REDUCTION OF MATH ANXIETY LEVELS OF STUDENTS ENROLLED IN ELEMENTARY ACCOUNTING

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THE RESEARCH PROBLEM

Introduction

Math anxiety has been referred to in the literature in various ways. Kogelman (1978) referred to it as the "fear of numbers," while in 1957, Dreger referred to this same condition as "number anxiety." In addition, "mathophobia" is also a currently used term when discussing math anxiety (Hodges, 1983). Math anxiety is an "I can't" attitude toward math that may surface at any time in a person's life. It is no respector of age, sex, or profession. But, as Burton (1979a) commented:

> Although the condition is not a pleasant one, it does have two positive facets: it is curable at any stage, and its hold is never irreversible. The first step, however, is to admit that the anxiety exists . . . it is important to understand that there is nothing shameful in admitting to being math anxious (p. 130).

Across the nation, clinics are being started at the university level, as well as clinics involving the general public. Tobias founded the earliest math anxiety clinic at Wesleyan University in 1975 (Stent, 1977). Kogelman and Warren (1978) conduct their Mind Over Math workshops on a consultant basis in the New York City area. A similar program was reported by Stent (1977) at Wellesley College in Massachusetts. Each of the programs has the same ultimate goal: to enable the students and clients they serve "who are anxious about math to build their self-confidence and possibly choose careers in which they will use math" (Stent, 1977, p. 43).

Statement of the Problem

The problem of the study was to utilize a selected number of math anxiety reduction techniques to determine if the math anxiety level of elementary accounting students could be reduced. Comparisons were made between a treatment and control group.

This study specifically addressed the following questions:

1. Can the computational math anxiety level of the treatment group, as measured by a revised version of the Mathematics Anxiety Rating Scale (MARS), be reduced during an eight-week treatment period?

2. Can the exam math anxiety level of the treatment group, as measured by a revised version of the Mathematics Anxiety Rating Scale (MARS), be reduced during an eight-week treatment period?

The data for this study were obtained by using Rounds and Hendel's (1980) suggested shortened version of Richardson and Suinn's (1972) Mathematics Anxiety Rating Scale (MARS). The MARS was revised for accounting and two subscales were isolated, a computational anxiety level and an exam anxiety level. In addition data were obtained by means of a questionnaire and opinionnaire developed specifically for this study and by using midterm exam averages. The questionnaire obtained information from each student concerning age, sex, educational background, prior high school and college math courses completed, completion of a bookkeeping course, and college major. The opinionnaire obtained the student's perceived benefit of the math anxiety reduction techniques used in the treatment group.

Hypotheses

The null hypotheses that were tested in this study include:

1. There is no significant difference in the pre-computational math anxiety level and the post-computational math anxiety level between the control group and the treatment group, as measured by a revised version of the Mathematics Anxiety Rating Scale.

2. There is no significant difference in the pre-exam math anxiety level and the post-exam math anxiety level between the control group and the treatment group, as measured by a revised version of the Mathematics Anxiety Rating Scale.

Purpose of the Study

The purpose of this study was to provide accounting instructors with some methods that can be utilized with math anxious accounting students. Math anxiety reduction techniques that were suggested by mathematicians were utilized to determine if these methods could be beneficial in a math-oriented course such as accounting.

Need for the Study

Although literature is replete with research on math anxiety conducted by counselors, psychologists, and mathematicians, little research has been done with a business or accounting focus. The current curriculum of business majors typically includes six hours of college-level accounting. In the accounting textbooks, the assumption is made that the student is competent in the basic math and algebraic functions; consequently, these functions are seldomly discussed. In addition to math anxiety being handled in mathematics courses, math anxiety must be consciously or unconsciously handled in the accounting courses.

Sells (1978, p. 28) reported results of a 1972 survey she conducted "among the top 12.5 percent of high school graduates admitted to the University of California at Berkeley." She found that

> . . . 43 percent of the entering men and 92 percent of the entering women did not have the second year of algebra and the pre-calculus trigonometry background required to prepare for the standard freshman calculus sequence. Thus, 92 percent of the women in this class were effectively relegated to five fields: the humanities, music, social work, elementary education, and guidance and counseling (p. 28).

Tobias (1978), author of Overcoming Math Anxiety, felt that

> . . . the community college, with its emphasis on teaching and its careful, nonthreatening curriculum, may be just the place for a math avoidant adult-- even someone with a previously earned B.A.--to begin to rebuild . . . confidence and skills (p. 249).

The current drop-out rate in many beginning accounting courses is high. Part of this drop-out rate may be attributable to the nature of the course; but a portion is inadequate math preparation and/or math anxiety. Wilson (1952, p. 7), in a survey gathering data on accounting teaching practices from college and university administrators, found that most administrators felt that "the majority of the students were decidedly deficient in the use of the basic arithmetic processes." In a similar study involving a combined business math and business machines class of primarily business education majors, Quinn (1974) found that on a math pretest the students were also deficient in basic math skills.

Two studies by Baldwin and Howe (1982) and Stumbaugh (1975) focused on the completion of bookkeeping and/or algebra as determining factors for success in elementary accounting. Overall, Baldwin and Howe (1982) did not find any significant difference between the performance of students with prior bookkeeping and those students without bookkeeping in the first semester of elementary accounting. Utilizing second semester elementary accounting students, Stumbaugh (1975) found that between bookkeeping and college algebra, the best predictor of success was the completion of the algebra course.

The basic need for this study is best summarized by a quotation from a letter that Shoemaker (1978) received from a female student.

> I desperately need help in overcoming math anxiety because my fear is so great that I am at the point of dropping out of college. Currently, I am taking a course in accounting and I feel lost. Not only that, math has been a problem for me since ninth grade, . . . Deep down inside, I really don't want to give up (p. 145).

Limitations of the Study

This study was limited to students enrolling in either of the two sections of Accounting 2103 taught at Eastern Oklahoma State College during the Fall, 1985 semester. No attempt was made to assign students to groups. In the enrollment process, the students selected either the 8:00 a.m. or 9:00 a.m. lecture section. Determination of which section would be the control group and the treatment group was made by flipping a coin.

This study was also limited because the questionnaire depended upon the students' answering the questions honestly about their feelings toward math and accounting, without being influenced by the instructor's presence or peer pressure. The instrument used, the MARS, was designed to determine the math anxiety level of students in various courses but had not previously been used with accounting students.

Delimitations of the Study

No attempt was made to utilize students at any institution other than Eastern Oklahoma State College. Students involved in this study were enrolled in Accounting 2103 during only one semester (Fall, 1985). As a result, this study only represents students at one institution and results of this study can not be generalized to all elementary accounting students.

Math placement tests were not given to determine math achievement levels and to compare these levels to the computational math anxiety level and exam math anxiety level reported by the students at the beginning and end of the treatment period.

Only a limited number of treatments were utilized. Success of the overall treatments was determined by the reduction in the computational math anxiety level and the exam math anxiety level. The success of one particular treatment over another was determined by the opinion of the student.

Definition of Terms

To facilitate interpretation of the data in this study, the following terms have been defined.

Accounting 2103 (ACCT 2103)--Principles of financial accounting, with emphasis on the financial statements of corporations. The course includes coverage of transactions involving cash; inventories; fixed assets; bonds; capital stock; and adjusting, closing, and reversing entries.

Math Anxiety--"Involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (Richardson and Suinn, 1972, p. 551). Math anxiety is also referred to as fear of numbers, number anxiety, and mathophobia.

Mathematics Anxiety Rating Scale (MARS)--The MARS is a 98-item scale "composed of brief descriptions of behavioral situations" (Richardson and Suinn, 1972). The respondents rank each behavioral situation depending upon the amount of anxiety each situation provokes. The categories range from "not at all" to "very much". (See Appendix A.)

Control Group--Those students enrolled in the 8:00 a.m. section.

Treatment (Experimental) Group--Those students enrolled in the 9:00 a.m. section.

Computational Math Anxiety--The 30-item shortened MARS contains 15 statements in the computational area. Those question numbers are: 1, 2, 3, 4, 5, 8, 12, 14, 16, 17, 18, 19, 20, and 29.

Exam Math Anxiety--The 30-item shortened MARS contains 15 statements in the exam area. Those question numbers are: 6, 7, 9, 10, 11, 15, 21, 22, 23, 24, 25, 26, 27, 28, and 30.

CHAPTER II

REVIEW OF RELATED LITERATURE

This study examines the math anxiety levels of various groups of elementary accounting students at the college level. Math anxiety is a condition that is most frequently experienced by females and is often linked with math ability. Researchers, utilizing elementary students, have found little evidence to support a reduced math ability level in girls. Rather, the decrease in math skills and interest in mathematics tends to be the result of stereotyping girls as a group with little practical use for mathematics in future careers.

The math deficiencies and/or anxieties that often become apparent during the elementary and secondary grades become even more apparent at the college level. The amount of math completed at the secondary level often dictates career possibilities for the traditional student and the adult. At the college level, math anxiety levels have been determined for students enrolled in various math courses, as well as non-mathematics courses.

Adults who return to college for various reasons seem to be one of the more susceptible groups to a higher math anxiety level. In addition to the normal doubts that these students must overcome upon returning to school, math anxieties that may have been ignored for long periods of time must be openly confronted. Math clinics are one possible means of dealing with these old fears.

Research involving adults has focused on various treatment possibilities for adults with a high math anxiety level. In addition, Rounds and Hendel (1980) have isolated a test anxiety and number anxiety component with adults who completed the MARS.

Studies involving business majors have focused more attention on the identification of math deficiencies, rather than explanations for the deficiencies. Research in accounting education has found that the elementary accounting courses are perceived by working graduates to be useful. Factors explored that contribute to success in the first six hours of accounting range from prior bookkeeping and algebra to the age of the student.

The focus of the survey of the research and literature was upon: (1) the elementary and secondary level, (2) the college and university level, (3) the adult college students, (4) business and accounting students, and (5) methods of reducing math anxiety.

Elementary and Secondary Level

Research at the elementary and secondary level has focused upon determining when differences in math ability appear, what factors contribute to these differences, and possible solutions to narrow the differences between male and female students.

Math Ability Differences

In 1973, Ernest surveyed over 1,300 southern California students in grades 2 through 12. The students participating in this study were first asked to rank on the basis of "liking" four subjects, mathematics, English, science, and social studies. The results from this question were anticipated, "boys tended to prefer science and the girls English" (Ernest, 1976, p. 3). The subject that was a surprise in the ranking was mathematics. Ernest (1976) concluded,

> . . . in terms of <u>liking</u> the subject, mathematics was the only subject which exhibited no sex differences. In fact the preference patterns in mathematics were almost identical for boys and girls (p. 3).

Hilton and Berglund (1974) began a longitudinal study in 1961 with fifth grade students, focusing on the differences in mathematics achievement between males and females. Hilton and Bergland (1974, p. 232) felt that as the students became older, "differences in achievement would appear and thereafter would widen." The data for this study were taken from the Educational Testing Services (ETS) Growth Study where the Sequential Test of Educational Progress (STEP) and the School and College Ability Test (SCAT) were given to fifth graders in 1961 and subsequently in 1963, 1964, and 1967, to seventh, ninth, and eleventh grade students (Hilton and Berglund, 1974). Except for the first year, 1961, the students were also given a background questionnaire to complete. One control used in the sample for this study was to use only students who had completed the same amount of training.

Hilton and Berglund (1974, p. 234) found that at grade five, there were "no sex differences in math achievement." They did, however, find that from grades nine through eleven, "males have higher mean scores than females and the differences between the sexes increase with age" (Hilton and Berglund, 1974, p. 234).

In 1981, mathematics achievement was reported from a second national mathematics assessment. Fennema and Carpenter (1981) reported these results of the 1978 national mathematics assessment that included a sample of more than 70,000 students (ages 9, 13, and 17). With their assessment exercises, there was "no clear pattern of differences in achievement . . . at ages 9 or 13" (Fennema and Carpenter, 1981, pp. 554-555). However, at age 17, females were not achieving at the same level as males. Even when comparisons were made between males and females who had taken the same math courses, Fennema and Carpenter (1981, p. 558) found that "males' performance was higher than that of females, and the differences were greatest on the more complex tasks."

When the results of the first and second mathematics assessment were compared, there was little change between 9 and 13 year old students. From the first assessment in 1973 to the second in 1978, "the overall difference between female and male performance at age 17 decreased"(Fennema and Carpenter, 1971, pp. 557-558).

Contributing Influences and Possible Solutions

In addition to focusing on actual achievement in mathematics, differences in attitude have been found between males and females. Success and failure in mathematics is explained much differently by males and females. Boys generally have the attitude "that if they work hard, they will succeed" (Tobias, 1978a, p. 257). Failure in math is normally attributed to not working hard enough or to a bad book or teacher (Kogelman and Warren, 1978, Tobias, 1978a).

Girls, on the other hand, are less likely to attribute math success to ability but explain success in math as more of a lucky guess (Fennema, 1974). On the other hand, females normally attribute failure in math to a lack of ability (Pedro, Wolleat, Fennema, and Becker, 1981).

Math achievement is also influenced by several other variables besides self-confidence. These additional variables include: the perceived future usefulness of math, viewing math as a male subject, and the attitudes of parents and teachers.

Math was perceived as being more useful by males in Hilton and Berglund's (1974) study of math students in grades 5, 7, 9, and 11. The males had the attitude that math would "be useful in helping them earn a living" (Hilton and Berglund, 1974, p. 234). Pedro et al. (1981, p. 216) suggested in order to correct the misconception that math is more useful to males, the future need for math should be presented to "students in both female-specific and general formats. Female students need to be taught that the information does apply to them before they are given the information." Sherard (1983) recommended that math teachers stress the math requirements of a wide variety of programs of study to not only the males and, especially, the females in the class; but also other teachers, counselors, and parents. Sherard also challenged math teachers to relate math concepts being studied to everyday living. These suggestions could help diminish the view of math as a male subject.

Ernest (1976) found in his study of Southern California students that in the lower grades math is not considered as a male subject. The view of male superiority in mathematics does not emerge until high school. Ernest found that of approximately 500 high school students in his study, 32 percent felt that boys did better in math. This compares to 16 percent feeling that girls do better in math.

Fennema and Sherman (1977b) collected data at four high schools in Wisconsin. Overall in these schools, the "boys rated mathematics more of a male domain than girls did" (Fennema and Sherman, 1977b, p. 61).

An equally powerful source that all authors tend to agree upon is the influence of parents and teachers. Tobias (1978) in her book, Overcoming Math Anxiety, presented the contributions, both positive and negative, that parents make:

> Parents, especially parents of girls, often expect their children to be nonmathematical. If the parents are poor in math, they had their own sudden non death experience; if math was easy for them, they do not know how it feels to be slow. In either case, they will unwittingly foster the idea that a mathematical mind is something one either has or does not have (p. 47).

Ernest (1976) found that the father becomes the "math authority" after students complete the sixth grade; while the mother continues to be the "English authority". Fennema and Sherman (1977) suggest that the father's attitude toward mathematics may play a crucial role in the math success of their daughters.

Tobias (1976) illustrated the father's role in a daughter's math preparation.

> Math anxiety is a serious handicap. It is handed down from mother to daughter with father's amused indulgence ('Your mother never could balance a checkbook,' he says fondly.) (p. 57).

She went a step further in her book, Overcoming Math Anxiety (1978, pp. 83-84), by stating: "Parents, peers, and teachers forgive a girl when she does badly in math at school, encouraging her to do well in other subjects instead."

If parents influence success in math, so does the math teacher. Burton (1979a) feels that elementary teachers contribute to their students' math anxiety when they are not adequately prepared to teach math. She recounts in her article entitled, "Getting Comfortable with Mathematics," the typical math preparation of elementary teachers. For most of these teachers, an elementary math methods course is their basic preparation. This course could be the only math course completed since high school. The result can be an elementary math teacher who unconsciously passes his/her own fears to the students.

Adults who are math anxious recall events from their school days that Tobias (1981, pp. 37-38) has placed into four categories: "time pressure, humiliation, emphasis on right answer, and working in isolation." Sherard (1983), Morris (1981), and Burton (1979a, 1979b) have all made recommendations to math teachers that concern these categories.

