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ABSTRACT

This study investigated the attitudes toward statistics of graduate students who used a computer program as part of the instructional effort, which allowed for an individualized, self-paced, student-centered activity-based course. The 9 sections involved in the study were offered in 2001 through 2003, and there were 75 participants for whom there were complete data. Of these, 75% were female. The design of the study was a single-sample pretest-posttest with no control group since the students were taught by the same instructor. The instruction was the Statistics Attitude Survey (D. Roberts and E. Bilderback, 1980). Findings indicate differences in the distributions of ranks between pretest and posttest results. Most of these differences occurred as increases in the rankings marked at each end of the scales. That is, after the course, students felt more strongly that they agreed or disagreed with statements about some aspects of statistics. For example, students agreed more strongly that statistics would be useful to test the superiority of one method over another and that statistics provide a useful way to improve the quality of professional performance. They disagreed more strongly that one should be good at mathematics before attempting statistics and that statistics is too theoretical to be much use to the average professional. Comments from the open-ended evaluation forms may help explain survey results. Findings suggest that offering the course using computers may help improve students' attitudes about certain aspects of statistics. The course syllabus is attached. (Contains 2 tables and 15 references.) (Author/SLD)

Students' Attitudes in a Graduate Statistics Class

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Students' Attitudes in a Graduate Statistics Class

Abstract

This study investigated the attitudes toward statistics of graduate students who used a computer program as part of the instructional effort, which allowed for an individualized, self-paced, student-centered, activity-based course. The nine sections involved in this study were offered in the spring and fall 2001, spring and fall 2002, and spring 2003 terms. There were 75 participants for whom there was complete data. All were enrolled in advanced statistics, with 72% being females. The design of the study was a single-sample pretest-posttest with no control group due to the students' being taught by the same instructor. The instrument used was the Statistics Attitude Survey (Roberts and Bilderback, 1980). The calculated chi square (89.77, $p<0.0000005$) and Cohen's w (0.13) indicated that there were differences in the distributions of ranks between pretest and posttest results. Most of these differences occurred as increases in the rankings marked at each end of the scales. That is, after the course, more students felt more strongly that they agreed or disagreed with statements about some aspects of statistics. For example, students agreed more strongly that "Statistics will be useful to me to test the superiority of one method over another." and "Statistics will be a useful way to help me improve the quality of my professional performance." On the other hand, they disagreed more strongly that "You should be good at math before attempting statistics" and "Statistics is too theoretical to be of much practical use to the average professional." Comments from open-ended evaluation forms may help explain the results of the survey: "freedom to learn at my own pace and style", "class flexibility", "relaxed environment", and "I have learned a lot about stat and can apply it to my profession as a useful tool." It is concluded, then, that offering the course using computers may help improve students' attitudes about certain aspects of statistics.

Students' Attitudes in a Graduate Statistics Class

Students have often expressed some degree of anxiety about taking any statistics class (Chermak and Weiss, 1999; Harrington, 1999; Kottke, 2000; Onwuegbuzie, 2000; Onwuegbuzie and Leech, 2003; Onwuegbuzie and Wilson, 2003; Rainville, 2001; Sgoutas-Emch and Johnson, 1998; Zanakis and Valenzi, 1997), and perhaps even more so when beginning an advanced statistics class. "Some will experience a great deal of anxiety simply at the sight of the numbers (McKean, 1999)." Their concerns, possibly based on prior experiences, rumors, or simply fear of the unknown, probably affect their attitudes. As Gal and Ginsburg (1994) noted, many statistics teachers focus on knowledge, but many of their students may have difficulty related to non-cognitive factors, such as negative attitudes or beliefs which may hinder their learning, at least to some extent. Since statistics courses tend to be among the most anxiety-provoking for those college students required to take them, researchers have investigated techniques to help reduce students' anxiety and negative attitudes (Sgoutas-Emch and Johnson, 1998). For example, Sgoutas-Emch and Johnson (1998) tried journal writing with a group of undergraduate students in their statistics course. Compared to a control group, the journal group showed improved grades and lower anxiety before exams.

Other approaches to lowering anxiety in the classroom have involved technology. For example, Ellram and Easton (1999) presented a case study on developing and implementing a purchasing class via the Internet. The attitudes of the students were generally quite positive and supportive despite a variety of problems with the technology and other issues. Fortunately for the instructors, the students realized that there would be challenges with technology and did not hold the instructors accountable for these problems. In fact, the instructors stated that they had not experienced such understanding and patience before at either the undergraduate or graduate level.

