situations. These basically across the board differences appear to be reflective of male-female differences in trait anxiety generally (Bander & Betz, 1981; Sarason, 1963). Of note, however, as in the TSRS comparison between students with and without LD, situations involving distractions (e.g., "crowded exam room," and "distractions") showed some of the largest differences in anxiety ratings between males and females. This finding seems to relate to prior research (Nottleman, 1975; Hembree, 1988) suggesting that off task thoughts and behaviors are major components/correlates of test anxiety. More anxious students appear to be more distractible, and to be aware of this as a problem. These findings about the connection between anxiety and distractibility may also relate to students' with LD heightened scores on the "Test Irrelevant Thinking" subscale of the RTA; however, females were not elevated on the "Test Irrelevant Thinking" scale relative to males, though their TSRS scores for situations relating to distractions were high. The connection between test anxiety, attention, LD, and gender thus needs to be investigated further to tease out how all of these variables relate. This is an important area of study, because, as noted in the review of the literature, distractibility may be one of the mechanisms through which test anxiety translates into poorer test performance. Distractions are also a fairly easy (in most cases) testing problem to address; doing so may provide great benefits for the test anxious.

Some of the most useful data overall from the TSRS is simply the rank ordering of test situations from most to least anxiety producing for the full sample. Many of these situations would be quite easy to remedy, (e.g., "unclear test questions," "pop quiz") by the instructor alone. Others are more involved, operating at an institutional level (e.g., "two tests on one day"), but almost all could be addressed. The top nine situations all carry an anxiety rating of 3.4 (out of 5; 3 = a "fair amount" of anxiety) or higher; these certainly are the first aspects of the testing situation that should be looked at by any institution wishing to help students with this issue.

The second aspect of test situations looked at in hypothesis three , subject area, showed clear differences in anxiety levels for testing in different subject areas between students with and without LD, and between males and females. Most notably, students with LD were much more anxious about testing in foreign language classes than were non-LD students; this difference is probably reflective of the fact that almost three quarters of the sample of students with LD had a language based LD. Females were significantly more anxious about testing in mathematics classes than were males; this echos the findings of Bander and Betz (1981) that differences in test anxiety between males and females are greater for sex stereotyped domains, and is reflective of the general stereotype in our society that math is not an academic domain where women excel.

In summary then, the results of the TSRS and of the subject area test anxiety ratings do show clear differences in the aspects of testing found to be anxiety producing by groups of students with different academic histories, abilities, needs, and socialization. These results fit nicely with the model of test anxiety developed by Zohar (1998), which suggests that students' actual levels of test anxiety vary in different situations as a function of their self efficacy for grade attainment on a particular exam in addition to their general level of trait anxiety. Results of the TSRS and subject area ratings suggest that such self efficacy for grade attainment may be a function of the above mentioned factors of academic history, needs, and socialization.

Research Question Three

Research question three concerned differences between students with and without learning disabilities in terms of the types of modifications to the testing environment that they felt would be most

helpful in reducing their test anxiety. This research question was investigated via hypothesis four, that students with and without learning disabilities would differ in their (TMRS) ratings of how desirable particular modifications to the testing environment were. It was found that students with and without LD, and males and females, did differ significantly on their ratings of a variety of testing modifications. As would be expected from RTA and TSRS findings, in general students with LD rated the majority of the TMRS modifications more favorably than did non-LD students; females rated every modification more highly than did males. These general findings are again reflective of the fairly high correlation (.54) between the TMRS and the RTA; however, an interesting pattern emerged when looking at the modifications that students with LD rated significantly more favorably than did their non-LD peers. These modifications mirrored almost exactly the accommodations that the students with LD were already receiving: private test conditions, untimed tests, a campus advocate (i.e., case manager), and flexible scheduling of test time. This finding suggests that the LD acccommodations provided at the University of Massachusetts, Amherst, are perceived by students as useful and helpful in relieving anxiety. It also suggests that once students have actually experienced an accommodation and have become used to receiving it (i.e., many of these students had received similar accommodations in middle and high school) they are more likely to regard it as desirable and/or necessary. Doubtless a combination of these two factors was responsible for the nature of the differences in ratings of testing modifications between students with and without learning disabilities. This finding is also interesting in that it repeats to some extent the findings for hypothesis three, involving the TSRS ratings.

Given that students with LD rated almost all (15 of 18) situations on the TMRS as more anxiety relieving than did their non-LD peers, it seems important to look at the modifications that non-LD students found more appealing. Of the three modifications preferred by non-LD students, only "drop lowest test grade" approached significance in terms of the amount it was more highly rated. On the other two modifications, "option to retake test," and "choice of test questions," mean ratings of students with and without LD were virtually equal. In terms of the larger difference between the groups on "drop the lowest test grade," it seems possible that non-LD students generally consider a low test grade to be a unique experience, caused primarily by remediable behaviors (e.g., lack of studying) that can be compensated for

by better performance on other tests. Students with LD, given their more pervasive difficulties with, and anxiety about testing, may be more likely to perceive all tests as potentially problematic. For non-LD students, then, dropping a single bad test grade might make more of a difference, as they believe they can make up for this on other tests. However for students with LD, other modifications, involving how testing is conducted generally over the course of the whole semester appear to be more desirable. It is important to note however, that both groups rated this accommodation highly, and that the size of the difference between the ratings of the two groups (.24 point on a scale of 1-5) is of small magnitude and may just be unique to the data for these particular groups of students.

Differences between male and female students on the TMRS ratings uniformly showed females as perceiving modifications as more desirable than males. As with the TSRS findings, this result seems reflective of the general and well documented (Bander & Betz, 1981; Sarason, 1963) differences in overall (trait) anxiety level between males and females, with no specific conclusions to be drawn from it.

In terms of the interaction between sex and LD status on the TMRS found on items 10 and 17, there seems to be little to say. These interactions were quite small in effect; given this, and given the fact that significant interactions were only found for two of the 18 situations of the TMRS, they do not seem particularly meaningful or indicative of any important trends in the data. For these two modifications, "partial credit given for showing work," and "outline in advance of what will be on the test," LD status seems to smooth out differences in ratings due to gender (i.e., males and females with learning disabilities rated these situations similarly, while non-LD females rated these modifications as a bit more desirable than did non-LD males); however, as this effect is not repeated throughout the TMRS or exhibited by any of the other measures used in the study, it appears to be of little consequence in general.