Sherard (1983) recommended using alternate evaluation procedures; such as homework, group projects, direct observations, etc., to be used as a part of the grading criteria. In the actual testing process, he recommended allowing ample time for the tests and testing for mastery where the students are given the opportunity to take the test more than once. Morris (1981) suggested giving the students the formulas for the test instead of forcing them to memorize the formulas. Kogelman and Warren (1978) emphasized that

> . . . time-limited tests, flash cards, and arithmetic drills have all added to the impression that mathematical competence and speed are the same thing. Speed is not a measure of ability. It is the result of experience and practice (pp. 39-40).

Humiliation and emphasis on one right answer is vividly remembered from going to the chalkboard to work math problems. Morris (1981, p. 44) recommends creating a "positive, supportive classroom atmosphere where all students of any ability are not fearful of asking a question." Educated guessing or intuition should be actively encouraged. Sherard (1983, p. 109) encourages being "generous in awarding partial credit for using correct methods and reasoning." The last category, working in isolation, can be reduced by the use of peer tutoring or mathematics by committee (Morris, 1981).

Burton (1979b), feels that:

> One of the best ways to reduce math anxiety in students currently taking mathematics is through good teaching. Teaching the subject in a meaningful way and insuring that all prerequisite knowledge is part of the student's repertoire is extremely helpful in promoting positive attitudes towards mathematics. Teacher enthusiam and high expectations for student success also go a long way toward dispelling uneasiness (p. 268).

College and University Level

Research utilizing college and university students as the subjects can be classified into three types: (1) comparisons among math students, (2) comparisons between math students and students from other disciplines, and (3) comparisons involving adults.

Studies Among Math Students

One of the early researchers in the area of math anxiety was Dreger and Aiken (1957). They referred to "number anxiety" as "a syndrome of emotional reactions to arithmetic and mathematics" (p. 344). Their original beliefs were predominately supported by their own personal observations, rather than documented research studies. Dreger and Aiken were interested in identifying number anxiety as: (1) being distinct from general anxiety, (2) not being related to intelligence, and (3) results showing that people with high number anxiety will tend to have lower math grades.

Their subjects were over 700 students who were enrolled in basic math classes at Florida State University. The instrument was a modified version of the Taylor Manifest Anxiety Scale. The modification was the exclusion of three low validity items and the inclusion of three items to measure anxiety of working with numbers. Student response to these three math-related questions showed "number anxiety . . . to be present in approximately one-third of the 704 students" (Dreger and Aiken, 1957, p. 346).

Dreger and Aiken (1957, p. 350) concluded in this early research that number anxiety appeared "to be a separate factor from general anxiety," and that number anxiety did not "seem to be related to general intelligence." In addition they found that individuals with higher number anxiety tended to have lower math grades.

During the spring semester of 1981, Calvert (1981) conducted a study with over 400 junior college students who were enrolled in math courses which were considered precalculus level. These math students were given the MARS test and a biographical check list to ascertain sex, age, enrollment status (full or part-time), highest math course completed, and the grade received in this course.

This study focused on four major comparisons: (1) math anxiety levels of males and females, (2) math anxiety levels of students of different ages, (3) math anxiety levels of students based upon the highest math course completed, and (4) math anxiety levels of students by considering the grade the student received in their most recently completed math course (Calvert, 1981).

Calvert (1981) found a significant difference at the .05 level between math anxiety levels and sex. The study involved 215 males who had a mean math anxiety level of 189.4. The 226 females had a mean math anxiety level of 204.3. The mean age was 22.02 and age was not found to "be an accurate predictor of the level of mathematics anxiety" (Calvert, 1981, p. 29).

A significant difference was also found between the last math course completed and the grade received in this course. An especially interesting result of this study was that the 45 students who had completed only a general math course had a mean math anxiety level of 240.53; while the six students completing the first course of calculus had a mean score of 132 (Calvert, 1981, p. 29).

Three beginning algebra classes where enrollment totaled approximately 150 students were utilized in a 1980 study by Bohuslov. Bohuslov (1980) was interested in math anxiety levels and attitudes of students who were experiencing algebra for the first time. The researcher used five of the nine scales that were developed in 1976 by Fennema and Sherman to measure attitudes related to mathematics (Bohuslov, 1980). The five scales selected to be used in this study each included six positively worded items and six negatively worded items that are ranked on the basis of 5 = strongly agree to 1 = strongly disagree. The scales included were:

1. Attitude Toward Success in Mathematics Scales
2. Attitude Toward Teacher Scale
3. Mathematics as a Male Domain
4. Usefulness of Mathematics Scale
5. Mathematics Anxiety Scale (Bohuslov, 1980, p. 12).

From the responses to the scales, those "reflecting negative or conflicting attitudes or anxieties were summarized for class discussion" (Bohuslov, 1980, p. 13). Class discussions focused on possible explanations of the extremes and recommendations that the students felt would reduce the extremes.

The results of the first scale, Attitude Toward Success in Mathematics, showed that females had conflicting "attitudes toward top grades and having others know that they earned top grades"

(Bohuslov, 1980, pp. 15-16). Bohuslov (1980, p. 25) concluded that although students want to do well in math, "their anxiety seems to stem to some degree from peer pressure." Student recommendations included class discussion of not only math anxiety but also peer pressure. The students also recommended that class objectives, as well as grading procedures and standards, be discussed and given to students in a written form.

The results from the second scale, Attitude Toward Teachers, revealed that women have a more negative attitude toward their teachers than men. The scores on this scale tended to be in the middle. Class discussion resulted in students' expressing the feeling "that more math teachers appeared aloof and distant and did not come across as warm human beings" (Bohuslov, 1980, p. 25). These feelings by students support the suggestions to teachers made by Burton (1979a, 1979b), Morris (1981) and Sherard (1983). The students from Bohuslov's (1980) study recommended that math teachers test for mastery, set no time limits for completion of exams, immediately grade and discuss errors made on exams with students, and devise some alternate grading procedures.

The results from the third scale, Mathematics as a Male Domain, was that "women's attitudes appear very strong on both positively and negatively worded items" and a desire to know more about the contribution math makes to success in a variety of careers (Bohuslov, 1980, p. 26). The students recommended beginning the discussion of careers with careers, such as computer programming/data processing.

Discussions of careers requiring math competencies might also influence the results of the fourth scale, Usefulness of Math. The males from this study saw math as being "useful through out life;" while females viewed "math as primarily job oriented" (Bohuslov, 1980, p. 19).

On the fifth and final scale, Mathematics Anxiety, Bohuslov's (1980) subjects, both male and female, exhibited high levels of test anxiety. Modifications of test procedures and practices were the major student suggestions.

Bohuslov suggested that results from his study could be utilized in an experimental study with a control group to determine if the recommendations from this study actually reduce math anxiety levels or result in a modification of the student's attitudes toward math.

Resnick, Viehe, and Segal (1982) utilized the study of Betz (1978) with modifications. First, the Resnick et al. (1982) study used math students in a precalculus course and three different course combinations that covered the calculus sequence. Betz (1978) utilized one group of precalculus students, one group of calculus students, and a group of students enrolled in an introductory psychology course. Both studies focused on math anxiety and its relationship to sex and prior math achievement. Betz (1978) included an investigation of the relationship between math anxiety and ability, general anxiety, and test anxiety. (A full description of Betz's (1978) study will be made later in this chapter.) Resnick et al. (1982) compared math anxiety and interest and attitudinal measures based on the Strong-Campbell Interest Inventory (SCII). From the Strong-Campbell Interest Inventory, three scales were obtained: (1) Mathematics Basic Interest, (2) Academic Orientation, and (3) Introversion-Extroversion. In addition, the subjects of the study were given the MARS test and a

Math Placement test that had been developed and used by the mathematics department at the University of Rochester, a private institution that has a selective undergraduate admissions policy.

The mean MARS score was 156, which is a lower overall score than researchers have reported for other groups of college students. When the students of the various courses were isolated, the MARS scores were higher for students enrolled in the pre-calculus course (Resnick et al., 1982).

Resnick et al. (1982) also did not find any large differences in the MARS scores of males and females. This may be partially attributable to the age of the students. Students at the University of Rochester are normally 17 to 22 years of age. The students in this study averaged 18 years of age.

The authors concluded that although math anxiety is not apparent at the University of Rochester, "this study in no way detracts from the need to vigorously and appropriately advise students of the necessity of a background in mathematics for many vocations and jobs" (Resnick et al., 1982, pp. 46-47). Instead, this study indicates the need to evaluate the math anxiety levels of students in a variety of institutions and settings.

The four studies presented in this section involved college age students enrolled in various mathematics courses and the studies were in general agreement concerning their findings. Dreger and Aiken (1957) concluded that math anxiety was different than general anxiety. Bohuslov (1980) and Calvert (1981) found differences in the math anxiety levels of males and females. In addition, Calvert found a significant difference between math anxiety and the last math course completed and the grade received in that course. Bohuslov

(1980) was concerned with the attitudes and recommendations of the students involved in his study so that procedures could be taken to reduce the extreme responses. Bohuslov did find evidence of peer pressure causing a difference in the attitude of college students and a difference in the perceived usefulness of mathematics. These attitudes have been found by researchers as early as the elementary level. The work of Resnick et al. (1982) did not support the findings of the other three researchers. The institution used by Resnick et al. was an institution with a selective admission policy where the age of the students involved in this study were 17-22 years of age. The results of this study reinforce the need to evaluate math anxiety at a variety of institutions.

Studies Between Math Students and Other Students

A popular group of students to either use alone or to compare with math students has been students in psychology classes. These psychology classes are normally required by a variety of majors, thus making the comparisons with math classes suitable. Two studies have been completed by Betz (1978) and Morris, Kellaway and Smith (1978). Betz (1978) measured math anxiety using a modified version of the Mathematics Anxiety Scale of Fennema and Sherman (1977a, 1977b); while Morris et al. (1978) utilized the Mathematics Anxiety Rating Scale of Richardson and Suinn (1973).

Betz (1978, p. 442) was interested in not only identifying the level of math anxiety including the effect of sex, age, and prior math courses completed, but was also interested in the "relationships between math anxiety and ability, general anxiety, and test anxiety." General anxiety was measured by using the State-Trait Anxiety

Inventory, A-Trait Scale; test anxiety by the Test Anxiety Inventory; and ability by the ACT Mathematics and Verbal subtest scores. Her subjects were divided into three groups. The first group, designated as Math 1, was composed of students enrolled in the most basic mathematics course offered. The second group, designated as Math 2, was a "precalculus course for students planning majors in engineering, the physical sciences, mathematics, and premedicine" (Betz, 1978, p. 442). The third group was composed of students enrolled in an introductory psychology course.

From this study Betz (1978) reported that:

> Approximately half of the Math 1 students and one-fourth of the Psychology 1 and Math 2 students indicated that math made them feel 'uncomfortable, nervous, uneasy, and confused.' Expressions of anxiety were most common when the items concerned math tests; about half the students in all three groups reported getting 'really uptight' during math tests (p. 446).

When comparing the math anxiety levels of males and females, the female students in Math 2 were the only group that did not report higher levels of math anxiety than males. In Math 2, males and females were basically equal in reported math anxiety levels. Older women in both math groups did report higher math anxiety levels than those students who entered college immediately upon completion of high school.

Betz (1978) also found math anxiety moderately related to ACT Mathematics scores. A moderate degree of relationship was also found between math and test anxiety. Betz (1978, p. 447) concluded that this may suggest "that some students reporting test anxiety may be primarily math anxious and experiencing greatest difficulties with anxiety during math tests."

Counselors were urged to "explore the extent to which anxiety about math is causing a student to limit his or her educational and/or vocational options" (Betz, 1978, p. 447). Ernest (1976, p. 11) found that at the University of California at Santa Barbara in the elementary calculus courses during the Fall of 1971, "women comprised only about a third of the class even though women were in the majority in the freshman class." Sells (1978, p. 28), in a 1972 survey of freshman at Berkeley, found that "among the top 12.5 percent . . . 92 percent of the entering women" had not completed the prerequisites for freshman calculus.

Morris et al. (1978) compared math anxiety, measured by the MARS test, to the worry and emotionality components of test anxiety. They compared math majors voluntarily taking courses in their major to psychology students required to complete a statistics course.

The MARS test was given prior to the first exam. The total score and three subscores were computed for: (1) math class anxiety, (2) math test anxiety, and (3) math studying anxiety. After the MARS was administered and prior to the first exam, a ten-item worry/emotionality questionnaire was administered. Three class scores were utilized: first test, last test, and course grade. The subjects were also asked to rank the difficulty of the course and their perception of the importance of the grade received in the course at the time they completed the MARS.

Morris et al. (1978, p. 591) found "no sex differences in MARS, worry, or emotionality scores, and no significant differences in the magnitude of the correlations for males and females." The psychology students did have higher MARS scores than the math students. Of the MARS subscores, "only the Math Test Anxiety Subscale was correlated with performance for the math students" (Morris et al., 1978, p. 592). Morris et al. (1978) concluded that

> . . . the Math Text Anxiety subscale was a somewhat better predictor of worry and emotionality scores in the actual test situation and might well be used alone when a brief predictive measure is desired. This subscale was also the best single MARS predictor of performance for math students in both studies (p. 592).

Undergraduate students have been utilized in several studies, such as the one conducted by Dew, Galassi and Galassi (1983). A unique feature of the Dew et al. (1983, p. 443) research was the utilization of "multiple measures of math anxiety, thus permitting a direct comparison of the major instruments currently in use and providing basic reliability data for each." The subjects of the Dew et al. research were 769 students at the University of North Carolina at Greensboro during 1981.

The students were given three instruments that are designed to measure math anxiety and one instrument that measures test anxiety. The math anxiety measures were: (1) the Mathematics Anxiety Rating Scale (MARS), (2) the Fennema-Sherman Mathematics Anxiety Scale (MAS), and (3) the Sandman Anxiety Toward Mathematics Scale (ATMS). The Test Anxiety Inventory was utilized, with the worry and emotionality components of this instrument being isolated.

Results of the study indicated that women showed a higher level of math anxiety than men on all the math anxiety instruments. The MARS and MAS also showed approximately the same differences between men and women. When Dew et al. (1983) compared the three math anxiety instruments, they concluded that

> . . . the MARS does seem to be the more internally consistent measure. For some unexplained reason, however, the MARS demonstrated better test-retest reliability with men than women (p. 445).

The Sandman Anxiety Toward Mathematics Scale appeared to be the weakest of the three math anxiety measures.

When Dew et al. (1983, p. 446) compared the math anxiety and test anxiety instruments, they concluded that "although math and text anxiety are related, the two constructs do not seem to be interchangeable."

Math and psychology college students have been two popular groups to be utilized in math anxiety studies. Betz (1978) and Morris et al. (1978) utilized math and psychology students in their studies. Betz (1978) was interested in more than just identifying math anxiety and the effect of age, sex, and prior mathematics courses completed upon math anxiety. In addition, Betz was interested in the relationship of math anxiety to general anxiety and test anxiety. Along with finding a higher level of math anxiety for older women in lower level math and psychology classes, Betz found that there was a relationship between math anxiety and test anxiety. Morris et al. (1978) compared math majors enrolled in a required math course with psychology students enrolled in a required statistics course. Their findings were similar to those of Betz. Morris et al. (1978) found that psychology students reported a higher math anxiety level than math majors. The Dew et al. (1983) study compared three math anxiety instruments and one test anxiety instrument. The Mathematics Anxiety Rating Scale (MARS) was selected as the best math anxiety instrument. Dew et al. also concluded that math anxiety and test anxiety were not the same.

The Adult College Student

The popularity of math anxiety and its subsequent math avoidance was brought to the attention of the general public in 1976 when Ms. magazine published the Tobias (1976) article, "Math Anxiety: Why is a Smart Girl Like You Counting on Your Fingers?" In the Ms. article, Tobias describes a few of the math questions that participants are asked to consider in the math anxiety sessions at Wesleyan University. These sessions stress not the actual solving of math problems, but instead the thought processes that each person uses to solve these problems. Participants of these sessions are asked to share with the group how they approached the problem. The answer is an irrelevant part of these exercises. The emphasis of these exercises is to illustrate that there are several ways to approach a problem and the correct approach is the one that each individual is the most comfortable with.

Math anxiety/avoidance has undoubtedly contributed to the estimated 52.1 million adults who, based upon 1980 figures from the Adult Performance Level Project, are classified as functionally incompetent in computational skills. This estimate results in 32.9 percent of all adults lacking the computational skills needed to "perform productively in society as a citizen, family member, consumer and worker" (Wellborn, 1982, p. 54). As Brocklehurst (1979, p. 22) emphasized, math anxiety "may affect anyone, regardless of gender, but its occurrence and implications seem to affect women and minorities most seriously." Tobias (1978a, p. 98) stated, "men have math anxiety too, but it disables women more."