Robertson and Stanforth (1999) surveyed Family and Consumer Science students about their interests in Web-based distance education and found that their computer attitudes were not particularly positive, despite (or perhaps because of) their experience in using computers. For this group of students, primarily young females, computer access did not have the expected positive impact on their computer attitudes. Because of sample bias, there was limited generalizability of their findings.

Graham and McNeil (1999) described a project using the Internet for disseminating information about social geography. There were some technological difficulties, but students still reacted favorably, overall.

Blake (2000) incorporated e-mail and the World Wide Web to teach an introductory media writing course. Students in this course left with very positive attitudes, rating it highly enjoyable and convenient, and saying that they would recommend the course to their friends.

Zeis, Shah, Regassa, & Ahmadian (2001) found that students were better able to learn statistics when they were put into a context in which they learned how to collect, organize, and manage their own data before they learned analysis and inference. This approach gave students the confidence to believe that they could carry out their own research.

In a course based on WebCT technology, an approach increasingly used on college campuses, Sanders and Morrison-Shetlar (2001) used Web-enhanced instruction in an introductory biology course. The students' attitudes toward the Web-based instruction were generally positive, with the students being most comfortable with assessment over the Web. However, most preferred receiving a hard copy of the course syllabus rather than having to print one from the Web. They also preferred talking face-to-face as opposed to using chat rooms, and had mixed feelings about interacting through the bulletin board and getting class notes from the Web. Nevertheless, they overwhelmingly preferred using Web-enhanced instruction as opposed to not using it.

Bushway and Flower (2002) also used WebCT-based technology to help students learn statistics. However, their focus was on learning enhancements, including Supplemental Instruction, quizzes, and required class attendance for students regarded as at-risk. The additional instruction and the quizzes substantially lowered the failure rate although required attendance, by itself, was not deemed effective.

Similar to Sgoutas-Emch and Johnson (1998), Potthast (1999) worked with groups in teaching basic statistics, but in this case the groups were involved with cooperative learning experiences. Not all of the students valued working in cooperative learning groups, however. Some preferred working alone, believing that other members of the group inhibited their progress. Others, though, found the experiences helpful.

Zanakis and Valenzi (1997) worked with an undergraduate business statistics class and noted that students were anxious about using computers to do statistical calculations. The authors suggested modifications to the statistics course to strengthen students' beliefs in statistics and reduce their test anxiety. To do this, they proposed changes which included reduced method coverage, newspaper stories exemplifying data abuses, reduced weighting of tests in the course grade, more group work, and more emphasis on short, real-world cases.

Harrington (1999) offered statistics using statistical computer packages and compared traditional and programmed learning. Students rated this course positively, other than difficulty with using the Data Desk statistics program, although they were not required to use it. Harrington had hoped that the students' computer skills would improve, but they did not report an increase in them.

Holcomb and Ruffer (2000) proposed using extended projects involving a single, real multivariate data set to teach statistics. The assignments combined the use of computers, real data, collaborative learning, and writing. The authors administered a questionnaire to students at the end of each term. Almost all of the students agreed that the projects helped them understand statistical concepts and that the projects were beneficial in learning how to make graphs and tables. Most of the students agreed that consistently using the same data set helped them to see the range of statistical procedures that could be used to analyze data, and that working in groups was helpful.

Bartz (2001) found in a survey of undergraduate psychology departments, that although most offered computer-assisted data analysis, many did not use this approach in their introductory statistics courses. He suggested that instructors may feel that trying to learn both statistical concepts and the statistical computer program may be too daunting. Also, using the computer program may detract from learning underlying statistical concepts.

Quilter and Chester (2001) worked with 35 graduate students in education and the health professions using a web-based conferencing system that allowed the users to post text, graphics, and audio files in a multimedia forum. After the students completed a six-week course in beginning statistical applications for the social sciences, the authors found significant gains in achievement and improved attitudes toward statistics. The conferencing system enhanced communications, helped to resolve problems outside of scheduled class time, and provided the instructor with feedback on the course.

Chermak and Weiss (1999) developed an activity-based course that involved using computers to teach statistics to criminal justice students. The statistics program used was SPSS/PC+ with which some students had difficulty. Despite these problems, most of the students reported that the experience was valuable.

