THE EFFECT OF A GRADUATE LEARNING EXPERIENCE ON ANXIETY, ACHIEVEMENT, AND EXPECTATIONS IN RESEARCH AND STATISTICS

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Many graduate students do not profit from the integration of quantitative research skills into their curricula due to stress and anxiety and lack of self-efficacy, a statisticophobia (Dillon, 1982). The current research was designed to evaluate the attitude and competency changes for male and female graduate students toward statistics and research after completion of a research methods course. Students should better understand the relevance of research to the enhancement of their careers.

Questionnaires and achievement tests were used to assess students' feelings, anxieties, self-efficacies, and skills in both statistics and research methodologies before and after the completion of a methods of research course.

Contrary to expectations, male and female graduate students did not report significantly different anxiety levels to research and statistics prior to and after completion of a research methods course. Male students reported greater perceived knowledge in statistics and research courses than female students. Reported knowledge of statistics was significantly correlated with achievement levels on a pretest measure of statistical knowledge.

METHODOLOGY

Methods of Research is a core course to satisfy the requirements for a standard methods course for research and statistics for graduate students. The course combines objectives for the introduction of theory and methods of research, instruction for becoming statistically literate with instruction and application for understanding and interpreting professional research studies. The culminating project for this course is the formulation and development of an action research proposal.

The subjects ranged in age groupings from 20 to 56+. The subjects were attending a university in the Greater New York Metropolitan area. Fourteen different graduate areas were represented. The sample consisted of 109 graduate students, 85 females and 24 males, who were enrolled in Methods of Research**,** Fall 1996. The instruments consisted of questionnaires and skill assessments developed by the researcher using feedback from a research professor and author at a university in the Greater New York Metropolitan area.

The subjects completed surveys and were administered pretests prior to the commencement of instruction during the initial class meeting. The survey was designed to measure the students' self-reports of (a) statistical and research anxiety; (b) perceptions of research and statistical knowledge, and (c) future expectations related to research and

statistics. The pretest was used to measure research and statistics knowledge. Surveys and postests were administered during the last class of the semester.

RESULTS, CONCLUSIONS, AND EDUCATIONAL IMPLICATIONS

The main focus of the research analysis addressed the issues of anxieties and expectancies related to a course in the statistics and research areas. The investigator believed that high levels of anxiety and low self-efficacies were impediments to learning and use of statistics and research; requisite skills needed to (a) evaluate research and (b) become contributors to accumulated knowledge in their disciplines. Contemporary cognitive psychologists (Bandura 1986, 1989; Rotter and Hochreich 1975) have stated that the expectancies of the achievement levels have a great impact on success. The investigator considered that anxiety was a deterrent to both thoughtful work and achievement. If the student expects to fail, failure may become a self-fulfilling prophecy. Thus, the ability to master research and statistics may not be enough.

A summary of the results and conclusions follows. There were no significant mean anxiety level differences between the self-report measures by males and females on anxiety levels for (a) pre- and post-test research anxieties and b) pre- and post-test statistical anxieties beyond the .05 level.

The zero order correlations between pre- and post-test research anxieties, $r(107) = 0.47$, $p < 0.001$ and pre- and post-test statistical anxieties, $r(107) = 0.30$, $p < 0.001$, were both significant relationships beyond the .05 level. On the above basis, anxiety levels tended to remain stable over the course of the semester. However, these were moderate and low correlations. The results of a paired sample t-test yielded further information. The anxiety levels associated with research and statistics were significantly lower after the course than prior to the methods of research course. The mean self-reported anxiety levels towards (research) were higher prior to the methods course ($M = 2.36$, $SD = 0.90$) than after completion of the course ($M = 2.00$, $SD = 0.87$), $t(108) = 4.11$, $p < 0.001$. Also, the mean self-reported anxiety levels (statistics) were significantly higher at the beginning of the methods course ($M = 2.71$, $SD = 0.98$), than at the end of the course ($M = 2.39$, $SD = 0.85$), $t(108) = 3.08$, $p < 0.01$. Therefore, although the anxiety levels remained somewhat consistent for the students, there was a positive result in that the overall self-reported anxiety levels were reduced. If a student's self-efficacy is increased, anxiety levels would be lowered. The males decreased in self-