As with the test situations rating data, some of the most useful data overall from the test modifications ratings is simply the rank ordering of test modifications from most to least anxiety relieving for the full sample. Most of these modifications would be quite easy to institute (e.g., "outline of test in advance," "option to retake," "drop lowest test grade") by the instructor alone. Others are more involved, (e.g., "free weekly tutoring," "campus advocate"), but almost all could be addressed. All modifications

rated carry a rating of 3 or higher (on a scale of 1-5; 3 = would reduce anxiety a "fair amount"), thus implementing *any* of the modifications listed would likely be seen as quite helpful by students.

Research Question Four

Research question four concerned the nature of a student's LD, and whether or not this would differentially affect their test anxiety levels for different subject areas. This research question was investigated via hypothesis five, that differences in students' with LD anxiety levels for testing in different subject areas would be related to the specific nature of their LD. It was thought, for example, that students with language disabilities would be more anxious about testing in foreign language classes, while students with math based disabilities would be more anxious about testing in math based classes. This hypothesis was not supported, however. It was found that anxiety level did not differ as a function of type of learning disability for any of the six subject areas investigated.

The failure of these results to achieve significance may have been due to a variety of factors. Clear classification of students into language learning disability, math learning disability, cognitive (memory, attention, or organizational) learning disability, or combination learning disability diagnostic categories was not always possible, resulting in students being placed in the diagnostic category in which they fit "best," though in many cases their diagnostics may have indicated some learning needs relative to other categories. Beyond this, the uneven and in some cases small (purely cognitive disablities, n = 2; combination language/math disabilities, n = 14) sample sizes may have made differences between the diagnostic groups difficult to detect. Given that the relationship between mean anxiety scores for the different diagnostic groups were as hypothesized (though not pronounced enough to achieve significance) for each subject area, future studies should explore this question using larger, more evenly matched, and more clearly classified/diagnostically pure samples.

Research Question Five

Research question five concerned the relationship between testing accommodations, perceived control over testing, and test anxiety. This research question was investigated via hypotheses six, seven, and eight. Hypothesis six, that higher levels of perceived control would correlate negatively with test anxiety, was partially supported. Higher external academic locus of control (LOC) scores did correlate

positively with test anxiety, indicating that students who felt they had less control over their academics had more anxiety.

Perceived control over testing, as measured in this study using PCOT factor one, "Actions Taken," did not correlate with test anxiety as originally expected, but this appears to be a function of what this factor actually ended up measuring. PCOT factor one turned out to be a measure of actual behaviors students engaged in relative to the testing situation (e.g., asking for extra time, extra help) as opposed to the amount of control they *believed* they had. Hence, students who scored high on PCOT factor one scored a bit *higher* on test anxiety (instead of lower, as expected). This finding probably occurred for the total sample because PCOT factor one questions directly reflected behaviors that students with LD at UMASS are encouraged to engage in by their case managers, hence, this measure is to some extent confounded with the variable of LD status, which has a similar relationship with test anxiety (students with LD have higher anxiety). Supporting this speculation is the fact that for the sample of students with LD only, PCOT factor one did not correlate significantly with test anxiety at all.

The best correlate of test anxiety in terms of control over testing , or in terms of academic LOC generally, then, appears to be the ALOCS, suggesting that a generalized sense of control over academics is related to lower test anxiety. This effect appears to be independent of LD status, as the LD and non-LD samples in the study had virtually identical mean scores on the ALOCS. This conclusion is supported by the previous research of Hembree (1988), who also found that high test anxiety was significantly correlated with an external LOC (less student control).

In looking at the relationship between perceived control and use of testing accommodations in students with LD, hypothesis seven suggested that students with learning disabilities' use of testing support and general support services would be related to their levels of perceived control over testing. Although LOC as measured by the ALOCS and by PCOT factor one (actions taken to improve the test/grading situation) correlated significantly with use of support services, in the regression model predicting level of PCOT factor one, "Actions Taken," use of services (either testing specific or general support) was not uniquely predictive of control taking. The finding that use of services was not uniquely predictive of control taking, in conjunction with the significant correlation between ALOCS scores and use of testing

services, suggests one possible interpretation of the data: that students with a more internal LOC (conceptualized as a long standing and stable personality trait) tend to use support services as a way of manifesting control, as opposed to the original conceptualization of the study, that the availability and use of support services by students would increase their (internal, psychological) sense of control over testing and over academics generally. Although the salient variables are to some degree confounded, making it difficult to assess the exact nature of the relationships between them, the analyses performed do suggest that in general a more internal LOC leads students to use testing/support services, and to "take action" with professors (e.g., asking for extra time). Availability and use of support services in and of themselves do not as much appear to increase students' sense of control over their testing/grades as to be a vehicle through which a general sense of control can be manifested. This does not imply that support services are not useful, however. As noted, support services are a vehicle through which students can exercise more control over testing. This increased control may translate into higher grades, as indicated by the fact that PCOT factor one, measuring actions taken to get more control over testing/grades, and use of testing support services both correlate positively with GPA. It should also be remembered that when investigating the differences in GPA between students with and without learning disabilities, students' use of testing support services was a significant covariate, mitigating the differences in achievement between these two groups. Support services aid students, but this help appears to be more practical, as opposed to psychological (i.e., changing underlying attitudes/beliefs).

In terms of test anxiety and use of support services, hypothesis eight suggested that the use of support services by students with learning disabilities would correlate negatively with test anxiety. Support services were conceptualized as mitigating test anxiety through providing a (again, psychological) "safety net" of sorts. This was not found to be the case. Support services did not correlate significantly with test anxiety. Again, as in analyses performed on the total sample of students, in the regression model using students with LD only, the best predictor of test anxiety in students with LD was the ALOCS, suggesting, as noted before, that a more external LOC is related to higher test anxiety generally. Although PCOT factor one appeared as a significant unique predictor of test anxiety when combined with the other predictor variables in the regression equation for students with LD, the correlation between PCOT factor

one and RTA score alone was very low and nonsignificant. Thus while the regression equation suggests that (to a very weak degree) high anxious students "take action" more, it seems more reasonable to surmise, given all the data available, that there is no real relationship between PCOT factor one, "Actions Taken," and test anxiety for students with LD. Use of support services, then, does not appear to be directly related to test anxiety levels in either direction: use of services does not reduce anxiety, and high anxiety does not drive students to use services.