Many math anxious adults are harboring a misconception concerning their ability to rediscover math. This misconception that adults often have is that they "think that if they could not succeed in mathematics while young, they will never master it" (Tobias and Knight, 1978, p. 5). Tobias and Knight countered this misconception by viewing age not as a disadvantage but as an advantage to learning math the second time around. They chose this viewpoint because the adult "can bring his life experience and a more sophisticated vocabulary to bear on the subject" (Tobias and Knight, 1978, p. 6).

Math anxious adults who are going to rediscover math must again learn to trust their intuition and handle the feared word problem. Tobias (1978a, p. 129), a self-reported victim of math anxiety, feels that "word problems . . . are . . . at the heart of math anxiety." Kogelman and Warren (1978) and Tobias (1978a) both indicate that the difficulty with these problems is largely a reflection of attitude, rather than math aptitude.

In all the research that Tobias (1978a, p. 95) has conducted focusing on math anxiety, she has concluded that, in her opinion, "the most important elements in predicting success at learning math are motivation, temperament, attitude, and interest." Other characteristics that she felt were important are a "willingness to tolerate certain kinds of ambiguity," in addition to "persistence and a willingness to take risks" (Tobias, 1978a, pp. 95-96). Kogelman and Warren (1978, p. 42) were in basic agreement when they stated that "self-confidence . . . is one of the most important determining factors in mathematical performance." This self-confidence must be built or rebuilt, gradually by a series of successful encounters with math. One technique or method of gaining math self-confidence is through participation in a math anxiety clinic.

Math Anxiety Clinics

One of the earliest Math Anxiety Clinics was started in the Fall of 1975 at Wesleyan University by Tobias and Rosenbaum. This clinic was originally targeted toward adult females, although younger females and males are not excluded from the clinic. The Wesleyan Clinic is not a part of the mathematics department but the Math Clinic does offer a one-semester algebra course (Stent, 1977).

The Wesleyan Math Clinic begins by giving each student a diagnostic test. From this diagnostic test, the students are divided into three groups based on their level of math anxiety. The same textbook is used for all groups but the approach taken by the instructor is tailored to meet the needs of the students. During the diagnostic phase, the students are also asked to complete a "math autobiography" where the student "recalls the positive and negative experiences he associates with math from early childhood on" (Tobias and Knight, 1978, p. 5). In addition to the instructors who work with the groups of no more than 20 students per section, the Wesleyan Math Clinic also offers counseling to the students through a psychology lab (Stent, 1977). This counselor/psychologist is an active participant in the diagnostic phase and the regular sessions.

Mathematician and psychiatric social worker, Stanley Kogelman, along with Joseph Warren, worked with Wesleyan University during the first years of the clinic. During the early years when both of these men were associated with the clinic, they also developed the "Mind Over Math" consulting service in New York City. Their consulting service was developed to meet the needs of the general public through workshops and programs for schools, colleges, corporations, and groups of individuals (Kogelman and Warren, 1978). The "Mind Over Math" workshops are approached on a group therapy basis. Their emphasis is not on teaching mathematics but instead on the removal of the "barriers" to learning math so that the participants "can learn the math they need rapidly and on their own" (Tobias and Knight, 1978, pp. 5-6).

A third type of math clinic is located in the math department of Wellesley College in Massachusetts. The students at Wellesley are chosen to participate in the clinic on the basis of SAT verbal and mathematics scores. The students selected are those who showed considerable promise in math. They are not students with the lowest math ability (Stent, 1977). This math clinic stresses instruction and the individual faculty member works with the student's anxiety. The goal of this clinic is the same as the other, to open new doors and career options to the math anxious individual.

In a fourth approach to handling math anxiety, Sequin (1984) utilizes the Suggestive Accelerative Learning and Teaching Method (SALT). The students begin this method by discussing with other participants their own fears and anxieties about math. The unique difference about this method is that it includes an exercise segment to get each student's "blood circulating and their minds cleared so they can concentrate" (Sequin, 1984, p. 34). The purpose of this exercise is in support of the belief that "in order to learn well you must be relaxed physically and mentally" (Sequin, 1984, p. 34).

The physical exercise is followed by an exercise to calm the mind. This clears "the head of external worries and distractions so that learning can take place" (Sequin, 1984, p. 34). After these exercises are completed, the topic for the session is introduced and short problems are completed. This is followed by a presentation of the material a second time with additional problems worked. Quizzes during a session are scored by the student solely for the purpose of learning from any mistakes that are made. Each session ends with the two types of exercises being completed a second time so that the "students leave in a peaceful, relaxed frame of mind" (Sequin, 1984, p. 35).

Research Studies Involving Adults

Hendel has conducted three studies that examine the math anxiety levels of adults. Hendel's first study was completed with Davis (1978) and involved 69 females in a math anxiety program at a large midwestern university. The program consisted of three phases: (1) diagnosis, (2) three choices of courses for special math instruction, and (3) group counseling to reduce math anxiety. The average age of the female participants was 37.2, and 18.6 years had elapsed since their last formal math instruction. Participants in the diagnostic phase chose whether they would enroll in one of the three math courses, participate in the counseling session, or discontinue with the program. Of the 69 participants in the diagnostic phase, 37 chose to enroll in one of the math courses, with 15 also participating in the counseling sessions. Math anxiety was assessed during the diagnostic phase by use of the MARS. The MARS was also used for follow-up after the courses ended.

Hendel and Davis (1978) found that the younger participants were those who completed only the diagnostic phase. The average age of the participant who completed one of the three math courses and participated in the counseling sessions was 40.6. The average decrease in the MARS scores for this group of participants was approximately 75 points. Those participants in only the diagnostic phase were an average of 34.9 and their MARS scores decrease was approximately 14 points. Hendel and Davis (1978, p. 433) concluded "that curricular and counseling interventions for adult women who are anxious about mathematics can be effective in reducing the self-reported level of mathematics anxiety."

Hendel, along with Rounds, reported the results of a similar study in 1980 with over 300 female participants of a mathematics anxiety treatment program. The MARS was given to all the participants. In addition, 67 of the participants (Sample 1) were given three test anxiety measures and an arithmetic placement test. An arithmetic placement test and the Fennema-Sherman Math Anxiety Scale was completed by 111 participants (Sample 2). The participants had a mean age of 35.6 and "16.5 years had elapsed since the participants had received formal instruction in mathematics" (Rounds and Hendel, 1980, p. 140).

Rounds and Hendel (1980) utilized the MARS to isolate a Mathematics Test Anxiety Scale and a Numerical Anxiety Scale. Table I shows the items included in the Mathematics Test Anxiety Scale and Table II shows the Numerical Anxiety Scale. Rounds and Hendel (1980, p. 144) found that the internal consistency reliability

TABLE I

MATHEMATICS TEST ANXIETY SCALE ITEMS REPORTED BY ROUNDS AND HENDEL (1980)

MARS Question Number	MARS Question
26	Signing up for a math course.
28	Walking into a math class.
36	Walking on campus and thinking about a math course.
39	Sitting in a math class and waiting for the instructor to arrive.
45	Raising your hand in math class to ask a question.
54	Taking an examination (final) in a math course.
73	Thinking about an upcoming math test 1 week before.
74	Thinking about an upcoming math test 1 day before.
75	Thinking about an upcoming math test 1 hour before.
76	Thinking about an upcoming math test 5 minutes before.
78	Waiting to get a math test returned in which you expected to do well.
79	Waiting to get a math test returned in which you expected to do poorly.
81	Realizing that you have to take a certain number of math classes to fulfill the requirements of your major.
85	Receiving your final math grade in the mail.
91	Being given a "pop" quiz in a math class.

TABLE II

NUMERICAL ANXIETY SCALE ITEMS REPORTED BY ROUNDS AND HENDEL (1980)

MARS Question Number	MARS Question
1	Determining the amount of change you should get back from a purchase involving several items.
5	Dividing a five digit number by a two digit number in private with pencil and paper.
7	Listening to a salesman show you how you would save money by buying his higher priced product because it reduces long-term expenses.
8	Listening to a person explain how he figured out your share of expenses on a trip, including meals, transportation, housing, etc.
14	Adding up 976 + 777 on paper.
33	Reading your W-2 form (or other statement showing your annual earning and taxes).
47	Reading a cash register receipt after your purchase.
48	Figuring the sales tax on a purchase that costs more than $1.00.
50	Figuring out which of two summer jobs offers the most lucrative; where one involves a lower salary, room and board, and travel, while the other one involves a higher salary but no other benefits.
59	Hearing friends make bets on a game as they quote the odds.
63	Juggling class times around at registration to determine the best schedule.
64	Deciding which courses to take in order to come out with the proper number of credit hours for full-time enrollment.
65	Working a concrete, everyday application of mathematics that has meaning to me, e.g. figuring out how much I can spend on recreational purposes after paying other bills.
67	Being given a set of numerical problems involving addition to solve on paper.
90	Figuring out your monthly budget.

of these scales, "compared favorable with the . . . 98-item MARS."

When the test and number anxiety components were isolated, Rounds and Hendel (1980) found that

> . . . on the average, the female participants in the math anxiety program were reporting 'not at all' to 'a little' apprehension on the Numerical Anxiety Scale items and 'a fair amount' to 'much' apprehension to the Mathematics Test Anxiety Scale items (pp. 143-144).

From their sample of female participants in a math anxiety treatment program, Rounds and Hendel (1980, p. 145) concluded that the anxiety of the participants was "primarily . . . test anxiety and secondarily as anxiety associated with mathematics courses." The Mathematics Anxiety Scale "correlated highly with the STABS, a measure of general test anxiety" (Rounds and Hendel, 1980, p. 145). Results of the Numerical Anxiety Scale showed "that the female participants were relatively unconcerned about numerical manipulation in the context of daily activities" (Rounds and Hendel, 1980, p. 145).

Rounds and Hendel (1980) cautioned that there are limitations to the use of the term mathematics anxiety. The results of their study showed that "mathematics anxiety is less a response to mathematics than a response to evaluation of mathematics skills" (Rounds and Hendel, 1980, p. 146). Rounds and Hendel (1980, p. 146) further recommend that when the MARS is utilized, that the "Mathematical Test Anxiety Scale and the Numerical Anxiety Scale should be scored."

In a third study, Hendel (1980) again utilized females in a mathematics anxiety treatment program. During the diagnostic portion of the treatment program, the participants were given five anxiety scales, an arithmetic test, and an extensive background questionnaire. The five anxiety scales included the MARS, the Suinn Test Anxiety

Behavior Scale (STABS), and three other anxiety scales. The treatment program also included special mathematics courses and group counseling.

The female participants indicated that "mathematics was the least liked subject" and "English was the most liked subject" (Hendel, 1980, p. 222). In addition, the female participants indicated on Hendel's (1980, p. 222) questionnaire that "their mathematics ability was poor," although an average of 3.2 semesters of high school math had been completed. Comparisons made with the MARS scores indicated "that the present group of subjects scored considerably higher than other general groups of students" (Hendel and Rounds, 1980, p. 223). The average MARS score was 254.1. One distinguishing feature of the females who participated in this treatment program was their feeling "that being anxious about mathematics was a problem for them and that they were sufficiently motivated to enroll in a program for its treatment" (Hendel, 1980, p. 227).

Hendel (1980) found the highest correlation between mathematics anxiety and test anxiety. Hendel (1980, p. 228) concluded that "neither semesters of high school mathematics nor years since last formal instruction were important variables in the multivariate prediction of mathematics anxiety."

Business and Accounting Students

The elementary accounting courses have been the focus of much attention in the literature. The variety of needs and career goals of students enrolling in elementary accounting was a concern of the American Institute of Certified Public Accountants (AICPA). In a 1978 report by Wayne J. Albers, chairman of the AICPA Task Force on the Report of the Committee on Education and Experience Requirements for CPAs, the educational requirements of the CPA were outlined and later approved (Education, 1979). These educational requirements have become the backbone of collegiate undergraduate and graduate accounting programs. Their 60-hour general education core included three to six hours of elementary accounting and 12 hours of math and statistics.

The inclusion of elementary accounting in the general education core was due to the belief "that an educated person in our society should learn the rudiments of the subject" (Education, 1979, p. 123). The report further emphasized that elementary accounting should be oriented to meet the needs of students "who may not choose to concentrate in accounting" and "the foundation for those who choose to study the subject in greater depth and may, in fact, attract a large number of the better students to do so" (Education, 1979, p. 123).

The AICPA also recommended 12 hours of math and statistics, but did not include specific courses. Instead, the recommendations included an introduction to the "mathematical techniques that have application to the solution of business problems" (Education, 1979, p. 123).

A deficiency in math skills has been indicated by Wilson (1952) and Quinn (1974). A study of elementary accounting teaching practices in 69 colleges and universities was conducted by Wilson (1952). The data were obtained from the administrator in charge in each institution. Of the 69 administrators who responded, "85 percent stated . . . that the majority of the students were decidedly deficient in the use of the basic arithmetic processes" (Wilson, 1952, p. 7).

Quinn (1974) utilized a mental test of business arithmetic problems as a pretest in a combined office machines and business math class. The test had 48 points possible and the 207 students averaged 16.38 on the test. Quinn indicated that the students in these business calculations courses were predominately business education majors who would be required to complete elementary accounting. From the arithmetic test scores, Quinn (1974, p. 30) felt that "the students would begin accounting with a handicap which could affect their performance."

Wilson (1952), Quinn (1974) and the AICPA (1979) have all focused on the need for accountants and accounting students to have a mastery of mathematics. Cowie and Fremgen (1970) discussed two major reasons why accountants should study math. "First, the use of mathematics in problem solving requires a consistent logical approach" (Cowie and Fremgen, 1970, p. 28). This includes not only the identification of the problem; it also includes selection of relevant information and math techniques and solution to the problem. The second reason Cowie and Fremgen (1970, p. 28) gave to study mathematics is "that certain of mathematics have useful applications in the study and in the practice of accounting."

As early as 1967, Capon identified the importance of the computer and mathematics to accounting. Capon (1967, p. 54) stated that "tomorrow's accountant must be trained in mathematics, for computers have made it possible to apply mathematics to the solutions of accounting or financial problems as never before."

The importance of the computer and mathematics in the career of an accountant was found in Whitham's (1974) study. Whitham sent a questionnaire to owners and managing partners in a random sample of CPA firms included in the AICPA's directory of CPA firms. One portion of Whitman's (1974) study asked the respondents to rank the subjects they felt would be of increased important to persons entering public accounting in 10 years. The subject ranked highest in importance by 92.9 percent of the respondents was computers, followed by mathematics, statistics, and probability (66.8 percent).

The accounting firm of Laventhol and Horwath conducted an equally important study with staff members who were in their first two years of work after completion of a collegiate accounting program. The staff members were divided into two groups: those who had prior accounting/bookkeeping work experience during college and those who did not have any prior work experience (Chazen, Solomon, and Stein, 1977). The results of this study which are of most interest are the course(s) that these staff accountants felt were the most beneficial. Of the staff accountants with prior work experience, 83 percent felt that the most beneficial course was Principles or Elementary Accounting. The group without work experience rated the Principles course as the second most beneficial course.

The results of the Chazen et al. (1977) study have important implications to accounting education. The AICPA expressed the importance of the elementary accounting courses to prepare all individuals with the language of accounting. In addition staff accountants in the Chazen et al. (1977) study expressed the importance of the first six hours of accounting as being the first and second most beneficial accounting course. With the importance of the elementary accounting courses to future career prospects, several studies focus on factors that contribute to success in the elementary accounting courses.

Baldwin and Howe (1982) compared two groups of first semester elementary accounting students: those who had completed high school bookkeeping and those who had not. From 10 sections of elementary financial accounting at Arizona State University, 116 students had completed high school bookkeeping. From these same 10 sections, 116 students were randomly selected who had not completed high school bookkeeping.

Each group was given the same three 50-minute exams and a two-hour comprehensive final exam. Baldwin and Howe (1982) found no significant difference in the performance of elementary financial accounting students who had or had not completed bookkeeping in high school. Baldwin and Howe did find a difference in the scores of the two groups on individual exams. The group that completed high school bookkeeping scored higher on the first tests than the non-bookkeeping group. The results of the final exam showed just the opposite: the non-bookkeeping group scored higher than the bookkeeping group.