reported anxiety levels in research on the posttest (M = 1.96, SD = 0.91) when compared to self-reported research anxiety levels on the pretest (M = 2.29, SD = 0.96, t (23) = 2.33, $p < 0.05$. There was no significant difference on the posttest for statistics anxiety (M = 2.42, SD = 0.93) than pretest statistics anxiety, (M = 2.33, SD = 0.96, t (23) = 0.53, $p = 0.60$. The females decreased in self-reported anxiety levels in the posttest (M = 2.01, SD = 0.87) when compared to self-reported research anxiety levels on the pretest (M = 2.38, SD = 0.89, t (84) = 3.50, $p < 0.001$. The females also decreased in self-reported anxiety levels in the posttest (M = 2.40, SD = 0.82) when compared to self-reported statistics anxiety levels on the pretest (M = 2.79, SD = 0.99, t (84) = 3.10, $p < 0.01$.

There were significant, low inverse correlations between the graduate students' self-reported, perceived knowledge of research with reported research anxiety levels prior to the Methods of Research course, $r (107) = -0.29$, $p < 0.01$, and after completion of the Methods of Research course, $r (107) = -0.21$, $p < 0.05$. Greater significant, inverse relationships were noted for the graduate students' perceived knowledge of statistics with reported perceived statistics anxiety levels prior to the Methods of Research course, $r (107) = -0.45$, $p < 0.001$, and after the research methods course, $r (107) = -0.23$, $p < 0.05$. From these relationships, it was apparent that there was a greater fear of statistics due to a lack of perceived statistical competence prior to the completion of a research methods course than after the research methods course. Furthermore, self-reported knowledge was negatively correlated with anxiety levels in both academic disciplines. Therefore, the college instructors should realize that increased self-efficacy does result in decreased anxiety. Students who become more confident to succeed should experience less anxiety.

Previous researchers (Roberts and Saxe, 1982; Benson, 1989; Zeidner and Safir. 1989) reported that females may feel less confident than males in their perceived knowledge of research and statistics. Therefore, the investigator used two chi square analyses to compare the ratings of males and females on their responses to self-reported knowledge of research and statistics. There was a significant relationship between the self-reported knowledge in research and the sex of the college respondent, chi square $(2) = 7.41$, $p < 0.05$. The reason for the significant chi square was that there was a greater than chance expectancy for males to report a high previous knowledge of research (n = 7) than expected by chance (3.1). In like manner, fewer females (n = 7) than

expected by chance (10.9) reported high previous knowledge of research. Moderate levels of previous knowledge were in the opposite direction, as fewer males (n = 12) than expected by chance (15.4) reported a moderate level of previous knowledge. More females (n = 58) than expected by chance (54.6) reported a moderate level of statistical knowledge. Slightly less males (n = 5) then expected by chance (5.5) reported a low knowledge of research while more females (n = 20) reported a low level of research knowledge than expected by chance (19.5). Therefore, females were more likely to report a moderate level of research knowledge than males. In a like manner, males were more likely to report a higher level of research knowledge than females. There was no significant relationship beyond the 0.05 level between the students' previous knowledge of statistics with sex, chi square (1) = 1.71, p = 0.19. However, a higher proportion of females (n =55, 64.7%) reported a lower previous knowledge of statistics than the males (n = 12, 50%).

There was one low positive correlation significant beyond the 0.05 level between reported knowledge of statistical methods with the posttest research scores, r (107) = 0.21, $p < 0.05$. With respect to the above, students who reported more knowledge in statistics tended to have higher mean scores on the post research test. However, this was a low, nonchance relationship. On this basis, self-reported previous knowledge of statistics (self-efficacy) was one factor that should be considered when students begin a statistics course. However, other measures need to be developed to assess students capabilities and self-efficacies prior to taking the course.

In order to determine if there were significant differences between the students levels of understanding in research and statistics, the investigator used 2 x 2 repeated measures ANOVA designs. The repeated measures were the students scores on the pretest and posttest (a) research and (b) statistics questions. The between measure was based on the sex of the respondents. In this manner, the investigator was able to determine if there were significant differences due to (a) the interaction of sex with pretest-posttest measures, (b) significant differences due to sex, and (c) significant differences on the pretest-posttest measures in relation to (a) research knowledge and (b) statistics knowledge.