In general, then, there does appear to be a relationship between test anxiety, control taking, and use of support services, but the nature of this relationship does not appear to be as originally conceptualized. It was hypothesized that control over testing (originally conceived of as independent of more general measures of LOC) and test anxiety were variables that were relatively malleable with respect to environmental influence (e.g., use of support services), and that changes in support services use would affect these variables. This does not appear to be the case, at least not with the sample of students used in this study. There are several reasons why this might be so. First, in terms of measures, it may be that the measures of use of support services do not reflect students' commitment to utilizing LDSS accommodations as well as they might. Ratings of use of support services were based on archival data only, and while these reflected the amount of contact students had with LDSS, they did not necessarily reflect the nature of such contact. A better measure of students' use of services might have been ratings by the individual students' case managers. This was not possible, however, as students frequently had seen 2-3 different case managers during their time using LDSS services, and most of these case managers were graduate students who, at the time study data was collected, had since left the university. Although not possible to obtain for this study, then, a more precise measure of the extent *and nature* of LDSS students' use of support services might have provided a more accurate view of the effects of such services. Of note, of the two measures of use of support services, only "use of testing support services" showed significant relationships with other variables. The "use of general support services" score was in no way related to any of the other variables in the study. This is probably reflective of the quality of the different measures comprising the two scores. The "use of general support services" score was based on less specific information than the "use of testing support services" score and was thus less precise. This difference

between the two measures is in general indicative of the problems encountered in developing accurate measures for these variables, and suggests that more specific measures of these variables overall might have led to clearer results regarding their functions and importance.

Another measure which did not operate as anticipated was the PCOT. The PCOT was intended to measure student's beliefs about their control over testing as a general (and fairly stable) construct. PCOT factor one, "Actions Taken," was the most psychometrically adequate factor to emerge from the total scale, but this factor measured behaviors related to testing/grading rather than beliefs/attitudes. It may be that beliefs about control over testing are variable as a function of the situation and depend upon factors such as the instructor's demeanor and attitude in any given class, while the behaviors measured by PCOT factor one may be more habitual and consistently engaged in. As such, *perceived control* over testing may not be a static concept amenable to quantification. PCOT items that attempted to measure *beliefs* about testing alone were relegated to PCOT factor two "Persuasion Beliefs," a notably less reliable factor than PCOT factor one. Thus, although PCOT factor one provided interesting data, it did not really provide the data necessary to assess beliefs about control over testing. However, as noted, "control over testing" may simply be a concept that is too situationally variable to be measured reliably anyway. This conclusion actually obliquely supports one of the major contentions of this study, namely that test anxiety and some of its related correlates are in significant part a function of the environment, and cannot be quantified as general traits.

As stated, the data gathered do suggest a relationship between LOC, test anxiety, and use of support services. Only tentative inferences can be made about this relationship, given that all of the correlations between the relevant variables were low to moderate at best. Thus, the following speculations about the relationships between these variables are made with caution. In general, LOC appears to be the central factor, relating both to test anxiety and to use of services. Those students who have a strong sense of control are double winners in that they generally have lower anxiety and that they generally engage in more positive behaviors to help themselves; both of these factors are traditionally related to better grades. Those students with a more external LOC tend to be more anxious and tend to do less to take control over their situations and help themselves. As Bandalos et al. (1995) note, high test anxiety is related to stable,

internal attributions for failure; these types of attributions are consistent with the external LOC found to be related to high test anxiety in this study. Although this is speculation not directly supported by study data, these findings suggest that high anxious students with LD (in this study, at least) may be to some degree experiencing "learned helplessness" (Phillips et al., 1980, p. 338), where a sense of futility about their academic situation lowers their motivation to utilize options that may be helpful to them (i.e., support services). By failing to utilize helpful options, such students do not experience the success they might, and potentially remain stuck in a cycle of anxiety and perceived powerlessness. It is important to note at this point that at the postsecondary level we may only see the lowest level manifestations of such a cycle. Students for whom such a dynamic was most damaging may well have already left formal education before ever reaching the postsecondary level.

In general, then, an external LOC and high test anxiety appear to form a negative constellation that does not support positive self helping behaviors or fuel improved academic performance. Use of support services does not so much appear to affect this constellation as to be affected by it. Of course it is possible that if a student is encouraged and guided to use available support services, positive experiences might result which over the long run could translate into increased feelings of control and ultimately also reduce anxiety somewhat. This possibility needs further investigation. Future studies should attempt to measure these variables (particularly use of support services) more precisely, include additional variables (such as the atmosphere of the particular class under consideration), and use path analytic techniques or structural equation modeling to better assess the nature of the relationships between these variables, and how they may develop over time.

Research Question Six

The final research question of the study concerned the relationship between test anxiety and avoidance of testing intensive classes or major areas. The first part of hypothesis nine, that high levels of test anxiety would correlate significantly with reported avoidance of testing intensive classes/majors, was supported; the second part of hypothesis nine, that this effect would occur to a greater degree for students with LD that for non-LD students, was not supported. Test anxiety showed strong, significant correlations with all measures of testing avoidance for all students. Regression analyses showed that test anxiety was

the single best predictor, standing well above all others used, of self reported testing avoidance. This relationship was not found to be stronger for students with LD than for non-LD students, however. These results echo the findings of Strom et al. (1987), who found that test anxiety correlated negatively with a measure of preference for course difficulty. Test anxiety is already known to affect performance; these findings about course avoidance suggest a much more insidious effect: that of heading off students from participating in courses, majors, or fields of service that they might enjoy, and where they might excel and make valuable contributions. Future studies might look at the factors that affected individual's choices of college majors and careers, using test anxiety as one variable, and determine more precisely the extent to which test anxiety might affect such decisions.