Stumbaugh (1975) completed a similar study with students enrolled in the second semester elementary accounting course at four-year colleges and universities in Oklahoma. Stumbaugh had four groups of students, depending upon whether or not the subjects had completed college algebra and whether or not bookkeeping had been completed.

Stumbaugh (1975, p. 72) found that those students that completed the math course and bookkeeping had "the highest level of success in the second course of accounting principles." When only one factor, math or bookkeeping was completed, those subjects with only the math background "achieve at a higher level . . . than those students . . .

who have obtained only a high school bookkeeping background" (Stumbaugh, 1975, p. 72).

Another factor that influences success in accounting is the age of the student. A study by Bachman and Patten (1967, p. 11) of AACSB member schools found that "most schools teach the first elementary accounting course mainly to sophomores." This agrees with studies conducted by Wilson (1952) and Ross (1968).

Age of the student was also found to be a reliable measure of success of students seeking admission to undergraduate accounting programs. Dockweiler and Willis (1984) conducted a study involving students entering the undergraduate accounting program at the University of Missouri--Columbia (UMC). Upon isolating the differences between native (local) students and transfer students, Dockweiler and Willis found that age was an important variable for transfer students. Age was combined with the transfer student's GPA and grade in the second principles course to develop the best model for predicting success in the undergraduate accounting program. For native students, age was replaced by the grade the student received in the first principles course.

Accountants and accounting educators have stressed the need for a solid mathematics background. The work of Wilson (1952), Capon (1967), Cowie and Fremgen (1970), and Stumbaugh (1975) have illustrated this need for a mathematics background prior to studying accounting. Also supporting the findings of these individuals, are the results of the Chazen et al. (1977) study and the study conducted by the accounting firm of Laventhol and Horwath. Both of these studies presented findings that stressed the importance of elementary accounting for not only those students who will not become accounting majors but also for those students who will major in accounting. Baldwin and Howe (1982) found that completion of bookkeeping was not a prerequisite for successfully completing an elementary accounting course. Stumbaugh's (1975) findings agreed with those of Baldwin and Howe (1982) concerning the completion of bookkeeping. An additional factor for determining success in accounting has been age. Bachman and Patten (1967) recommended a sophomore standing prior to enrolling in elementary accounting. Also using age, Dockweiler and Willis (1984) found age as an important variable for predicting success for transfer students in an undergraduate accounting program.

Methods of Reducing Math Anxiety

Mathematicians and psychologists have taken differing approaches in their exploration for methods to reduce math anxiety. The basic approach by mathematicians has been toward the atmosphere of the math classroom and teaching procedures utilized in the classroom. The methods utilized have included completion of math homework by groups of students, use of a "Dummy of the Week" (Smith, 1980), math labs, special review math courses, etc.

Psychologists have focused more on the self-concept and attitudes of math anxious individuals. The methods utilized have included relaxation techniques, test-wiseness, discussion of math anxiety, etc.

Mathematics Classroom

The atmosphere of the mathematics classroom and teaching methods that can be utilized to reduce math anxiety have been discussed by Smith (1980), Morris (1981), and Sherard (1983).

Smith (1980) and Morris (1982) have both advocated the math by committee concept. Working in small groups has made learning math a less intimidating experience. Smith (1980) also pointed out that for many students this is the first time that math is viewed as a social experience. In utilizing the group problem-solving approach, Smith utilizes the committee concept for the first exam.

During the actual exam, these three authors have a variety of recommendations. Smith (1980) and Sherard (1983) both support the concept of mastery testing. Smith (1980, p. 7) has found that "the possibility of retakes seems to reduce the test anxiety and by the middle of the semester very few are needed." Morris (1981) includes the math formulas on the test. During the test, Morris is concentrating on whether the student can apply the formulas. Smith (1980) allows the students to bring any needed formulas on a 3x5 card.

Homework and quizzes are also utilized. Smith (1980) uses unsigned quizzes to determine how many students understand a particular topic, instead of which students understand the material. In addition, Smith has a "Naming Day" where students earn points for knowing their fellow classmates.

To encourage questions, Smith (1980) and Morris (1981) use a "Dummy of the Week" concept. As Morris (1980, p. 414) commented, "the math anxious are especially sensitive to criticism and would rather sit through a whole class without understanding than to risk ridicule by asking a 'dumb' question." Smith (1980) appoints one student each week to serve as the "Dummy of the Week." Any student who has a question that they do not want to ask, writes the question down. The "Dummy of the Week" is then responsible for actually asking the question(s).

The recommendations of Smith (1980), Morris (1981), and Sherard (1983) are primarily focused upon procedures that reduce the tension associated with many mathematics classrooms. The goal of these three individuals is to create a more relaxed atmosphere where learning of mathematics can be more easily achieved. The use of math by committee, mastery testing, and other procedures are methods of achieving this goal.

Math Anxious Individual

The self-concept and attitude of the math anxious have led psychologists to the use of relaxation techniques. These relaxation techniques have been used alone and as a component of the various types of desensitization and anxiety management training.

Desensitization is "a reconditioning process in which the relaxation response is gradually substituted for the inappropriate anxiety response" (Scherer and Pass, 1979, p. 3). The traditional systematic desensitization and accelerated massed desensitization techniques involve the construction of mathematics anxiety hierarchies, training in deep muscle relaxation, and presentation of the anxiety hierarchy items from lowest to highest (Richardson and Suinn, 1973). When each anxiety hierarchy item is presented, the participants are presented with methods of dealing with the anxiety situation.

Anxiety management training (AMT) has been suggested by Suinn and Richardson (1971) as an alternative to the desensitization techniques. Suinn and Richardson cite AMT as a less time-consuming treatment that does not require the construction of anxiety hierarchies. An additional deficiency of the desensitization technique cited by Suinn and Richardson was that the desensitization process concentrates on current maladaptive behavior but not on the development of future maladaptive behaviors. By contrast, "anxiety management training is a partial attempt at preparing the client for coping with future tensions when they arise" (Suinn and Richardson, 1977, p. 499). The time frame needed for the method can be a matter of hours.

Test taking skills have become a popular topic within the last 20 years. Millman, Bishop and Ebel (1965, p. 707) defined test-wiseness "as a subject's capacity to utilize the characteristics and formats of the test and/or the test-taking situation to receive a high score." Millman and Pauk (1969, p. xiii) have pointed out that skill in taking tests can not replace mastering "the subject matter through thorough study and periodic review."

Millman and Pauk (1969) pointed out in their book, How to Take Tests, several tips to be used regardless of the type of exam or subject matter involved. These tips revolved around effective utilization of time, careful reading of the directions and questions, and use of good reasoning. Specific guidelines for approaching the various types of objective test questions have been presented by Millman et al. (1965), Sarnacki (1979), Starks (1981), and Gorman (1981). A consensus of the guidelines presented by these authors was included in Appendix B.

Math anxiety workshops conducted by Tobias and Kogelman and Warren have both included discussions about math anxiety. In their book, Mind Over Math, Kogelman and Warren (1978) point out that math anxiety is not related to intelligence, is no respector of sex or age, and is never fatal. In Chapters 5 and 6 of Mind Over Math, they discuss "math games we play on ourselves" and "math games others play on us." The points discussed by Kogelman and Warren (1978) are presented in Appendix B.

The math anxiety reduction techniques suggested by psychologists can be utilized by the student or participant in math-oriented situations and in other high anxiety situations. The relaxation techniques, desensitization, and anxiety management training are examples of this. In addition, the test-taking tips that have been suggested by the various authors are all designed to apply to any subject. The overall objective of the math anxiety reduction techniques has been to raise the self-confidence of the math anxious individual.

Summary

Math anxiety's roots have been traced to students at the elementary and secondary level. It is also very strongly influenced by the attitudes of parents and teachers. While math anxiety has been found to affect both males and females, much attention has been devoted to females, who have in many studies consistently reported higher levels of anxiety and/or are more willing to openly admit to their fears of math. These fears of math are not a result of a lower ability level, but more frequently a learned response that is traced back to their early and middle school years.

For many years, the accounting profession has recognized that a strong mathematics background is a necessity. Math preparation and success in accounting have been the focal point of numerous studies. The results of these studies have all supported the solid mathematics background theme. But, the connection between an inadequate math background and math anxiety has not been made.

CHAPTER III

RESEARCH DESIGN AND PROCEDURES

The following steps were used in researching the problem, planning the study, conducting the experimental study to reduce the math anxiety level of elementary accounting students, and presenting the results of the study.

1. Review of related literature.
2. Selection and pilot testing of the research instrument.
3. Development of treatment procedures.
4. Selection of the population.
5. Collection of the data.
6. Analysis and interpretation of the data.
7. Presentation of conclusions and recommendations.

This study was designed to obtain data regarding techniques that could be utilized to reduce math anxiety in the elementary accounting classroom. Data were obtained using a standardized research instrument where all references to math courses were changed to accounting courses, an information questionnaire, the midterm exam average, and an opinionnaire. The standardized research instrument was used at the beginning and end of the study by both the control group and the treatment group. The information questionnaire completed by all students yielded data such as age, sex, educational background, math courses completed, prior bookkeeping courses completed, and college major. The mid-term exam average for each student was also obtained. The opinionnaire was completed at the end of the study by the treatment group to determine which treatments the students perceived to be the most beneficial.

This chapter describes the research design by elaborating on each of the steps utilized in completing the study.

Survey of Related Literature

The available professional publications and literature relating to math anxiety and treatments of math anxiety were examined to determine if similar studies had been conducted and to review the literature concerning math anxiety as well as acceptable standardized research instruments. Sources used were the Business Education Index, Business Periodical Index, the Comprehensive Dissertation Index, and numerous professional journals. On-line searches of the Education Resources Information Center (ERIC) data base, the Psychological Abstracts data base, and the ABI Inform Business data base were conducted by the Oklahoma State University Library.

The researcher principally examined the literature from the 1970s to the present but also examined frequently cited literature prior to the 1970s. The review of literature was informative and beneficial, even though no published studies were found which dealt with the reduction of math anxiety in accounting courses.

Selection and Pilot Testing of the Research Instrument

Because of the difficulty in developing a valid and reliable measure of math anxiety, a standardized math anxiety instrument was selected. After a review of the related literature, the Mathematics Anxiety Rating Scale (MARS) was selected.

The Mathematics Anxiety Rating Scale (MARS), shown in Appendix A, was developed in 1972 by Richardson and Suinn. The MARS is a 98-item scale composed of brief descriptions of behavorial situations. The "total mathematics anxiety score is calculated by assigning a value of from 1 to 5 corresponding to the level of anxiety checked" (Richardson and Suinn, 1972, p. 552). A 1 is assigned when the anxiety level of "not at all" is indicated, a 2 for "a little", a 3 for "a fair amount", a 4 for "much", and a 5 for "very much". The total MARS score ranges from 98 to 490.

Richardson and Suinn (1972) collected normative data in a sample of nearly 400 students enrolled in a Missouri university. The results of the normative data are presented in Table III. The students were freshmen and sophomores.

"Reliability data were obtained by retesting two of these classes (n=35) seven weeks later" (Richardson and Suinn, 1972, p. 552). Participants in a separate validity study "were 30 junior and senior students enrolled in an advanced undergraduate psychology course at the University of Missouri" (Richardson and Suinn, 1972, p. 552).

The test-retest reliability coefficient was computed for the 35 students who took the MARS a second time after a lapse of seven weeks. The average MARS score on the first testing was 235.08 and an average of 232.97 was obtained from the second testing (Richardson and Suinn, 1972). The coefficient between the two sets of scores was .85. The "internal consistency reliability coefficient . . . was .97" and Richardson and Suinn (1972, pp. 552-553) concluded that "the test is highly reliable."

TABLE III

RICHARDSON AND SUINN'S (1972) NORMATIVE DATA FOR THE MARS

Percentile Rank	Raw Score
5%	123
20%	156
25%	165
40%	189
50%	215
60%	228
75%	255
80%	267
95%	325

Brush (1978) conducted a validation study of the MARS, utilizing two samples of upperclass university students. The samples of students included humanities, social science, and physical science majors. Students from both samples were given the MARS. The first sample also completed a background questionnaire concerning previous math courses, performance in these math courses, and anxiety about the math courses. The second sample completed the Suinn Test Anxiety Behavior Scale (STABS). Two factors, Problem-Solving Anxiety and Evaluation Anxiety, were isolated from the MARS. When Brush (1978) compared MARS scores and STABS scores, she concluded:

> . . . whereas all major groups expressed similar degrees of test anxiety, they differed considerably in their mathematics anxiety. The MARS is measuring anxiety above and beyond the uncomfortable feeling most students have toward tests (p. 489).

Rounds and Hendel (1980) utilized the MARS in developing a shorter version of the MARS. This 30-item version of the MARS was chosen as the research instrument, after permission was received to substitute the word "accounting" for "mathematics" in the instrument (see Appendix A).

A pilot study was conducted with the Spring, 1985, second semester accounting students at Eastern Oklahoma State College. This group of students was selected since there was no possibility that any of these students would be part of the actual study. The purpose of the pilot study was to compute a reliability measure for the altered research instrument. The alpha level computed, utilizing Cronbach's Coefficient Alpha, was .9615. In addition, the pilot study indicated areas where the anxiety level of the students was high, resulting in evidence that a treatment procedure was needed.

Development of the Treatment Procedures

Treatments were developed as the result of recommendations contained in studies and articles from the subjects of mathematics and psychology. In addition, the questions where students in the pilot study indicated a high anxiety level were utilized.

The treatments developed for this study were classified into three major areas: classroom management techniques, math anxiety discussion, and error analysis tips and test-taking tips. The classroom management techniques were: (1) becoming acquainted with classmates, (2) formation of accounting teams, (3) use of the Student of the Week concept, and (4) no name/no grade quizzes. The second major treatment area involved class discussion and a student handout on math anxiety. Tips on error analysis and tips on taking tests were the treatments of the third major area.

Classroom Management Techniques

The first treatment in this area was that the students become acquainted with fellow classmates. Each student introduced himself/herself to the class. In addition, each student received a copy of the class seating chart and the address and phone number of all students.

The formation of accounting teams was introduced along with the first treatment which emphasized that the students become acquainted with their fellow classmates. The accounting teams were composed of two or three students who completed the first problem in an accounting topic as a group problem. The group solution for the six team problems was turned in and all members of the group received the same grade. All accounting problems cannot be completed by the team approach, but the support of the group or team on the first problem was viewed as a way to aid the less confident student in understanding the material more fully. During the treatment period, the students in the treatment group were encouraged to use team members as study partners.

The Student of the Week concept was designed to reduce the anxiety students felt when they had a question but did not feel comfortable asking the question themselves. From the pilot study, approximately 30 percent of the students responded that asking a question in class produced a level of anxiety ranging from "a fair amount" to "very much." During the treatment period, the students in the treatment group were encouraged to write on paper any questions they had but, for whatever reason, did not feel comfortable asking themselves. A central location was provided for students to place their questions. The two students designated as Student of the Week were then responsible for asking the questions at the next lecture class meeting.

In the treatment group, the concept of no name/no grade quizzes was used. Results of the pilot study showed that for over 50 percent of the students, quizzes produced "a fair amount" to "very much" anxiety. The students in the treatment group put the last four digits of their Social Security number in place of their name. Quizzes were checked for correctness, but no grade was recorded as a part of homework. As a result, the quizzes were used solely for the student and instructor to monitor how well the student was comprehending the material.

Math Anxiety Discussion

A discussion of math anxiety was presented to the treatment group during the first three weeks of class. Class discussion centered around general characteristics and the definition of math anxiety, plus the internal and external dialogue that Kogelman and Warren (1978) discussed in their book, Mind Over Math.

Math anxiety was defined for the students as "tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems" (Richardson and Suinn, 1972, p. 551). Reactions to anxiety in general, both good and bad, were also presented. The roots of math anxiety in elementary school and the contribution of peers and society were discussed. Students in the treatment group were asked to make comparisons between how they handled frustrations involving math and non-math frustrations, such as visiting a doctor or experiencing car trouble.

During the discussion of math anxiety, two positive aspects were stressed: the presence or absence of math anxiety has no relationship to the intelligence of an individual (Burton, 1979a); and as Burton (1979a) stressed, math anxiety is not fatal and can be cured.