The results of the 2 x 2 ANOVA design comparing pretest and posttest scores on research methods by sex indicate there was no significant difference on the measures of sex, F (1,106) = 0.00, p = 0.99, or interaction effect, (sex x pretest-posttest),

F (1,106) = 1.55, p = 0.22. There was, however, a significant difference beyond the .05 level between the pretest and posttest measures, as the subjects had significantly higher research scores on the posttests (M = 4.87, SD = 0.99) than on the pretest measure of research knowledge (M = 3.76, SD = 1.67), F(1,106) = 36.51, p < 0.001. Therefore, there was a small but significant gain in research knowledge on the posttest measure.

The results of the 2 x 2 ANOVA design comparing pre- and post-test scores on statistics by sex indicate there was no significant difference on the measures of sex, F (1, 106) = 3.14, p = .08, or interaction effect (sex x pretest posttest), F (1,106) = .06, p = 0.81. There was, however, a significant difference beyond the 0.05 level between the pre- and post-test measures on statistics as the subjects had significantly higher scores on the posttests (M = 2.40, SD = 1.09) than on the pretest measure of statistical knowledge (M = 1.44, SD = 1.06), F(1,106) = 30.82, p < 0.001. Therefore, there was a small but significant gain in statistical knowledge on the posttest measure.

The final analysis was made by evaluating the graduate students' responses to eight expectations prior to and after the research methods course and the primary and secondary expectations reported by the male and female subjects. In regards to learning about statistics an interesting change in expectations was noted for the female respondents. Initially, 33 (38.8%) of female respondents indicated their expectations were to learn about statistics. At the conclusion of the methods of research course, 59 female subjects (69.4%) reported the expectations of learning more about statistics had been met.

Other positive but less dramatic changes were also noted for women in the areas of a) learning to write a research proposal increased from 74.1% to 88.8 %, (b) understanding and interpretation of professional studies increased from 72.9% to 82.4%, and c) knowledge of statistics to prevent being mislead by media reports increased from 44.7% to 58.8%. The larger increases in expectations, greater than 10%, were reported by female graduate students.

SUMMARY AND FUTURE RESEARCH CONSIDERATIONS

The results were consistent with the expectation that students reporting a greater breadth of knowledge (self-efficacy) reported less anxiety in the discipline. Therefore, instructors need to help students build their self-confidence in the quantitative areas. Seminars for instructors could be used to this end. Constructive confidence building instructors could change a student's expectations.

At the end of the research course, approximately twice the proportion of female students (69.4%) reported expectations to learn statistics, an increase of 30.6%, when compared to prior expectations of 38.8%. The above finding supported the fact that the self-reports of females were lower in expressed knowledge of statistics than males prior to the methods course. Based on these findings, the female students made enough gains in self-efficacy as expressed by knowledge of research by the end of the course to no longer conclude that they had less confidence than males in understanding and using research.

In future research studies, pre- and post-test assessments of self-reports of male and female self-efficacies, knowledge of research and statistics, need to be measured to determine if sex differences on expressed knowledge change. The investigator found that females reported a higher expectation to study statistics and conduct research; males' expectations to learn about statistics remained constant before and after the course (41.7%). The proportion of males who expressed the expectation to become familiar with research method and theory also remained constant, 87.5%, prior to and after the completion of the methods course. Although a smaller proportion of females reported a positive expectation to become familiar with research methods and theory before taking the research course, 84.7%, than males the expectations after the course rose to 91.8%.

A higher proportion of the graduate students also reported more interest in learning how to write a research proposal and develop competencies to critically review research articles in their disciplines. The increase of 25.6% was due to the fact that 89% of all subjects reported they wished to write a research proposal at the end of the course compared to 73.4% prior to the research methods experience.

No significant relationship between anxiety levels and sex were found. However, females reported a lower self-efficacy in statistical knowledge. Since there are conflicting research data for the above, sex and anxiety levels should be investigated in different educational fields. The investigator plans to continue the research by replicating the study on a subsequent group of students enrolled in the methods of research course. Added insight will be found by incorporating these results in future analyses.

Finally, students did earn a significantly higher score on the research and statistics posttests than the pretests. Therefore, there were positive gains in both expectations and skills due to the research experience.

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