In this study, hypothesis ten constituted an attempt, with the data available, to look at the relationship between test anxiety and academic major choice, to determine if, for this group of students, such an important decision had been affected by test anxiety. Hypothesis ten was that there would be a significant relationship between test anxiety and academic major choice, with more anxious students choosing less testing intensive majors, and that this effect would be more pronounced for students with LD. It was hypothesized, then, that for "typical" students (i.e., non-LD) those with lower test anxiety would be more willing to major in areas traditionally viewed as "scary" and testing intensive, such as mathematics, while those with higher anxiety would tend to major in less "scary", less traditionally testing intensive fields, such as the humanities and social sciences. Although mean differences by major area were not significant, they were in these hypothesized directions for non-LD students. This was not the case for students with LD, however, to the degree that the interaction between LD status and major category was significant. For non-LD students, math majors had the lowest test anxiety, and humanities majors had the highest (as predicted); for students with LD, however, humanities majors showed the lowest test anxiety and social science majors (followed by math majors) the highest. This interaction suggests that students may in fact have their major choice affected by test anxiety; however, this effect is different for students with and without LD, because they tend to have (relative) difficulty with different subject areas. In fact, the differences in RTA score by major choice for students with and without LD to *some* extent reflect the subject area anxiety ratings by students with and without LD investigated as a part of hypothesis three. On

the subject area anxiety ratings students with LD rated language classes as much more anxiety producing than any other kind; this was not the case for non-LD students, who rated math as most anxiety producing. While the anxiety ratings for subject areas by students with and without LD do not *exactly* parallel the findings of regarding test anxiety and major choice, there is enough overlap to speculate that perhaps test anxiety, as it idiosyncratically manifests itself in different students due to their different academic histories and learning needs, may affect long term choices about learning such as which fields of study to pursue and which to avoid. Unfortunately, this conclusion can not clearly be drawn on the basis of this study due to several limitations.

First, academic major categories were broadly defined, with each category, social sciences in particular, covering many different majors. "Social science" majors ranged from Accounting to Sociology; in other words, covering majors that are quite math oriented to majors that are much more similar to humanities. This was reflected in the data, in that more students fell into the social science major than any other group. Due to this, sample sizes for the different majors were unequal, and some were quite small (e.g., math majors with LD =6; humanities majors with LD = 11). Beyond this, first, second, and even third year students may still be choosing and changing majors, so the major area indicated by any given student may not reflect what that student's final choice will ultimately be. Future studies should carefully select approximately equal and reasonably sized samples of students who are *committed to* majors that are clearly exemplars for their particular major category (e.g., psychology majors for "social sciences").

Another problem with the current study regarding majors stems from the manner in which the non-LD sample was selected. 60% of the males in this sample were taken from a chemistry lab course, while all of the females and the remaining 40% of the males were taken from a psychology course. Although both of these courses fulfilled general education requirements at the university, the males (who, remember, generally have lower test anxiety) from the chemistry class were primarily math and science majors. Although they did not constitute the entire non-LD male sample, they were 60% of it. Due to this unfortunate and unforseen sampling problem, findings involving academic major choice and test anxiety may be confounded with sex to some extent and so must be interpreted with caution. Still, given the differences between the samples of students with and without LD, and the ways in which these relate to

subject area anxieties as might be expected, as well as the strong correlation found between measures of test anxiety and measures of course and subject area avoidance, this is clearly a phenomenon deserving of further study.

General Discussion

In general then, several broad conclusions can be drawn from this study. Test anxiety is clearly a phenomenon that varies both quantitatively and qualitatively as a function of individual differences in academic history, areas of academic strength and need, and nature of available academic support; test anxiety also varies as a function of specific aspects of the test situation, such as the subject area testing is being conducted in. These factors all work together in any given test situation to affect the student differently each time. As current models of test anxiety suggest (Zohar, in press; Spielberger & Vagg, 1995), though anxiety as a trait is one component of test anxiety, test anxiety is not simply a constant trait based phenomenon that is set for a particular person regardless of the situation .

Further research, as noted earlier, is indicated in several areas to continue to tease out how specific areas of need (e.g., language versus math based learning needs) translate into anxiety for particular assessment situations. The relationship between test anxiety and distractibility also merits further investigation, particularly in students who may already have attentional problems. This is a particularly important area for research if distractibility/attention problems are a vehicle through which test anxiety is translated into poorer performance. Studies looking at the long term effects of test anxiety on choices involving classes and courses of study are also indicated. Longitudinal and retrospective studies could begin to more clearly illuminate the way anxiety may limit individuals' options and affect life choices. Such research is important, because long term consequences such as this may ultimately prove more damaging to individuals than short term performance deficits; beyond this, short term performance deficits probably act in concert with long term effects, by strengthening individual's beliefs that they "can't handle" testing in certain academic areas, and thus reinforcing avoidance of these areas.

The findings of this study regarding the effects of modifications to the testing environment are a bit more difficult to interpret. On the one hand, student self reports indicated a variety of modifications to the testing environment that they believed would be helpful to them in reducing anxiety; on the other hand,

students with LD who actually took advantage of available testing accommodations did not show a significant reduction in test anxiety. It is possible that the use of these accommodations may simply not affect general, non-sitationally based measures of test anxiety like those used in the study, though they may mitigate anxiety in varying degrees for specific tests, depending upon the particulars of the situation. It is also possible that the modifications actually available to students with LD in the study, although appropriate accommodations for disability, are not the most useful for ameliorating anxiety per se. When one looks at the modifications chosen by students as most important for reducing test anxiety, these more reflect how professors provide review materials and set up grading options, as opposed to specific measures aimed at particular learning needs (e.g., untimed testing). Test accommodations as conceived of by LDSS are in place to equalize a student with a disability's chance of successful performance, not to mitigate anxiety. Thus, the effect of the quite specific modifications offered by LDSS may not be as useful a measure of the potential value of environmental modifications in mitigating test anxiety as are the actual student ratings of proposed modifications (TMRS). In general, then, it appears that modifications to the testing environment could help reduce test anxiety. Again, though, as the nature of test anxiety appears to be variable as a function of individual factors and the particulars of any given test situation, modifications would ideally be tailored to some extent to fit individual student needs as they applied in context. This does not mean that every student needs unique modifications, it simply means that a menu of commonly useful modifications might be developed from which instructors could choose, given their own needs and the needs of individual (or groups of) students. Future studies could manipulate some of these variables (presence and absence of particular modifications) and begin to assess their actual effects and usefulness. Studies such as these would be fairly easy to institute, as many of the modifications to the testing environment rated most highly by students (e.g., outline of test materials in advance, option to retake tests, dropping of lowest test grade) are already commonly used in college courses. Further research could determine what combination of these modifications would be both most helpful to students and most acceptable to instructors. Perhaps ultimately a viable model for conducting non (or less) stressful assessments might be developed that could be implemented as a general rule in college classrooms. The idea of Universal Instructional Design (Silver, Bourke, & Strehorn, 1998) is moving in such a direction;

further research on best combinations of anxiety reducing modifications, given particular student and instructor needs, could contribute meaningfully to this model.