Lower self-concept and confidence can be the result of the internal and external dialogues that Kogelman and Warren (1980) describe in Mind Over Math. Kogelman and Warren (1980, p. 70) stress that internal dialogue can be beneficial when used to "urge ourselves on and give ourselves warnings." This self-talk can be harmful when used to criticize and belittle. Kogelman and Warren (1980, pp. 70-71) express concern about this self-talk or games becoming "negative and defeatist" and felt that "if you know what these games are, you will be able to catch yourself playing them." Topics included in Kogelman and Warren's nine "games we play on ourselves" were such items as: everyone knows what to do, except me, speed at completing math, lack of a math mind, deriving a math answer in the wrong way, and asking stupid questions. A more complete description of the nine "math games we play on ourselves" which were discussed are included in Appendix B.

Kogelman and Warren (1980) also devoted equal attention to the external dialogue that the math anxious individual allows others to both intentionally and unintentionally use. Comments such as "you did it the wrong way, it's obvious, and that's an easy problem" are not helpful and only serve to discourage the math anxious (Kogelman and Warren, 1980, pp. 80-89). A more complete description of the six "math games others play on us," as discussed in the treatment groups, is included in Appendix B.

Each student in the treatment group was given a handout of Kogelman and Warren's "math games we play on ourselves" and "math games others play on us." A copy of the student handout on math anxiety is included in Appendix B.

Error Analysis Tips and Test-Taking Tips

The final major treatment area was tips for locating trial balance errors and tips for answering objective test questions. Copies of the handouts given to the students are included in Appendix B.

Errors made in recording and posting accounting transactions first appear when the trial balance is prepared. The trial balance verifies that equal debits and credits were kept in recording and posting accounting entries. The trial balance that balances is not absolute proof that no errors were made, only that equal debits and credits were recorded. The trial balance will not balance when the debit or credit amount is not posted; an individual debit or credit amount is posted twice; a debit amount is posted as a credit or a credit amount is posted as a debit; or addition and subtraction errors, transposition errors, or transplacement (slide) errors are made.

Trial Balance Error Analysis is a step-by-step procedure utilized by accountants to locate the errors in the trial balance described above. The basic logic of the system involves retracing (in reverse order) the steps used to prepare the trial balance. The first steps of the system are to double check the addition of column totals and to verify that each account is in its normal balance position.

If the error has not been located, the next steps involve finding the difference between the column totals. A difference of $.01, $.10, $1.00, etc., normally indicates an addition or subtraction error. The difference can also be divided by 2, 9, or 11, to discover the type of error that has been made. A posting error is evenly divisable by two and indicates that a debit has been posted as a credit or vice versa. If the error is evenly divisable by 9, a transposition error has been made. This error occurs when an amount such as 136 is recorded as 163. A transplacement or slide error is divisable by 9 or 11 and occurs when an amount such as 254.40 is recorded as 25.44.

The current elementary accounting textbooks available for college level students devote very little, if any, space to this error analysis topic. As a result, the elementary accounting student is often given no systematic procedure to use in locating errors in the trial balance. The rationale behind this treatment was to give the students in the treatment group a systematic method to use in locating errors. The assumption was made that the more time a student had to spend looking for trial balance errors, the greater their anxiety. Appenxix B includes the handout the students in the treatment group received.

Many books and articles have been written and seminars conducted that were designed to give the reader or participant a tool that can be utilized while taking an exam. Millman has been a leader in the area of test wiseness. Test wiseness involves using the cues given in test questions as an aid in answering the question. As Gorman (1981) pointed out, test wiseness is not a substitute for understanding the test material, but it can be an aid that is utilized for occasional questions.

Millman and Pauk (1969), authors of How to Take Tests, discussed several general tips that can be used when taking any type of an exam. Before beginning any exam, students should survey the entire test. By also knowing the time allotted for the exam, time can be equally distributed. A question worth 20 percent of the available points on an exam should be allocated approximately 20 percent of the time available for the exam. Millman and Pauk (1969) recommend that students concentrate on the sections that will result in the most points. Other general guidelines include working as rapidly as possible, following directions, and attempting all questions.

Students in the treatment group were given a handout listing general tips that could be used when taking any exam. In addition, the students in the treatment group were given a second handout that listed specific tips for completion, multiple choice, and true-false questions (see Appendix B). During class discussion on the test-taking tips for completion, multiple choice, and true-false questions, examples illustrating the tips were shown on an overhead projector.

At the end of the treatment period, each student in the treatment group rated the treatments using the same scale as that used in MARS. The students rated each treatment based on how helpful they felt the treatment was.

Selection of the Population

The researcher chose as the population for the study those students enrolled and attending Accounting 2103 at Eastern Oklahoma State College during the Fall, 1985 semester. Two daytime lecture sections were available to the students, 8:00 a.m. and 9:00 a.m. on Monday and Wednesday. The lab sections available were on Tuesday from 8:00 to 10:00 a.m. and 10:00 a.m. to 12:00 noon. The laboratory section was completely neutral since students in the control group and students in the treatment group were enrolled in the same lab section. No attempt was made to group students into high or low math anxiety categories. The students participating in this study did not report a high level of math anxiety.

Collection of the Data

The designation of which class would be the control group and which class would be the treatment group was determined by the researcher by means of a coin flip. The control group was the 8:00 a.m. lecture class and the treatment group was the 9:00 a.m. lecture class. The lab sections were neutral since students in the experimental and control groups were interspersed between the two lab sections. The timetable for the administration of the instruments used in the study was as follows:

1. August 19, 1985--Completion of the Math Anxiety instrument and information questionnaire by all students.

2. October 21, 1985--Completion of the Math Anxiety instrument by all students and the opinionnaire by only the treatment group.

An identification of the composition of the groups in the study is shown in Table IV.

TABLE IV

COMPOSITION OF THE GROUPS

	Treatment Group	Control Group	Total
Students completing August 19, 1985 instruments	48	46	94
Students withdrawing prior to October 21, 1985	8	7	15
Students completing October 21, 1985 instruments	40	39	79
Students eliminated from the study due to incomplete data	4	2	6
Students utilized in the study	36	37	73

Analysis and Interpretation of the Data

After the data were completed, the responses were coded and entered into a data set. A SPSS-X program was used to analyze the data, using a repeated measures multivariate analysis of variance design. The tabulation of the data collected is shown in table form in Chapter IV. The interpretation of the tabulated data resulted in the findings which are also reported in Chapter IV.

Presentation of Conclusions and Recommendations

On the basis of the findings reported in Chapter IV, summary, conclusions and recommendations were made which are included in Chapter V.

CHAPTER IV

FINDINGS

The purpose of this study was to compare the pre- and post-computational math anxiety levels and the pre- and post-exam math anxiety levels of students enrolled in elementary accounting during the Fall, 1985 semester at Eastern Oklahoma State College. The comparisons were made to determine if one or both of the anxiety levels could be reduced in the treatment group during an eight-week treatment period.

This chapter reports the findings of the study by presenting statistical evidence and relating these data to the hypotheses and by reporting additional analyses pertinent to the experiment.

Analysis of Data

Information Questionnaire

The first instrument completed by all students was an information questionnaire. Specifically, this form asked for information concerning the student's age, sex, degrees completed, and number of college hours completed. In addition the students indicated, from a list of math courses, which courses were completed in high school or college. This included any math courses in which the student was currently enrolled. The students also indicated their college major and whether or not they had even completed a bookkeeping course. (Appendix C shows the questionnaire.)

Table V shows the specific age and gender information for both the control and treatment group. The range of ages in the control group was 17 to 34 years of age; the range of ages in the treatment group was 17 to 44 years of age. A larger majority of the control group (91.9 percent) was 25 years and younger; while in the treatment group, 74.9 percent was 25 years and younger. The median age of both the control and treatment groups was 19 years of age.

Both of the groups were composed of a larger percent of females than males. Females comprised approximately 65 percent of each group and males the remaining 35 percent.

All students involved in the study were high school graduates. In the treatment group, three students (8.3 percent) had completed an associated degree prior to enrolling in elementary accounting. These statistics are shown in Table VI.

From Table VI, differences are evident between the groups concerning the number of college hours completed. The range of hours completed by the control group was 9 to 65 hours, and in the treatment group the range of hours completed was 0 to 200 hours. The control group was composed predominately of first semester freshmen. Twenty-four (64.9 percent) of the students in this group were first-semester freshmen who had completed less than 15 hours of college credit. Of these twenty-four first-semester freshmen, 20 (54.1 percent) were beginning freshmen that had completed no college hours. The remaining four first-semester freshmen had either completed college credit by concurrent enrollment as a high school senior or by attending summer

TABLE V

AGE AND GENDER COMPOSITION OF THE GROUPS

	Control Group			Treatment Group			Combined Groups		
Variable	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
<u>Age</u>									
17-19	23	62.2	62.2	21	58.3	58.3	44	60.3	60.3
20-22	10	27.0	89.2	3	8.3	66.6	13	17.8	78.1
23-25	1	2.7	91.9	3	8.3	74.9	4	5.5	83.6
26-28	0	--	91.9	1	2.8	77.7	1	1.4	85.0
29-31	2	5.4	97.3	1	2.8	80.5	3	4.2	89.2
32-35	1	2.7	100.0	3	8.3	88.8	4	5.5	94.7
Over 35	0	--	100.0	4	11.2	100.0	4	5.5	100.2
<u>Gender</u>									
Male	13	35.1	35.1	13	36.1	36.1	26	35.6	35.6
Female	24	64.9	100.0	23	63.9	100.0	47	64.4	100.0

TABLE VI

DEGREES AND COLLEGE HOURS COMPLETED BY THE GROUPS

Variable	Control Group			Treatment Group			Combined Group		
	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Educational Background									
Degrees Completed									
High School Student	0	--	--	0	--	--	0	--	--
High School Graduate	37	100.0	100.0	33	91.7	91.7	70	95.9	95.9
Associate Degree	0	--	100.0	3	8.3	100.0	3	4.1	100.0
Bachelor's Degree	0	--	100.0	0	--	100.0	0	--	100.0
Master's Degree	0	--	100.0	0	--	100.0	0	--	100.0
Doctoral Degree	0	--	100.0	0	--	100.0	0	--	100.0
Hours Completed									
0	20	54.1	54.1	3	8.3	8.3	23	31.5	31.5
1-15	4	10.8	64.9	0	--	8.3	4	5.5	37.0
16-30	2	5.4	70.3	11	30.6	38.9	13	17.8	54.8
31-45	8	21.6	91.9	18	50.0	88.9	26	35.6	90.4
46-60	2	5.4	97.3	1	2.8	91.7	3	4.1	94.5
Over 60	1	2.7	100.0	3	8.3	100.0	4	5.5	100.0

school. In the treatment group, only three students (8.3 percent) were beginning freshmen.

The treatment group was composed of approximately 80 percent (80.6 percent) second-semester freshmen and first-semester sophomores. One-half of the treatment group were first-semester sophomores. In the control group, approximately one-fourth (27 percent) of the students were second-semester freshmen or first-semester sophomores.

Table VII shows the high school math courses and college math courses the students had completed or were currently enrolled in. Over one-half (54.0 percent) of the students in the control group had completed the algebra sequence in high school. In addition, over one-third (37.8 percent) had completed geometry in addition to algebra. In the treatment group, over one-half (55.5 percent) of the students had also completed the algebra sequence. One-fourth of the students had completed geometry, and seven students (19.4 percent) had completed trigonometry. In the control group three students (8.1 percent) had completed trigonometry.

At the college level (Table VII), the control group had completed less math than the treatment group. Over two-fifths (43.2 percent) of the students in the control group had not completed nor were currently enrolled in a math course. Less than one-third of the students (29.7 percent) were enrolled in general math or business math/calculations. Over 70 percent (72.9 percent) of the students in the control group had not completed the minimum math requirements that researchers have recommended prior to enrollment in elementary accounting.

TABLE VII

HIGH SCHOOL AND COLLEGE MATH COMPLETED BY THE GROUPS

Variable	Control Group			Treatment Group			Combined Group		
	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
<u>High School Math</u>									
None	1	2.7	2.7	0	--	--	1	1.4	1.4
General or Business Math	5	13.5	16.2	4	11.1	11.1	9	12.3	13.7
Algebra I	8	21.6	37.8	12	33.3	44.4	20	27.4	41.1
Algebra II	6	16.2	54.0	4	11.1	55.5	10	13.7	54.8
Geometry	14	37.8	91.8	9	25.0	80.5	23	31.5	86.3
Trig	3	8.1	99.9	7	19.4	99.9	10	13.7	100.0
Calculus	0	--	99.9	0	--	99.9	0	--	100.0
<u>College Math</u>									
None	16	43.2	43.2	7	19.4	19.4	23	31.5	31.5
General or Business Math	11	29.7	72.9	14	38.9	58.3	25	34.2	65.7
Elementary Algebra	0	--	72.9	0	--	58.3	0	--	65.7
Intermediate Algebra	6	16.2	89.1	10	27.8	86.1	16	21.9	87.6
College Algebra	3	8.1	97.2	2	5.6	91.7	5	6.8	94.4
College Algebra/Trig	0	--	97.2	1	2.8	94.5	1	1.4	95.8
Analytic Geometry	1	2.7	99.9	2	5.6	100.1	3	4.1	99.9
Calculus I	0	--	99.9	0	--	100.1	0	--	99.9
Calculus II	0	--	99.9	-	--	100.1	0	--	99.9

In the treatment group, approximately one-fifth (19.4 percent) of the students had not completed or were not currently enrolled in a college math course. Approximately 40 percent (38.9 percent) were enrolled in or had completed only a general math or business math/ calculations course. In the treatment group, 58.3 percent of the students had not started the algebra sequence. Approximately one-third (36.2 percent) of the students in the treatment group were enrolled in or had completed one of the following three algebra courses: Intermediate Algebra, College Algebra, or College Algebra/ Trigonometry. Over one-fourth (27.8 percent) of these students who had completed or were enrolled in an algebra course selected the Intermediate Algebra course.

Table VIII shows the number of students who had completed a bookkeeping course prior to enrolling in elementary accounting. For the two groups combined, approximately 70 percent (69.9 percent) of the students had not completed a bookkeeping course. The control group was almost equally split between those who had taken a bookkeeping course (43.2 percent) and those who had not taken a bookkeeping course (56.8 percent). In the treatment group, less than one-fourth (16.7 percent) of the students had completed a bookkeeping course. In the treatment group, 83.3 percent of the students had not completed a bookkeeping course.

Table IX shows the majors of the students in the control and treatment groups. The vast majority (95.9 percent) of the students were business majors. Over one-half (51.4 percent) of the students in the control group were Computer Science majors. In the treatment group, over one-half (55.6 percent) of the students were Business

TABLE VIII

COMPLETION OF BOOKKEEPING BY THE GROUPS

	Control Group			Treatment Group			Combined Group		
Response	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Yes	16	43.2	43.2	6	16.7	16.7	22	30.1	30.1
No	21	56.8	100.0	30	83.3	100.0	51	69.9	100.1

TABLE IX

COLLEGE MAJOR REPORTED BY THE GROUPS

Major	Control Group			Treatment Group			Combined Group		
	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Business Administration	13	35.1	35.1	20	55.6	55.6	33	45.2	45.2
Computer Science	19	51.4	86.5	7	19.4	75.0	26	35.6	80.8
Business Education	1	2.7	89.2	4	11.1	86.1	5	6.8	87.6
Secretarial Science	1	2.7	91.9	5	13.9	100.0	6	8.2	95.8
Non-Business	2	5.4	97.3	0	--	100.0	2	2.7	98.5
Undecided	1	2.7	100.0	0	--	100.0	1	1.4	99.9
Adult Education	0	--	100.0	0	--	100.0	0	--	99.9

Administration majors. One-fourth (25 percent) of the students in the treatment group were Business Education or Secretarial Science majors. Over 80 percent (80.8 percent) of all the students in the study were either Business Administration or Computer Science majors.

Midterm Exam Average

The midterm exam average was computed by averaging the first three exams. Identical exams were given in both the control and treatment groups. All exams were administered during the lab section. The division of grades by group is shown in Table X. The combined mean (n=73) for both groups was 79.6. The treatment group (n=36) had a slightly higher average (80.1) than the average (79.1) for the control group (n=37).

Of the 12 students with a 59 or lower average, seven (18.9 percent) were part of the control group while five (13.9 percent) were part of the treatment group. Over 75 percent (75.6 percent--control group and 77.7 percent--treatment group) of the students achieved a midterm grade of a "C" or better. Median grades were 84 for the control group and 87 for the treatment group. The range of grades was 30 to 100 in the control group and 26 to 100 in the treatment group.