Further research is also indicated on the nature of current support services and their relationship with test anxiety, LOC, control taking, and GPA. Unfortunately, in this study all correlations between these variables were low to moderate at best, and clear conclusions about how they related to one another were impossible to reach. While support services appear to be useful to students, as they are related to higher GPA's, the exact nature of their relationship to LOC and test anxiety is not clear, nor are their possible positive long term effects on these and other variables. Support services possibly have an important role in teaching students how to take more control over testing and grade evaluation; beyond this, as Goldsmith and Albrect (1993) discovered about informal support services, formal support services may also help students emotionally through difficult classes. This would be important to ascertain, as this study suggests that test anxiety leads to course avoidance. Consistent, formal support may mitigate this effect. Models that can begin to specify the direction of relationship between particular support services, test anxiety, control taking, achievement, and course avoidance need to be developed, so that services such as LDSS can be developed even further on useful lines that will be of greatest advantage to students.

Even without additional research, this study has a number of implications for practice, both for psychologists and educators. In terms of working with test anxious students, particularly those with learning disabilities, focusing on attention to task and how to maintain it might be important, as this seems to be a mediator between anxiety and performance. Some research has already been done that supports attention training as a way of increasing the test performance of the test anxious (Ribordy, Tracy, & Bernotas, 1981), and results of this study confirm the potential usefulness of this intervention.

Implications for instructional practice are many and varied. Instructors should consider in detail the student ratings of the anxiety reducing value of modifications to the testing environment and to grading procedures/options, as well as the ratings of anxiety provoking test situations. In reviewing this material, five themes in terms of lessening student anxiety emerge: 1) clarity, in terms of what will be on the test and in test questions themselves, is critical; 2) good review materials and review sessions (particularly for students with LD) are important; 3) an environment that is comfortable (not crowded) and distraction free

is important; 4) options that offer flexibility in accruing course credit, such as available extra credit assignments, and option to drop one's lowest test grade are very desirable to students, and 5) situations that require knowledge of a large amount of material at one time, such as cumulative finals and multiple tests on the same day, are very anxiety producing.

Beyond these important concerns, it is perhaps most important to remember that different situations are anxiety producing for different students. A large percentage of students with LD, for example, have language based learning needs. For these students, tasks that rely heavily on reading comprehension and writing might prove stressful; for other students (including other students with different types of LD as well as non-LD students) this might not be the case. Encouraging students on an individual basis to discuss their learning styles and needs, the types of tasks that cause them anxiety, and the types of modifications to testing/grading that might make them more at ease, could help instructors to develop a menu of testing/credit options that they feel comfortable with and that cover the needs of most students. In many cases this set of options/modifications might be quite simple; for example, allowing extra time on tests, providing review materials, and allowing students to drop one grade. Other cases might be more complex, but the very knowledge that the instructor is aware of the problem and is willing to work with it sets a tone in the classroom that may in and of itself do much to reduce anxiety. Test anxiety is a complex and to some extent idiosyncratic phenomenon, thus the ideas offered here are merely suggestions, though hopefully they indicate directions which instructors may explore when working with anxious students.

As with all research , the current study had a number of limitations that should be mentioned so that they may be taken into account when interpreting findings. One important concern involves the nature of the samples of students used in the study. Although mentioned previously, it is important to remember that the sample of students with LD consisted of students who were defined as LD based upon their receiving support services. The study did not consider students with LD who were not receiving services. These unsupported students with LD may have very different anxiety profiles and learning needs. Also, there is some danger that the most salient common characteristic of the sample of students with LD was their experiences with and use of LDSS services, as opposed to anything unique to their learning needs.

This was reflected in the data at several points, and was noted; however, it is important to keep in mind when reviewing all results, not simply those where its presence is obvious.

The sample of non-LD students was taken from two classes, with the majority of the males taken from a chemistry lab class; thus math and science majors may have been slightly over-represented in the male non-LD population, as discussed previously. In general the demographic data indicate that the samples of students with and without disabilities were fairly well balanced, but these sampling concerns should still be noted in interpreting results.

It is also important to remember that the study took place at a large state university, and that all of the participants were postsecondary students. This limits the generalizability of results to the postsecondary level, and to comparable institutions. This is particularly true in a study considering test anxiety, as the results of the study itself confirm that test anxiety is variable based upon academic history, ability, age, sex , and a variety of other factors; clearly some of these factors (particularly academic history and ability) are salient in university admissions processes, and so generalizability in terms of the nature of the institution where the study took place is limited on these dimensions especially.

It is worth noting that as college attendance is not mandatory, many lower achieving (and thus likely more anxious) students who would have been present in a high school or middle school sample may not be represented in the current study as a result of attrition. A postsecondary sample is likely to be a bit more homogeneous in terms of abilities (and anxiety). Previous research (Hembree, 1988) suggests that test anxiety drops off at the post secondary level, and this should be considered if the results of this study are to be applied in any way to high school populations. Although the statement is made with caution, it seems likely that the test anxiety levels, and probably the differences in test anxiety between students with and without LD, would be more extreme at the high school level. This should be taken into account when evaluating the importance of test anxiety as a factor affecting student performance. As much as test anxiety was a problem for the students in this study, it is probably worse at lower grade levels, where students do not have the choice to not attend school if they find it problematic for whatever reason.

Finally, it should be remembered that some of the measures used in the study (particularly the PCOT) were of limited technical adequacy and/or had only limited investigations of their reliability and

validity performed. Result found using these measures should be interpreted with caution. Concerns regarding the PCOT and LDSS data measures in particular are discussed earlier, but readers should assess these materials (presented in Appendix A) themselves as they review and assess study findings.

Conclusion

In conclusion, this study continues to demonstrate the prevalence and importance of test anxiety as a phenomenon affecting students' academic performance, attitudes, and choices. Importantly, test anxiety is not an equalizing phenomenon, as it more severely affects students who are already academically troubled and thus increases the already too large gap in achievement and opportunity between academically, economically, and socially advantaged and disadvantaged students. Fortunately, as previous research suggests and this study reiterates, there are a number of environmental factors that can be manipulated to mitigate students' test anxiety levels. It is hoped that the presentation and investigation of some such factors in this study will spark both further research on, and implementation of, modifications to the testing environment, so that test anxious students will be better served and not remain at a disadvantage in our schools.

APPENDIX A

DATA COLLECTION INSTRUMENTS

Revised Test Anxiety Scale (RTA)

Revised Test Anxiety Scale

The following items refer to how you feel when taking a test. Use the scale below to rate items 1 through 20 in terms of how you feel when taking tests in GENERAL.

1 = *Almost never* 2 = *Sometimes* 3 = *often* 4 = *Almost always*

1. Thinking about my grade in a course interferes with my work on tests.....1 2 3 4
2. I seem to defeat myself when taking important tests.....1 2 3 4
3. During tests I find myself thinking about the consequences of failing.....1 2 3 4
4. I start feeling very uneasy just before getting a test paper back.....1 2 3 4
5. During tests I feel very tense.....1 2 3 4
6. I worry a great deal before taking an important exam.....1 2 3 4
7. During tests I find myself thinking of things unrelated to the material being tested.....1 2 3 4
8. While taking tests, I find myself thinking how much brighter the other people are.....1 2 3 4
9. I think about current events during a test.....1 2 3 4
10. I get a headache during an important test.....1 2 3 4
11. While taking a test, I often think about how difficult it is.....1 2 3 4
12. I am anxious about tests.....1 2 3 4
13. While taking tests I sometimes think about being somewhere else.....1 2 3 4
14. During tests I find I am distracted by thoughts of upcoming events.....1 2 3 4
15. My mouth feels dry during a test.....1 2 3 4
16. I sometimes find myself trembling before or during tests.....1 2 3 4
17. While taking a test my muscles are very tight.....1 2 3 4

18. I have difficulty breathing while taking a test.....1 2 3 4

19. During the test I think about how I should have prepared for the test.....1 2 3 4

20. I worry before the test because I do not know what to expect.....1 2 3 4

Thank you !

Notes: To obtain sub-scale scores, Worry items = 1, 2, 3, 8, 11, 19; Tension items = 4, 5, 6, 12, 20; Test Irrelevant Thinking items = 7, 9, 13, 14; Bodily Symptoms items = 10, 15, 16, 17, 18.

Academic Locus of Control Scale (ALOCS)

Academic Beliefs

Please read each of the following statements, and in the blank immediately before the statement put a "T" if you believe the statement is *more true* than false, and put an "F" if you believe the statement is *more false* than true.

____1. College grades most often reflect the effort you put into classes. (F)

____2. I came to college because it was expected of me. (T)

____3. I have largely determined my own career goals. (F)

____4. Some people have a knack for writing, while others will never write well no matter how hard they try. (T)

____5. I have taken a course because it was an easy good grade at least once. (T)

____6. Professors sometimes make an early impression of you and then no matter what you do , you cannot change that impression. (T)

____7. There are some subjects in which I could never do well. (T)

____8. Some students, such as student leaders and athletes, get free rides in college classes. (T)

____9. I sometimes feel there is nothing I can do to improve my situation. (T)

____10. I never feel really hopeless - there is always something I can do to improve my situation. (F)

____11. I would never allow social activities to affect my studies. (F)

____12. There are many more important things for me than getting good grades. (T)

____13. Studying every day is important. (F)

____14. For some courses, it is not important to go to class. (T)

____15. I consider myself highly motivated to achieve success in life. (F)

____16. I am a good writer. (F)

____17. Doing work on time is always important to me. (F)

____18. What I learn is more determined by college and course requirements than by what I want to learn. (T)

____19. I have been known to spend a lot of time making decisions which others

do not take seriously. (F)

____20. I am easily distracted. (T)

____21. I can be easily talked out of studying. (T)

____22. I get depressed sometimes, and then there is no way I can accomplish what I know I should be doing. (T)

____23. Things will probably go wrong for me sometime in the near future. (T)

____24. I keep changing my mind about my career goals. (T)

____25. I feel I will someday make a real contribution to the world if I work hard at it. (F)

____26. There has been at least one instance in school where social activity impaired my academic performance. (T)

____27. I would like to graduate from college, but there are more important things in my life. (T)

____28. I plan well and I stick to my plans. (F)

Notes: Score is determined by summing the number of externally answered items. External answers are in parentheses at the end of each question. Higher scores thus reflect a more external locus of control; lower scores, a more internal locus of control.

Perceived Control Over Testing Scale (PCOT)

Survey of Beliefs/Behaviors involving Testing/Grading

We are trying to get information regarding student's attitudes about testing and grades.

I. Please circle one of the responses below each question to indicate how true you believe each statement to be. Please answer all questions as honestly as possible. If you have not been in the particular situation described, imagine what you would do if you *were*.

1. When I get a poor test grade I speak to the professor to see what I can do about it.

Never Rarely Sometimes Often Always

2. I ask for extra time to complete assignments when I need it.

Never Rarely Sometimes Often Always

3. I believe that where I sit in the room during a test is important to how well I do.

Never Rarely Sometimes Often Always

4. I'm sure I can convince a professor to change a test grade if I discuss it with him/her.

Never Rarely Sometimes Often Always

5. I'm sure I can convince a professor to change the scheduling of an exam if I request this in advance.

Never Rarely Sometimes Often Always

6. I'm sure I can convince a professor to change his/her exam format (for example changing multiple choice to essay) if I request this in advance.