Hypotheses Testing

To test the hypotheses, a multivariate repeated measures analysis of variance was performed to compare the two groups. The two measures of the two dependent variables (pre-computational math anxiety, post-computational math anxiety, pre-exam math anxiety, and post-exam math anxiety) were obtained from the students involved in the study by

TABLE X

MIDTERM EXAM AVERAGES OF THE GROUPS

Points	Control Group			Treatment Group			Combined Group		
	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
90-100	15	40.5	40.5	12	33.3	33.3	27	37.0	37.0
80-89	8	21.6	62.1	12	33.3	66.6	20	27.4	64.4
70-79	5	13.5	75.6	4	11.1	77.7	9	12.3	76.7
60-69	2	5.4	81.0	3	8.3	86.0	5	6.8	83.5
Below 59	7	18.9	99.9	5	13.9	99.9	12	16.4	99.9

use of the standardized research instrument (MARS--revised for accounting). The students completed this instrument at the beginning and end of an eight-week treatment period. Table XI shows the means and standard deviations of the control and treatment groups.

TABLE XI

MEAN AND STANDARD DEVIATION OF THE GROUPS FOR THE DEPENDENT VARIABLES

	Control Group		Treatment Group		Combined Groups	
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Pre-Computational	25.11	7.73	21.44	5.93	23.30	7.09
Post-Computational	26.68	7.38	20.67	4.87	23.71	6.92
Pre-Exam	37.84	10.53	37.06	14.76	37.45	12.71
Post-Exam	36.84	14.50	38.61	12.04	37.71	13.25

The error correlation of .527 between the two dependent variables form a construct and signify that results first be described as multivariate F. The three multivariate effects are group, the repeated factor (labeled time), and the interation of the two effects. A significant multivariate F indicates a need for isolating the univariate F to determine which dependent variable contributes the most to the significant multivariate F. Table XII shows the Wilks Lambda multivariate F and univariate F values. The multivariate F values are reported below, and the univariate F values are discussed with the restatement of each null hypothesis.

TABLE XII

MULTIVARIATE AND UNIVARIATE DATA

	df	Univariate F	Multivariate F	Eta^2
Time X Group	2, 70		5.19**	.129
Exam Anxiety	1, 71	1.10		
Computational Anxiety	1, 71	6.22*		.007
Group	2, 70		7.83**	.183
Exam Anxiety	1, 71	.03		
Computational Anxiety	1, 71	10.83**		.121
Time	2, 70		.38	
Exam Anxiety	1, 71	.05		
Computational Anxiety	1, 71	.76		

*$p < .05$.

**$p < .01$.

The effect of Group X Time resulted in a multivariate F value of 5.19 (df = 2, 70), which was significant at the .01 level. The strength of association measure that was computed was Eta^2, which is the amount of variability accounted for by an effect. The Eta^2 value was .129. The effect of Group (control or treatment) resulted in a multivariate F value of 7.83 (df = 2, 70), which was also significant at the .01 level. The strength of association measure (Eta^2) was .183. The effect of Time (beginning of the eight weeks or end of the eight weeks) resulted in a multivariate F value of .38 (df = 2, 70), which was not significant.

Hypothesis 1: There will be no significant difference in the pre-computational math anxiety level and the post-computational math anxiety level between the control and the treatment group, as measured by a revised version of the Mathematics Anxiety Rating Scale.

Table XII also shows the univariate F values for the computational math anxiety component by effect. The effect of Group X Time resulted in a significant multivariate F value of 5.19. The computational math anxiety component revealed a univariate F value of 6.22 (df = 1, 71), which was significant at the .05 level. The strength of association measure (Eta^2) was .007. This indicates that .7 percent of the variability can be explained by the interaction of group and time on the computational math anxiety level.

The effect of Group (control or treatment) showed a significant multivariate F value of 10.83. The computational math anxiety component of this multivariate effect resulted in a univariate F value of 10.83 (df = 1, 71), which was significant at the .01 level. The Eta^2 value was .121 which means that 12.1 percent of the variability can be explained by the group effect on computational anxiety.

The effect of Time (beginning of the eight weeks or end of the eight weeks) did not result in a significant multivariate F (.38). The univariate F value for the computational math anxiety component was .76 (df = 1, 71), which was not significant.

The control group pre-computational math anxiety mean was 25.11 while the post-computational math anxiety mean was 26.68. The standard deviations were 7.73 and 7.38, respectively. The treatment group pre-computational math anxiety mean was 21.44 while the post-computational math anxiety mean was 20.67, with standard deviations of 5.93 and 4.87. Table XI shows the means and standard deviations and Figure 1 shows the means graphically.

The results of these tests indicated that there was a significant difference in the computational math anxiety level of the control and treatment group; therefore the null hypothesis was not accepted.

Hypothesis 2: There will be no significant difference in the pre-exam math anxiety level and the post-exam math anxiety level between the control group and the treatment group, as measured by a revised version of the Mathematics Anxiety Rating Scale.

Table XII shows the univariate F values for the exam math anxiety component by effect. The multivariate effect of Group X Time resulted in a significant F value of 5.19. The exam math anxiety component resulted in a univariate F value of 1.10 (df = 1, 71), which was not significant. The effect of Group (control or treatment) resulted in a significant multivariate F value of 7.83. The exam math anxiety component of this multivariate effect indicated a univariate F value of .03 (df = 1, 71), which was not significant. The effect of Time (beginning of the eight weeks or end of the eight weeks) did not result in a significant multivariate F (.38). The univariate F value for the exam math anxiety component was .05 (df = 1, 71), which was not significant.

The control group pre-exam math anxiety mean was 37.84 while the post-exam math anxiety mean was 36.84. The standard deviations were 10.53 and 14.50, respectively. The treatment group pre-exam math anxiety mean was 37.06 while the post-exam math anxiety mean was 38.61, with standard deviations of 14.76 and 12.04. Table XI shows the means and standard deviations and Figure 2 shows the means graphically.

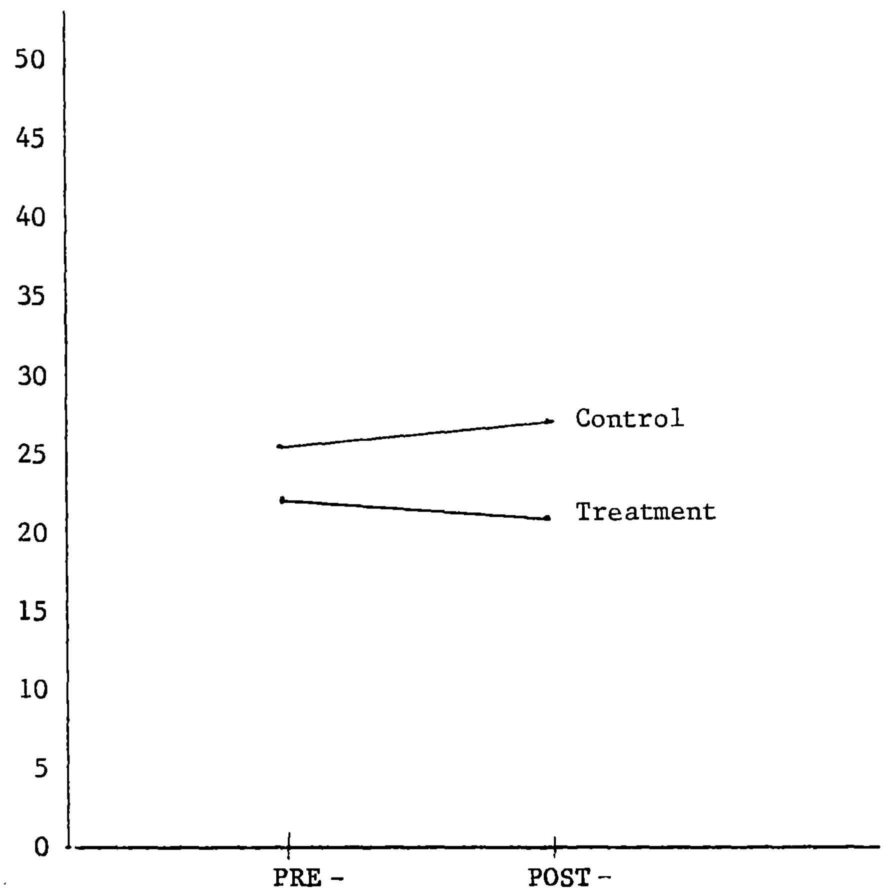

Figure 1. Mean of the Pre- and Post-Computational Math Anxiety Levels

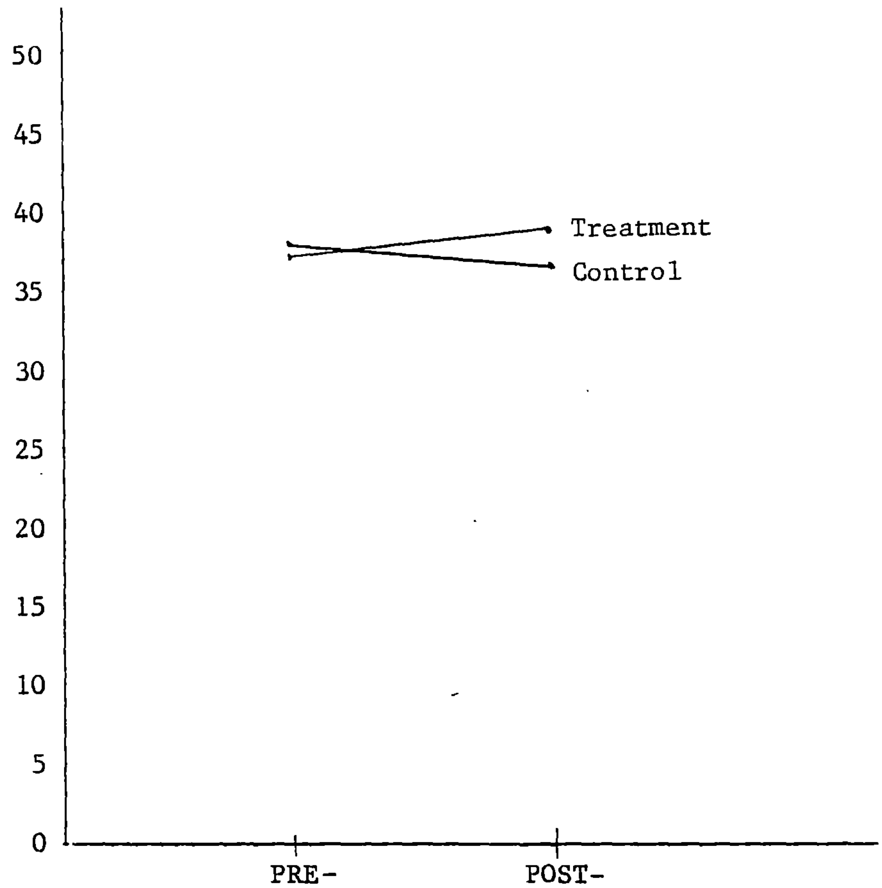

Figure 2. Mean of the Pre- and Post-Exam Math Anxiety Levels

The results of these tests indicated that there was no significant difference in the exam math anxiety level of the control and treatment group; therefore the null hypothesis was not rejected.

Treatments

The students in the treatment group rated each of the seven treatments from the standpoint of how helpful they felt each treatment was in their study of accounting. Students were not categorized into high and low anxiety groups to determine the effectiveness of individual treatments. The students participating in this study did not report a high level of math anxiety. The results for each treatment are presented and discussed below. (Appendix C shows the opinionnaire.)

Treatment 1 involved each student becoming acquainted with his or her fellow classmates. Each student received a copy of the class seating chart and the address and phone number of fellow classmates. The results of this treatment are presented in Table XIII. The mean rating was 2.2. Approximately 80 percent (80.5 percent) of the students rated this treatment at the levels of "a little" or "a fair amount." Almost one-half of the students in the treatment group rated this treatment as "a little helpful." This treatment could have been influenced by the fact that 50 percent of the students were first-semester sophomores and may have already been acquainted before the class began.

Table XIV shows the results of Treatment 2, the formation of accounting teams for homework. The accounting teams were composed of a maximum of three students. The first problem of each topic was designated as the team problem. During the treatment period, six problems were designated as team problems. The students of the team worked together and submitted one solution to the problem. This treatment was designed to encourage the less confident student and to reinforce the lecture material. The mean rating was 3.4. One-half of the students (50 percent) rated this treatment at the levels of "much" and "very much." More than one-third (36.1 percent) of the students rated this treatment at the highest level (very much).

TABLE XIII

TREATMENT 1: BECOMING ACQUAINTED WITH CLASSMATES

	Frequency	Percent	Cumulative Percent
Not at All	6	16.7	16.7
A Little	17	47.2	63.9
A Fair Amount	12	33.3	97.2
Much	1	2.8	100.0
Very Much	0	--	100.0

TABLE XIV

TREATMENT 2: FORMATION OF ACCOUNTING TEAMS

	Frequency	Percent	Cumulative Percent
Not at All	6	16.7	16.7
A Little	6	16.7	33.4
A Fair Amount	6	16.7	50.1
Much	5	13.9	64.0
Very Much	13	36.1	100.1

Treatment 3 results are shown in Table XV. This treatment utilized a Student of the Week concept. Each week during the treatment period, two names of students were randomly drawn. These students served as the Students of the Week. Any class member who had a question but did not want to ask the question (for whatever reason) was asked to write the question on paper and deposit the question in a specific location. The students were encouraged to ask the questions themselves in class. The Students of the Week checked this location before every lecture meeting, and any questions were to be asked by these two students during the lecture class. The mean rating was 1.36. During the treatment period, no questions were put in the box to be asked by the Students of the Week. The students in the treatment group did ask questions during class. Two-thirds of the students felt that this treatment was "not at all" helpful. Contributing to this treatment was the fact that the majority of the students in the treatment group had been in college for at least one semester and were possibly not as shy about asking questions in class.

Treatment 4 was no name/no grade quizzes. During the treatment period, the students put the last four digits of their Social Security number in place of their name on all quizzes. The quizzes were graded for correctness, although no grade was recorded as part of homework. In the control group, the grade received on the quizzes was included as part of the homework grade. The results are shown in Table XVI. The mean rating was 3.2. Twenty-seven (77.2 percent) of the students rated this treatment "a little" to "much." Only two students (5.7 percent) felt that this treatment was not helpful.

TABLE XV

TREATMENT 3: STUDENT OF THE WEEK

	Frequency	Percent	Cumulative Percent
Not at All	24	66.7	66.7
A Little	11	30.6	97.3
A Fair Amount	1	2.8	100.1
Much	0	--	100.1
Very Much	0	--	100.1

TABLE XVI

TREATMENT 4: NO NAME/NO GRADE QUIZZES

	Frequency*	Percent	Cumulative Percent
Not at All	2	5.7	5.7
A Little	8	22.9	28.6
A Fair Amount	11	31.4	60.0
Much	8	22.9	82.9
Very Much	6	17.1	100.0

*One student failed to record a response to this treatment.

Table XVII shows the results of Treatment 5, discussion of math anxiety. Classroom discussion centered around the definition of math anxiety, helpful and harmful reactions to anxiety, the contributions of peer pressure, society, and elementary school to math anxiety, and frustrations with math were compared to non-math frustrations. Also included in the class discussion of math anxiety was the internal and external dialogues that were included in Kogelman and Warren's (1978) book, Mind Over Math. The points discussed in the classroom are shown in Appendix B. The mean rating was 2.8. A large percent (75.1 percent) of the students ranked this treatment in the categories from "not at all" to "a fair amount." Nine students (25.0 percent) indicated levels of "much" and "very much."

TABLE XVII

TREATMENT 5: DISCUSSION OF MATH ANXIETY

	Frequency	Percent	Cumulative Percent
Not at All	5	13.9	13.9
A Little	11	30.6	44.5
A Fair Amount	11	30.6	75.1
Much	5	13.9	89.0
Very Much	4	11.1	100.1

Table XVIII shows the results of Treatment 6. This treatment involved class discussion and a handout on the various ways of locating trial balance errors. Accountants have a systematic procedure that can be utilized when the totals of the trial balance do not balance. The procedure involves retracing (preferably in reverse order) the steps used in preparing the trial balance. The difference in the debit and credit column total can be divided by 2, 9, or 11 as an additional means of isolating the type of error that has been made. The mean rating was 3.5. A large percentage (77.7 percent) of the students ranked this treatment in the categories from "a fair amount" to "very much." Only one student (2.8 percent) indicated that this treatment was not helpful.