Never Rarely Sometimes Often Always

7. How well I do on tests is mostly up to me.

Never Rarely Sometimes Often Always

8. How well I do on a test depends on things I can't control.

Never Rarely Sometimes Often Always

9. I believe my professors are willing to discuss problems I may have with testing.

Never Rarely Sometimes Often Always

10. I'm sure I can convince a professor to give me an extension on a major assignment if I am having a problem with it.

Never Rarely Sometimes Often Always

11. I know I have done everything I could to prepare myself when I walk into an exam.

Never Rarely Sometimes Often Always

12. I ask for extra credit assignments when I am doing poorly in a class.

Never Rarely Sometimes Often Alway

13. I believe I can get help from professors or TA's on studying for upcoming tests.

Never Rarely Sometimes Often Always

14. I check my work before handing in a

Never Rarely Sometimes Often Always

15. I ask for extra time on a test when I need it.

Never Rarely Sometimes Often Always

16. I speak with my professor/TA about how I can improve my grade

Never Rarely Sometimes Often Always

17. I feel I can find other people to help me study if I need to.

Never Rarely Sometimes Often Always

18. I avoid classes when I know the course grade is based only on rigorous testing.

Never Rarely Sometimes Often Always

19. I avoid whole subject areas because I know that grades in these areas are based almost entirely on rigorous testing.

Never Rarely Sometimes Often Always

20. Having to take the GRE will stop me from applying to graduate school.

Strongly Disagree Disagree Neutral Agree Strongly Agree

21. Whether the GRE is required would effect my decisions about what graduate schools to apply to.

Strongly Disagree Disagree Neutral Agree Strongly Agree

Notes: PCOT scale is items 1-17. Factor 1, "Actions Taken" is composed of items 1, 2, 12, 15, 16. Factor 2, "Persuasion Beliefs" is composed of items 4, 5, 6, 10. Factor 3, "General LOC" is composed of items 7, 8, 9, 13, 17. Items are scored from 0 ("never") to 4 ("always"); item 8 is reverse scored ("always" = 0 to "never" = 4).

TAM is items 18-21. Factor 1, "Admissions Test Avoidance" is composed of items 20, 21. Factor 2, "Class Avoidance" is composed of items18, 19. TAM items are scored in the same manner as PCOT items: 0 ("never" or "strongly disagree") to 4 ("always" or "strongly agree"). There are no reverse scored items on the TAM.

Test Situations Rating Scale (TSRS)

Test Situations Rating Scale

I. Please rate the following test/grade related situations in terms of how much they increase your anxiety about testing/grading.

1. = Not at all

2. = A little

3. = A fair amount

4. = Much

5. = Very much

____1. Pop Quizzes.

____2. Timed tests.

____3. Essay tests.

____4. Multiple choice tests

____5. Short answer tests.

____6. Oral presentations.

____7. Closed book tests.

____8. Cumulative final exam (covers material from the whole course, not just since the previous test)

____9. A crowded exam room

____10. Exam doesn't start on time

____11. Unclear test questions/instructions

____12. Scheduling of tests outside of the regular class meeting time.

____13. Test counts for a high percentage of final grade (more than 30%).

____14. Presence of noise or other distractions/interruptions

____15. Lack of review sessions for test.

____16. Use of computer scan forms.

____17. Test administered on computer.

____18. Assessment of projects/portfolios.

____19. Two or more important tests on the same day

____20. Penalties for guessing (e.g., points subtracted from score for wrong answers)

II. Please rate how anxiety producing you find testing to be in each of the following subject areas, using the following scale:

1 = not at all

2 = a little

3 = a fair amount

4 = very much

5 = completely

____1. Mathematics

____2. Physical/biological sciences

____3. Social sciences (psychology, sociology, business, economics, consumer studies, etc.)

____4. Humanities (English, History, etc.)

____5. Fine Arts (Music, Dance, Art, Theater)

____6. Foreign Languages

Test Modifications Rating Scale (TMRS)

Testing Modifications Rating Survey

Rate the following possible modifications to typical testing/grading procedures in terms of how much they would help you to feel *less* anxious about testing/grading. If you are already provided some of these modifications in your classes, how helpful do you find them in reducing your anxiety?

1. = Not at all

2. = A little

3. = A fair amount

4. = Much

5. = Very much

____ 1. No time limits - can take as long as you need

____ 2. Can use notes/text book during the exam.

____ 3. Take home instead of in class test.

____ 4. Choice of test format (example: choice between multiple choice, essay, short answer, or oral).

____5. Taking the test privately (not with the class), in a quiet area.

____ 6. Flexible scheduling of test time: you choose the date and time of day for test.

____ 7. Having the option to retake the test if your grade is poor.

____ 8. Having extra credit assignments in the class that can help make up for low test grades.

____ 9. Free weekly individual tutoring sessions to help you understand class and prepare for tests.

____ 10. Partial credit given for the process of solving problems (showing work), even if answer wrong.

____ 11. Opportunity to discuss test results with professor after the test.

____ 12. Final papers instead of tests.

____ 13. Choice of questions to answer (example: choose 3 out of 5 possible essay questions).

____ 14. Option of "drop the lowest grade" from semester (final) average.

____ 15. Presence on campus of a designated person to whom you can go for help in communicating with difficult professors about grading and testing issues.

____16. Many small tests/quizzes, given more often, instead of only 2 or 3 major tests.

____17. Getting an outline of exactly what will be on the test, to study from.

____18. Getting practice tests or copies of old tests to prepare with.

Demographic Data, non LD

Background Information

Please answer the following questions honestly to the best of your ability. Please print responses that require writing. Thank you.

1. Sex (circle one): Male Female
2. Year in school (circle one):

   Freshman Sophomore Junior Senior Graduate Other
3. Age: _____
4. Academic major or intended major - please check the area that most closely fits your major area (if undecided, please choose the area you are most likely to major in):

____ Mathematics (including engineering, computer science, and related fields)

____Physical/Biological Sciences (including Health Sciences)

____Social Sciences (including Business/Economics, Consumer Studies, and related fields)

____Humanities (including English, History, Foreign Languages, Fine Arts)

____Other (please specify): _____

5. What is your current GPA:_____
6. How many classes have you failed in college?_____
7. How many classes have you withdrawn from due to fear of failure/low grade?_____

Demographic Data, LD

Background Information

Please answer the following questions honestly to the best of your ability. Please print responses that require writing. Thank you.

1. Name: _____
2. Sex (circle one): Male Female
3. Year in school (circle one):

   Freshman Sophomore Junior Senior Graduate Other
4. Age: _____
5. Approximate age when first diagnosed as learning disabled:_____
6. Academic major or intended major - please check the area that most closely fits your major area (if undecided, please choose the area you are most likely to major in):

____ Mathematics (including engineering, computer science, and related fields)

____Physical/Biological Sciences

____Social Sciences (including Business/Economics, Consumer Studies, and related fields)

____Humanities (including English, History, Foreign Languages, Fine Arts)

____Other (please specify): _____

7. What is your current GPA:_____
8. How many classes have you failed in college?_____
9. How many classes have you withdrawn from due to fear of failure/low grade?_____

LDSS Data Sheet

Support Services Data Sheet

1. Student name:_____

2. Number of semesters receiving support services at LDSS _____

3. Number of contact sheets (divide by number of semesters)_____/_____=_____

4. Number of visits to LD tutor (multiply by 10 and divide by number of semesters)_____x10/_____=_____

5. Number of academic memos =_____

6. Number of special letters = _____

7. Number of test proctoring forms (divide by number of semesters)_____/_____=_____

8. Number of special testing requests, such as alternate types of tests or reader for test (divide by number of semesters)_____/_____=_____

9. Number of accommodations sheets (divide by number of semesters)_____/_____=_____

10. Total score, general support services used (add lines 3, 4, 5, 6) = _____

11. Total score, use of testing support services (add lines 7, 8, 9) = _____

12. Total score, overall use of services (add lines 10, 11) = _____

13. Nature of learning disability:

- Primarily verbal/auditory/writing/language____
- Primarily non verbal/visual/math____
- Primarily cognitive/memory/attention/organization_____
- Other (combination verbal and non verbal)_____

14. Study skills deficit noted or study skills course recommended: yes no

APPENDIX B

INFORMED CONSENT FORMS

Informed Consent, non LD

Study of the Differences in Reactions to, Beliefs about, and Perceived Control over Testing in College Students with and without Learning Disabilities

Consent for Voluntary Participation

I volunteer to participate in this study and understand that:

1. I will be filling out a series of six questionnaires consisting of multiple choice, true false, and rating scales.
2. I will be answering questions about taking tests and how taking tests makes me feel. I understand the reason for this research is to find out more about how college students with and without learning disabilities feel about testing, and what can be done to make testing less stressful for all students.
3. My name will not be used, nor will I be identified personally in any way or at any time.
4. I may withdraw from part or all of this study at any time.
5. I have the right to review the material prior to the final oral exam or other publication of the research.
6. I understand that the results from this survey will be included in Seth Stevens' doctoral dissertation and may also be included in manuscripts submitted to professional journals for publication.
7. There are no foreseeable risks or benefits from my participation in this study, because this is simply an assessment study and not a treatment study.
8. I am free to participate or not to participate without prejudice.

_____ _____ _____ _____

Researcher's Signature Date Participant's Signature Date

Thank you for your participation!

Informed Consent, LD

Study of the Differences in Reactions to, Beliefs about, and Perceived Control over Testing in College Students with and without Learning Disabilities

Consent for Voluntary Participation

I volunteer to participate in this study and understand that:

1. I will be filling out a series of six questionnaires consisting of multiple choice, true false, and rating scales.
2. I will be answering questions about taking tests and how taking tests makes me feel. I understand the reason for this research is to find out more about how college students with learning disabilities feel about testing, and what can be done to make testing less stressful for these students.
3. My file at Learning Disabilities Support Services (LDSS) will be reviewed, by the researcher only, for the purpose of gathering information about my learning disability and about how much I use the services provided by LDSS.
4. My name will not be used, nor will I be identified personally in any way or at any time.
5. I may withdraw from part or all of this study at any time.
6. I have the right to review the material prior to the final oral exam or other publication of this research.
7. I understand that the results from this survey will be included in Seth Stevens' doctoral dissertation and may also be included in manuscripts submitted to professional journals for publication.
8. There are no foreseeable risks or benefits from my participation, because this is simply an assessment study, not a treatment study.
9. I am free to participate or not to participate without prejudice.

_____ _____ _____ _____

Researcher's Signature Date Participant's Signature Date

_____ _____

Participants Name (please print) Participants telephone number

Thank you for your participation!

APPENDIX C

ACADEMIC MAJOR CATEGORIES

The following is a list of all academic majors at UMASS. Each major is followed by a code, indicating how this particular major should be categorized. The codes are as follows: M= Mathematics and related fields (e.g., Engineering); P/BS = Physical and Biological Sciences and related fields (e.g., Health Sciences); SS = Social Sciences (includes Business); H= Humanities (includes languages and fine arts); O = Other (Majors not easily classifiable, such as Landscape Contracting and other School of Agriculture type majors). If a student is in BDIC, their major must be classified according to which field it primarily falls into. Any student listing his/her major as " undecided" (even though they are instructed not to do this) should be put into the other category.

Accounting - M
Afro American Studies - H
Animal Science - P/BS
Anthropology - SS
Apparel Marketing - SS
Art - H
Art History - H
Astronomy - P/BS
Biochemistry and Molecular Biology - P/BS
Biology - P/BS
Building Materials and Wood Technology - O
Chemistry - P/BS
Chemical Engineering - P/BS
Chinese - H
Civil and Environmental Engineering - M
Classics - H
Classics and Philosophy - H
Communication - H
Communication Disorders - P/BS
Comparative Literature - H
Computer Science - M
Computer Systems Engineering - M
Dance - H
Economics - SS
Electrical Engineering - M
Engineering - M
English - H
Entymology - P/BS
Environmental Design - O
Environmental Health - P/BS
Environmental Science - P/BS
Exercise Science - P/BS
Family and Consumer Sciences -SS
Finance and Operations Management - SS

Food Science - P/BS
Forestry - O
French - H
French /Fracophone Studies -H
Geography - SS
Geology - P/BS
German - H
History - H
Hotel Restaurant and Travel Administration - SS
Human Nutrition - P/BS
Industrial Engineering and Operations Research - M
Italian - H
Japanese - H
Journalism - H
Judaic Studies - H
Landscape Architecture - O
Legal Studies - H
Linguistics and any other major tied to it - SS
Management - SS
Marketing - SS
Mathematics - M
Mechanical Engineering - M
Medical Technology - P/BS
Microbiology - P/BS
Middle Eastern Studies - H
Music - H
Natural Resource Studies - O
Nursing - P/BS
Philosophy - H
Physics - P/BS
Plant Pathology - P/BS
Plant and Soil Sciences - P/BS
Political Science - SS
Portuguese - H
Pre-Dental Studies - P/BS
Pre-Medical Studies - P/BS
Pre-Veterinary Studies - P/BS
Psychology - SS
Resource Economics - SS
Russian - H
Russian and Eastern European Studies - H
Science (in combination with other departments in natural and mathematics) - P/BS
Social Thought and Political Economy - H
Sport Management - SS
Spanish - H
Theater - H
Wildlife and Fisheries Conservation - O
Women's Studies - H

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