TABLE XVIII

TREATMENT 6: LOCATION OF TRIAL BALANCE ERRORS

	Frequency	Percent	Cumulative Percent
Not at All	1	2.8	2.8
A Little	7	19.4	22.2
A Fair Amount	9	25.0	47.2
Much	12	33.3	80.5
Very Much	7	19.4	99.9

Table XIX shows the results of Treatment 7. Class discussion and a handout focused upon general tips that can be used when taking any type of exam and specific guidelines that can be used when an exam contains completion, multiple choice, and/or true-false questions. Emphasis in this treatment was upon using the tips presented as a tool and not as the procedure for passing an accounting exam or exams in other courses. Knowledge of the subject matter was stressed as the first criterion for performing successfully on an exam. The mean rating was 3.4. All of the students felt this treatment was helpful. Three-fourths of the students rated this treatment from "a fair amount" to "very much."

TABLE XIX

TREATMENT 7: TEST-TAKING TIPS

	Frequency	Percent	Cumulative Percent
Not at All	0	--	--
A Little	9	25.0	25.0
A Fair Amount	13	36.1	61.1
Much	4	11.1	72.2
Very Much	10	27.8	100.0

Summary

Data were analyzed comparing the computational and exam math anxiety levels of students in an elementary accounting course. Background data were obtained on all students. The treatment group rated the effectiveness of the various treatments. The results were:

1. The control group had completed less high school algebra than the treatment group. The treatment group had continued with more higher level math (geometry and trigonometry) than the control group.

2. The control group had completed or were enrolled in either no math or the most elementary math course. Over half of this group, though, was first-semester freshmen.

3. In the treatment group, over half the students had completed or were enrolled in either no math or only the most elementary math course. In the group one-half of the students were first-semester sophomores who would graduate after one additional semester. The one-fourth of the students completing an algebra class are selecting a preparatory intermediate algebra class, rather than a college algebra class.

4. In the treatment group, a large majority of the students had not completed a bookkeeping course. In the control group, the students were almost equally split between those completing bookkeeping and those not completing a bookkeeping course.

5. A large majority of the students in both the control and the treatment group were either Business Administration or Computer Science majors.

6. In the control and treatment groups, the majority of the students achieved a "C" or better grade at midterm.

7. There was a significant difference in the math anxiety (pre- and post-computational and exam) levels of the control and treatment groups.

8. There was a significant difference in the pre- and post-computational math anxiety levels of the students in the control and those in the treatment group. The mean computational math anxiety level of the treatment group decreased, while the control group's computational math anxiety level was higher at the beginning of the eight weeks and increased during the treatment period.

9. There was not a significant difference in the pre- and post-exam math anxiety levels between the students in the control

group and the treatment group. The mean exam math anxiety level was slightly lower for the treatment group at the beginning of the treatment period but higher than the control group at the end of the treatment period.

10. The treatment ratings that had mean responses from "not at all" to "a fair amount" were: the Student of the Week concept, becoming acquainted with classmates, and discussion of math anxiety.

11. The treatment ratings that had mean responses from "a fair amount" to "very much" were: no name/no grade quizzes, formation of accounting teams, test-taking tips, and locating trial balance errors.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A summary of this experiment, conclusions drawn from the findings, and recommendations for future research are presented in this chapter.

Summary

The purpose of this study was to compare the computational and exam math anxiety levels of elementary accounting students during an eight-week treatment period.

The instructional method utilized in the control group and the lab sections was the procedure the researcher had been using in the elementary accounting classes. In the experimental group, seven treatments were implemented during the eight-week treatment period. The treatments were classified into three major areas: classroom management techniques, discussion of math anxiety, and tips for taking tests and locating trial balance errors.

Data were collected from students enrolled at Eastern Oklahoma State College, Wilburton, Oklahoma, in elementary accounting (ACCT 2103) during the Fall, 1985 semester. There were 37 students in the control group and 36 students in the experimental group. No attempt was made to group the students into high or low math anxiety categories.

Percentages and cross tabulations were computed for the background information, midterm exam average, and ratings of the treatments by the experimental group. From the math anxiety instrument (MARS) a computational and exam component was isolated. These data were analyzed using a repeated measures multivariate analysis of variance. The findings of this experimental study were:

1. There was a difference in the two groups in the amount of high school math completed, college math enrolled in or completed, and bookkeeping courses completed.

2. The majority of the students in the two groups were either Business Administration or Computer Science majors. The majority of the students received a midterm grade of a "C" or better.

3. There was a significant difference in the computational math anxiety levels of the two groups at the end of the treatment period.

4. There was no significant difference in the exam anxiety levels of the two groups at the end of the treatment period.

5. The treatment ratings utilized the same scale that was used in MARS. The mean responses of the treatment ratings, listed in reverse order ("very much" to "not at all") were: trial balance error analysis, formation of accounting teams and test-taking tips, no name/no grade quizzes, discussion of math anxiety, becoming acquainted with classmates, and use of the Student of the Week concept.

Conclusions

The conclusions set forth in this section are based upon the findings of the research study reported in Chapter IV.

1. Students in ACCT 2103 at Eastern Oklahoma State College do experience math anxiety.

2. Students in ACCT 2103 who have completed a bookkeeping course perform no better nor worse than students who have not completed a bookkeeping course.

3. The Mathematics Anxiety Rating Scale (MARS), revised for accounting, is a reliable instrument for measuring math anxiety of elementary accounting students.

4. While the seven treatments were effective in reducing the computational math anxiety levels of accounting students, they were not effective in reducing the exam math anxiety level.

5. Some treatments (methods of locating trial balance errors, formation of accounting teams, test-taking tips, and no name/no grade quizzes) were more effective ways of reducing math anxiety levels of accounting students than others (becoming acquainted with fellow classmates, math anxiety discussion, and the Student of the Week concept).

Recommendations

The recommendations for further research are:

1. This study should be replicated where the treatment period is the entire semester. The MARS should be administered at the end of Weeks 4, 8, 12, and 16. By waiting until Week 4 to administer the MARS for the first time, the students would have completed the first exam and could more effectively answer the questions relating to their feelings of anxiety prior to the exam.

2. A study should be conducted where students are grouped according to math anxiety levels. The seven treatments could then

be compared to determine their effectiveness, depending upon the math anxiety levels of the students.

3. A study should be conducted wherein the students rank the treatments used. This would give the researcher another basis for determining which treatments should be continued and which treatments should be eliminated.

4. A study should be conducted that follows students during the first six hours of accounting to determine if math anxiety levels increase or decrease during the two courses. The MARS would be administered three times in each course. In the first course, the MARS would be administered at the end of Weeks 4, 12, and 16. In the second course the MARS would be administered at the end of Weeks 1, 8, and 16.

5. Research studies should be conducted with students enrolled in vocational/technical schools, other junior colleges, and universities to compare the math anxiety treatments by types of institutions. The most effective treatment at one type of institution could be the least effective treatment at another type of institution.

6. The treatments utilized in this study should be considered by other accounting instructors as additional teaching methods to be utilized in the elementary accounting classroom.

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APPENDIXES

APPENDIX A

CORRESPONDENCE AND MATH ANXIETY INSTRUMENTS

Rocky Mountain Behavioral Science Institute, Inc.
P.O. BOX 1066 • FORT COLLINS, COLORADO 80522

April 15, 1985

Melody Ashenfelter
EOSC, Box 1153
Wilburton, OK 74578

Dear Ms. Ashenfelter:

As publishers of the Mathematics Anxiety Rating Scale by Dr. Richard M. Suinn, you are granted permission to substitute the word "accounting" for "mathematics" where it is appropriate in order to accomplish your research and reproduce copies of the altered scale, subject to the following conditions:

1) The copyright notice as it appears on the original MARS must appear on every copy of the altered version.

2) All rights to the MARS and to any version altered in any way such as the alteration you propose shall remain with the owner of the copyright, Dr. Richard Suinn.

3) As soon as it is completed, a copy of the form as you will be using it should be sent to RMBSI.

4) This permission is effective for the one study which you have proposed in your letter only.

If you have any questions, please contact me at (303) 491-6827.

Sincerely,

Ruth Edwards

Ruth Edwards

NAME ______________________ Total Score __________

MATHEMATICS ANXIETY RATING SCALE (MARS)

The items in the questionnaire refer to things and experiences that may cause fear or apprehension. For each item, place a check (✓) in the box under the column that describes how much you are frightened by it nowadays. Work quickly but be sure to consider each item individually.

	Not at all	A little	A fair amount	Much	Very much
1. Determining the amount of change you should get back from a purchase involving several items.	☐	☐	☐	☐	☐
2. Having someone watch you as you total up a column of figures.	☐	☐	☐	☐	☐
3. Having someone watch you as you divide a five digit number by a two digit number.	☐	☐	☐	☐	☐
4. Being asked to add up 976 + 777 in your head.	☐	☐	☐	☐	☐
5. Dividing a five digit number by a two digit number in private with pencil and paper.	☐	☐	☐	☐	☐
6. Calculating a simple percentage, e. g., the sales tax on a purchase.	☐	☐	☐	☐	☐
7. Listening to a salesman show you how you would save money by buying his higher priced product because it reduces long term expenses.	☐	☐	☐	☐	☐
8. Listening to a person explain how he figured out your share of expenses on a trip, including meals, transportation, housing, etc.	☐	☐	☐	☐	☐
9. Having to figure out how much it will cost to buy a product on credit (figuring in the interest rates).	☐	☐	☐	☐	☐
10. Totaling up a dinner bill that you think overcharged you.	☐	☐	☐	☐	☐
11. Telling the cashier that you think the dinner bill was incorrect and watching the cashier total up the bill.	☐	☐	☐	☐	☐
TOTAL	___	___	___	___	___

	Not at all	A little	A fair amount	Much	Very much
12. Being treasurer for a club.	☐	☐	☐	☐	☐
13. Totaling up the dues received and the expenses of a club you belong to.	☐	☐	☐	☐	☐
14. Adding up 976 + 777 on paper.	☐	☐	☐	☐	☐
15. Doing a word problem in algebra.	☐	☐	☐	☐	☐
16. Solving a problem such as: If x = 11, and y = 3, then the results of x/y is equal to _______?	☐	☐	☐	☐	☐
17. Solving the problem such as: If x = 12, and y = 4, then the ratio of x to y is equal to______?	☐	☐	☐	☐	☐
18. Determining the grade point average for your last term.	☐	☐	☐	☐	☐
19. Reading an article on the basketball team, showing what percentage of free throws each player made, the percentage of field goals made, the total number attempted, etc.	☐	☐	☐	☐	☐
20. Reading an historical novel with many dates in it.	☐	☐	☐	☐	☐
21. Counting the number of pages left in a novel you are engrossed in.	☐	☐	☐	☐	☐
22. Guessing at the number of people attending a dance you're at.	☐	☐	☐	☐	☐
23. Buying a math textbook.	☐	☐	☐	☐	☐
24. Watching someone work with a slide rule.	☐	☐	☐	☐	☐
25. Watching a teacher work an algebraic equation on the blackboard.	☐	☐	☐	☐	☐
26. Signing up for a math course.	☐	☐	☐	☐	☐
27. Listening to another student explain a math formula.	☐	☐	☐	☐	☐
28. Walking into a math class.	☐	☐	☐	☐	☐
TOTAL	____	____	____	____	____

	Not at all	A little	A fair amount	Much	Very much
29. Having to compute the miles/gallon on your car.	☐	☐	☐	☐	☐
30. Watching someone work with a calculator.	☐	☐	☐	☐	☐
31. Looking through the pages of a math text.	☐	☐	☐	☐	☐
32. Working on an income tax form.	☐	☐	☐	☐	☐
33. Reading your W-2 form (or other statement showing your annual earning and taxes).	☐	☐	☐	☐	☐
34. Studying for a math test.	☐	☐	☐	☐	☐
35. Starting a new chapter in a math book.	☐	☐	☐	☐	☐
36. Walking on campus and thinking about a math course.	☐	☐	☐	☐	☐
37. Meeting your math teacher while walking on campus.	☐	☐	☐	☐	☐
38. Reading the word "Statistics."	☐	☐	☐	☐	☐
39. Sitting in a math class and waiting for the instructor to arrive.	☐	☐	☐	☐	☐
40. Solving a square root problem.	☐	☐	☐	☐	☐
41. Signing up for a course in Statistics.	☐	☐	☐	☐	☐
42. Checking over your monthly bank statement.	☐	☐	☐	☐	☐
43. Taking the math section of a college entrance exam.	☐	☐	☐	☐	☐
44. Having someone explain bank interest rates as you decide on a savings account.	☐	☐	☐	☐	☐
45. Raising your hand in a math class to ask a question.	☐	☐	☐	☐	☐
46. Reading and interpreting graphs or charts.	☐	☐	☐	☐	☐
TOTAL	____	____	____	____	____

	Not at all	A little	A fair amount	Much	Very much
47. Reading a cash register receipt after your purchase.	☐	☐	☐	☐	☐
48. Figuring the sales tax on a purchase that costs more than $1.00.	☐	☐	☐	☐	☐
49. Having a person illustrate to you the best way to divide your money into a savings and a checking account.	☐	☐	☐	☐	☐
50. Figuring out which of two summer job offers is the most lucrative: where one involves a lower salary, room and board, and travel, while the other one involves a higher salary but no other benefits.	☐	☐	☐	☐	☐
51. Reading a formula in chemistry.	☐	☐	☐	☐	☐
52. Hearing a lecture in a social science class where the instructor is commenting on some figures, e. g., the percentage of each socio-economic group who voted Republican.	☐	☐	☐	☐	☐
53. Taking an examination (quiz) in a math course.	☐	☐	☐	☐	☐
54. Taking an examination (final) in a math course.	☐	☐	☐	☐	☐
55. Hearing two of your friends exchanging opinions on the best way to calculate the cost of a product.	☐	☐	☐	☐	☐
56. Having someone ask you to recheck his figures in a simple calculation, such as division, or addition.	☐	☐	☐	☐	☐
57. Being asked by a friend to answer the question: how long will it take to get to Denver if I drive at 30 miles per hour?	☐	☐	☐	☐	☐
58. Studying for a driver's license test and memorizing the figures involved, such as the distances it takes to stop a car going at differing speeds.	☐	☐	☐	☐	☐
59. Hearing friends make bets on a game as they quote the odds.	☐	☐	☐	☐	☐
60. Playing cards where numbers are involved, e. g., bridge or poker.	☐	☐	☐	☐	☐
TOTAL	____	____	____	____	____

	Not at all	A little	A fair amount	Much	Very much
61. Hearing a friend try to teach you a math procedure and finding that you cannot understand what he is telling you.	☐	☐	☐	☐	☐
62. Scheduling my daily routine to allocate set times for classes, for study time, for meals, for recreation, etc.	☐	☐	☐	☐	☐
63. Juggling class times around at registration to determine the best schedule.	☐	☐	☐	☐	☐
64. Deciding which courses to take in order to come out with the proper number of credit hours for full time enrollment.	☐	☐	☐	☐	☐
65. Working a <u>concrete, everyday</u> application of mathematics that has meaning to me, e. g., figuring out how much I can spend on recreational purposes after paying other bills.	☐	☐	☐	☐	☐
66. Working on an abstract mathematical problem, such as: "If x = outstanding bills, and y = total income, calculate how much you have left for recreational expenditures."	☐	☐	☐	☐	☐
67. Being given a set of numerical problems involving addition to solve on paper.	☐	☐	☐	☐	☐
68. Being given a set of subtraction problems to solve.	☐	☐	☐	☐	☐
69. Being given a set of multiplication problems to solve.	☐	☐	☐	☐	☐
70. Being given a set of division problems to solve.	☐	☐	☐	☐	☐
71. Picking up the math text book to begin working on a homework assignment.	☐	☐	☐	☐	☐
72. Being given a homework assignment of many difficult problems which is due the next class meeting.	☐	☐	☐	☐	☐
73. Thinking about an upcoming math test one week before.	☐	☐	☐	☐	☐
74. Thinking about an upcoming math test one day before.	☐	☐	☐	☐	☐
TOTAL	___	___	___	___	___

	Not at all	A little	A fair amount	Much	Very much
75. Thinking about an upcoming math test one hour before.	☐	☐	☐	☐	☐
76. Thinking about an upcoming math test five minutes before.	☐	☐	☐	☐	☐
77. Talking to someone in your class who does well about a problem and not being able to understand what he is explaining.	☐	☐	☐	☐	☐
78. Waiting to get a math test returned in which you expected to do well.	☐	☐	☐	☐	☐
79. Waiting to get a math test returned in which you expected to do poorly.	☐	☐	☐	☐	☐
80. Walking to math class.	☐	☐	☐	☐	☐
81. Realizing that you have to take a certain number of math classes to fulfill the requirements in your major.	☐	☐	☐	☐	☐
82. Picking up a math textbook to begin a difficult reading assignment.	☐	☐	☐	☐	☐
83. Being called upon to recite in a math class when you are prepared.	☐	☐	☐	☐	☐
84. Not knowing the formula needed to solve a particular problem.	☐	☐	☐	☐	☐
85. Receiving your final math grade in the mail.	☐	☐	☐	☐	☐
86. Opening a math or stat book and seeing a page full of problems.	☐	☐	☐	☐	☐
87. Being responsible for collecting dues for an organization and keeping track of the amount.	☐	☐	☐	☐	☐
88. Getting ready to study for a math test.	☐	☐	☐	☐	☐
89. Listening to a lecture in a math class.	☐	☐	☐	☐	☐
90. Figuring out your monthly budget.	☐	☐	☐	☐	☐
TOTAL	___	___	___	___	___

	Not at all	A little	A fair amount	Much	Very much
91. Being given a "pop" quiz in a math class.	☐	☐	☐	☐	☐
92. Seeing a computer printout.	☐	☐	☐	☐	☐
93. Having to use the tables in the back of a math book.	☐	☐	☐	☐	☐
94. Being told how to interpret probability statements.	☐	☐	☐	☐	☐
95. Asking your math instructor to help you with a problem that you don't understand.	☐	☐	☐	☐	☐
96. Being asked to explain how you arrived at a particular solution for a problem.	☐	☐	☐	☐	☐
97. Tallying up the results of a survey or poll.	☐	☐	☐	☐	☐
98. Acting as secretary, keeping track of the number of people signing up for an event.	☐	☐	☐	☐	☐
TOTAL	___	___	___	___	___

Total Score ____________________

MARS - REVISED FOR ACCOUNTING

The items in the questionnaire refer to things and experiences that may cause fear or apprehension. For each item, place an "X" in the box under the column that describes how much you are frightened by it nowadays. Work quickly but be sure to consider each item individually.

	Not at all	A little	A fair amount	Much	Very Much
1. Determining the amount of change you should get back from a purchase involving several items.					
2. Dividing a five digit number by a two digit number in private with pencil and paper.					
3. Listening to a salesman show you how you would save money by buying his higher priced product because it reduces long term expenses.					
4. Listening to a person explain how he figured out your share of expenses on a trip, including meals, transportation, housing, etc.					
5. Adding up 976 + 777 on paper.					
6. Signing up for an accounting course.					
7. Walking into an accounting class.					
8. Reading your W-2 form (or other statement showing your annual earning and taxes.					
9. Walking on campus and thinking about an accounting course.					
10. Sitting in an accounting class and waiting for the instructor to arrive.					
11. Raising your hand in an accounting class to ask a question.					
12. Reading a cash register receipt after your purchase.					
13. Figuring the sales tax on a purchase that costs more than $1.00.					

	Not at all	A little	A fair amount	Much	Very Much
14. Figuring out which of two summer jobs offers is most lucrative: where one involves a lower salary, room & board, and travel, while the other one involves a higher salary but no other benefits.					
15. Taking an examination (final) in an accounting course.					
16. Hearing friends make bets on a game as they quote the odds.					
17. Juggling class times around at registration to determine the best schedule.					
18. Deciding which courses to take in order to come out with the proper number of credit hours for full time enrollment.					
19. Working a concrete, everyday application of mathematics that has meaning to me, e.g., figuring out how much I can spend on recreational purposes after paying other bills.					
20. Being given a set of numerical problems involving addition to solve on paper.					
21. Thinking about an upcoming accounting test one week before.					
22. Thinking about an upcoming accounting test one day before.					
23. Thinking about an upcoming accounting test one hour before.					
24. Thinking about an upcoming accounting test five minutes before.					
25. Waiting to get an accounting test returned in which you expected to do well.					
26. Waiting to get an accounting test returned in which you expected to do poorly.					

	Not at all	A little	A fair amount	Much	Very Much
27. Realizing that you have to take a certain number of accounting classes to fulfill the requirements in your major.					
28. Receiving your final accounting grade in the mail.					
29. Figuring out your monthly budget.					
30. Being given a "pop" quiz in an accounting class.					

APPENDIX B

STUDENT HANDOUTS

OUTLINE FOR MATH ANXIETY DISCUSSION

I. Definition of math anxiety

"Tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems" (Richardson and Suinn, p. 551)

II. Some anxiety is helpful and natural. Unhealthy reactions are not helpful (Morris, p. 413)

   A. Physical illness
   B. Avoidance of math

III. No respector of age or gender (Brocklehurst, p. 22 and Burton, p. 130)

(most frequently admitted by women)

IV. Roots of math anxiety

   A. Elementary school (Morris, pp. 413-414)
   B. Many report negative experiences in 7th and 10th grades (Kogelman and Warren, p. 16)
   C. Peer pressure and societal pressure (Tobias, <u>Overcoming Math Anxiety</u>, pp. 83-84) (girls can't do math--boys can)

V. Math frustrations compared to non-math frustrations (Smith, p. 7)

   A. Going to a doctor-dentist
   B. Changing a flat tire

VI. No relation to intelligence

   A. Attitude not aptitude (Burton, p. 134; Kogelman and Warren, p. 10; Morris, p. 413)
   B. "I Can't" syndrome (Tobias, <u>Ms</u>., p. 57)
   C. Change from a "can't do" to "can do" attitude (Morris, p. 416)

VII. Advantages of Math Anxiety (Burton, p. 130)

   A. Never fatal
   B. Always curable
   C. First step is self-realization and acceptance

VIII. Lower self-concept and confidence (defeating self-talk) (Kogelman and Warren, p. 70)

   A. Internal dialogue--Math Games We Play on Ourselves (Kogelman and Warren, pp. 70-79) (Student handout following)

1. Everybody knows what to do, except me

2. I don't do math fast enough
(speed and skill are two separate tasks with speed being developed through repetition and practice. Compare to acquiring typing speed.)

3. I'm sure I learned it, but I can't remember what to do
(Any skill is lost if it isn't used. Compare to shorthand skills.)

4. I knew I couldn't do math
(Self-fulfilling prophecy, although we don't hesitate to use a dictionary when we can't remember the correct spelling of a word.)

5. I don't have a math mind

6. I got the right answer but I did it the wrong way
(The right way is the method you are comfortable with.)

7. This may be a stupid question. But . . .

8. It's too simple
(Everything doesn't have to be hard and seem illogical. Compare to reconciling personal bank statement and business bank statement.)

9. Math is unrelated to my life
(Use data from Lucy Sell's study at the University of Berkeley.)

B. External Dialogue--Math Games Others Play on Us (Kogelman and Warren, pp. 80-89)

1. You did it the wrong way
(Best method--what works for you the most comfortably.)

2. You should know that
(Discourages questions--worst comment a teacher can make.)

3. You will never be able to do math/accounting.
(Two possible things can happen: attitude of I'll show you and stop trying.)

4. I's obvious
(Only after you've gotten the answer.)

5. That's an easy problem
(Most individuals will not admit that they struggled with the solution to a particular problem.)

6. All you have to do to learn math is to work hard (There comes a point in time that you must walk away from a problem when it will not balance. Leave it for 30 minutes or more, then try again. Your mind will subconsciously work on the problem--you may wake up in the middle of the night and know where the error is.)

STUDENT HANDOUT: MATH ANXIETY DISCUSSION

MATH GAMES WE PLAY ON OURSELVES

1. Everybody knows what to do, except me.
2. I don't do math fast enough.
3. I'm sure I learned it, but I can't remember what to do.
4. I knew I couldn't do math.
5. I don't have a math mind.
6. I got the eight answer but I did it the wrong way.
7. This may be a stupid question. But . . .
8. It's too simple.
9. Math is unrelated to my life.

MATH GAMES OTHERS PLAY ON US

1. You did it the wrong way.
2. You should know that.
3. You will never be able to do math/accounting.
4. It's obvious.
5. That's an easy problem.
6. All you have to do to learn math is to work hard.

Source: Stanley Kogelman and Joseph Warren. Mind Over Math (Chapters 5 and 6). New York: The Dial Press, 1978.

STUDENT HANDOUT

LOCATING TRIAL BALANCE ERRORS

1. Recalculate column totals by adding the columns in the opposite direction.

2. Double check that each account has either a zero balance or has its normal balance. (Remember the normal balance of each account is how the account increases.)

3. Find the difference between the totals on the trial balance.

4. An ADDITION OR SUBTRACTION ERROR has occurred if the difference between the column totals is .01, .10, $1.00, $10.00, etc.

5. A POSTING ERROR has occurred when the debit or credit of a transaction has not been posted. A posting error is located by looking for a transaction equal to the difference between the column totals or checking the general journal for missing post reference information.

   A POSTING ERROR will also result when a debit has been posted as a credit or a credit has been posted as a debit. This posting error is located by dividing the difference (if it's an even number) between the column totals by two.

   Example:

Cash	100	
Accts. Rec.	200	
Accts. Pay.		100
Capital		500
Revenue		100
Expense	100	
Expense		300
Totals	400	1,000

   Difference = 600/2 Error: 300 Balance

6. Divide the difference between the column totals by nine. If the difference is divisible 1-9 times or 10-90 times, etc., the difference is caused by a TRANSPOSITION ERROR. A transposition error occurs when 136 is written as 163.

   An additional step that helps in locating a transposition error is to determine the column total differences, divide by 9, and watch for possible number combinations.

   Example: 163 - 136 = 27/9 = 3

   Number combinations with a difference of 3 are:

   1 and 4; 2 and 5; 3 and 6; 4 and 7; 5 and 8; or 6 and 9.

The following table will aid you in determining which number combinations have been transposed.

Difference/9 =	Number combinations to check:
1	1-2; 2-3; 3-4; 4-5; 5-6; 6-7; 7-8; 8-9
2	1-3; 2-4; 3-5; 4-6; 5-7; 6-8; 7-9
3	1-4; 2-5; 3-6; 4-7; 5-8; 6-9
4	1-5; 2-6; 3-7; 4-8; 5-9
5	1-6; 2-7; 3-8; 4-9
6	1-7; 2-8; 3-9
7	1-8; 2-9
8	1-9
9	0-9

7. If the difference between the column totals, when divided by nine is not an even number, a TRANSPLACEMENT ERROR has occurred. A transplacement error may also be divisible by 11.

   Example: $275.40 was recorded
   27.54 correct amount
   247.86

   247.86/9 = 27.54

8. If the error has not been located, go back and start checking your journal entries, postings, and <u>all</u> account totals and balances (work in reverse order).

9. If the error has not been located, put the problem away for a minimum of 30 minutes to one hour. Try again to locate your error.

10. Bring the problem to class or check your figures with a fellow classmate.

Source: Garrison, Lloyd. "Trial Balance Error Analysis." Mimeographed. Stillwater: 1977.

STUDENT HANDOUT

GENERAL TIPS FOR TAKING ANY EXAM

1. Know the length of time allowed for the test
2. Survey the entire test before beginning
3. Allocate your time
4. Work as rapidly as possible
5. Read and follow directions
6. Read the questions carefully
7. Attempt all questions
8. When stumped on one problem or question--move to other questions and return to the troublesome one later

Source: Jason Millman and Walter Pauk. How to Take Tests. New York: McGraw-Hill Book Company, 1969, pp. 15-37.

STUDENT HANDOUT

TIPS FOR TAKING EXAMS

COMPLETION QUESTIONS:

1. When a specific answer has been forgotten, use a general answer.[2]
2. Utilize grammar cues such as "a" and "an".[3]
3. Utilize number and length of blanks.[2]

MULTIPLE CHOICE QUESTIONS:

1. Eliminate absurd or distracting alternatives.[1]
2. The longest alternative is often a good choice, especially for definition type questions.[3]
3. A middle answer is more frequently used than first and last answers.[3]
4. When the answers contain opposite alternatives, one is usually correct.[3]
5. "All of the above" is more often correct than "none of the above."[3]
6. Avoid alternatives (2 or more) that mean the same thing.[3]
7. Grammar structure can help eliminate alternatives.[3]
8. Questions in one segment of the test may aid in answering questions in another segment.[3]

TRUE AND FALSE QUESTIONS:[3]

1. Never leave a question blank.
2. Specific determiners of true statements:

   "Most, generally, may, sometimes, some, can, most, tends to, usually, many, few, often, seldom, more, less, good, occasionally, great, little, rarely, probably, frequently."

3. Specific determiners for false statements:

   "Only, always, all, never, invariably, absolutely, every, none, best, worst, guarantees, undoubtedly, insures."

4. A question that is partially false is completely false.
5. If the question or statement sounds odd, it is probably false.

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3. Starks, Gretchen. "Learning the Ropes--Survival Techniques for College Freshmen." Reading Horizons, Vol. 21 (Spring, 1981), pp. 206-210.

APPENDIX C

QUESTIONNAIRE AND OPINIONNAIRE

Student No. _____

QUESTIONNAIRE

AGE: __________ SEX: MALE _____ FEMALE _____

EDUCATIONAL BACKGROUND: Check your most recent degree

1. High School Student _____
2. High School Graduate or GED equivalent _____
3. Associate Degree _____
4. Bachelor's Degree _____
5. Master's Degree _____
6. Doctoral Degree _____

Approximate Number of College Hours Completed: _______

PRIOR MATH BACKGROUND:

Indicate the math course/s you have completed or are currently enrolled in.

HIGH SCHOOL:

1. General Math or Business Math _____
2. Algebra I _____
3. Algebra II _____
4. Geometry _____
5. Trig _____
6. Calculus _____

COLLEGE:

1. General Math or Business Calculations/Math _____
2. Elementary Algebra _____
3. Intermediate Algebra _____
4. College Algebra _____
5. College Algebra/Trig _____
6. Analytic Geometry _____
7. Calculus I _____
8. Calculus II _____

BOOKKEEPING BACKGROUND:

Have you completed a Bookkeeping course? Yes _____ No _____

COLLEGE MAJOR:

1. Business Administration, including accounting _____
2. Computer Science _____
3. Business Education _____
4. Secretarial Science _____
5. Mid-Management _____
6. Non-Business _____
7. Undecided _____
8. Adult & Continuing Education _____

Student No. ________

OPINIONNAIRE

Listed below are the accounting activities that were used during the first half of the semester. Place an "X" in the box under the column that describes <u>how helpful you feel each activity was in your study of accounting</u>.

	Not at All	A Little	A fair Amount	Much	Very Much
1. Becoming acquainted with fellow class members.					
2. Forming accounting teams for homework.					
3. Using the Student of the Week.					
4. No name/grade quizzes.					
5. Discussion of anxiety over math.					
6. Discussion and handout on locating trial balance errors.					
7. Discussion and handout on tips for taking exams.					

2

VITA

Melody Diann Ashenfelter

Candidate for the Degree of

Doctor of Education

Thesis: REDUCTION OF MATH ANXIETY LEVELS OF STUDENTS ENROLLED IN ELEMENTARY ACCOUNTING

Major Field: Business Education

Biographical:

Personal Data: Born January 20, 1955, at Marysville, California, the daughter of Dale and Betty Ashenfelter.

Education: Graduated from Gotebo High School, Gotebo, Oklahoma, in May, 1973; received a Clerical Certificate from Southwestern Oklahoma State University in July, 1974; received the Bachelor of Science degree in Accounting in May, 1976, and the Bachelor of Science degree in Business Education in December, 1976, from Southwestern Oklahoma State University; received the Master of Science degree in Business Education from Oklahoma State University in May, 1978; completed the requirements for the Doctor of Education degree at Oklahoma State University in May, 1986.

Professional Experience: Accounting/Business Administration instructor, Eastern Oklahoma State College, Wilburton, Oklahoma, 1977-1983; graduate teaching assistant, Oklahoma State University, 1983-1984 academic year; Accounting/Business Administration instructor, Eastern Oklahoma State College, Wilburton, Oklahoma, 1984-1986.

Professional Organizations: National Business Education Association; Oklahoma Business Education Association; Delta Pi Epsilon; American Accounting Association; Higher Education Alumni Council of Oklahoma; Beta Gamma Sigma.