Activities

As with Chermak and Weiss, the course that is the subject of this study included the use of a computer program which made it possible to provide an individualized, self-paced, student-centered, activity-based course. The activities for both classes comprised conducting analyses of data given brief scenarios, as well as a final project, dubbed a "dissertation simulation" since it was designed to provide practice for the students in preparation for their dissertations. Other components of their grades included a midterm, a final, and participation in class discussions. The most recent syllabus for the course is appended to this paper. The statistical analysis program used for both Chermak's and this course was NCSS 2001 (Hintze, 2001).

Design

The design of the study was a single-sample pretest-posttest as used by Quilter and Chester (2001). A control group was not possible due to the students being taught in essentially the same way by the same instructor since the course is not offered by another instructor. As noted by Quilter and Chester, this approach is a weak experimental design because of the lack of a control group to support the idea that an intervention is the reason for any differences between pretest scores and posttest scores. In addition, the students who were compared in the their study as well as the present one were from intact, rather than randomly assigned, groups. Therefore, it may be inappropriate to make causal inferences based on the results.

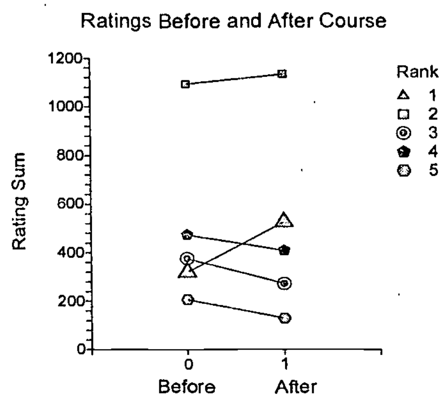
Subjects

The nine sections involved in this study were offered in the spring and fall 2001, spring and fall 2002, and spring 2003 terms. There were 75 participants for whom there was complete data. All were enrolled in advanced statistics, with 72% being females. Almost all of the students were either admitted to or considering applying for admission to the Higher Education or Educational Administration doctoral programs of the university. All were required to have had at least one prior course in statistics before being admitted to the class.

Instrument and Data Analysis

The instrument used to measure the students' attitudes toward statistics was the Statistics Attitude Survey (Roberts and Bilderback, 1980). The calculated chi square (89.77, $p<0.0000005$) and Cohen's w (0.13) indicated that there were differences in the distributions of ranks between pretest and posttest results. As a measure of effect for chi-square tests for contingency tables, Cohen (1988) recommended w (not to be confused with Kendall's W) as an index of "the amount of departure from no association" (p. 221). Cohen defined w as the square root of the ratio of the square of Pearson's contingency coefficient to one minus that square. Pearson's contingency coefficient for this study is 0.133461, so the resulting value of w is 0.134666, or about 0.13. In this case, then, the w of 0.13 is somewhat of a departure from no association. Cohen's index suggests 0.10 as a small effect, meaning that the observed effect is small. However, the measure captures only the net results of the frequency counts, not the movement. That is, if there are changes from ranks of 1 to 2, or from 2 to 3, and so on, then the net result might be a smaller number of 1's, perhaps, and a greater number of 5's, but about the same number of the ranks in between, which would mitigate the amount of change which actually took place.

The chart below illustrates the kinds of changes which could have occurred for the first question on the instrument. For example, the rank of 1 assigned to the first question could have been left as a 1 by some, but also changed to 2 or 4 by others after the course. Similarly, the rank of 2 could become 1, 2, 3, or 4. In other words, although the effect size is small, the statistical significance may be an indicator that some real change did occur as a result of the class' experiences with statistical problems.



Discussion

Most of these differences occurred as increases in the rankings marked at each end of the scales. That is, after the course, more students felt more strongly that they agreed or disagreed with statements about some aspects of statistics. For example, students agreed more strongly that "Statistics will be useful to me to test the superiority of one method over another."; "Statistics will be useful to me in my profession when I evaluate other people."; "Statistics will be useful to me when I describe my professional activities to other people."; and "I find statistics to be very logical and clear." On the other hand, they disagreed more strongly that "You should be good at math before attempting statistics"; "It is unreasonable to expect the average professional to master and apply statistics."; "When I solve a statistics problem, I am often unsure if I have a correct or nearly correct answer."; and "Statistics is the most difficult course I have taken." Comments from open-ended evaluation forms may help explain the results of the survey: "given the freedom to learn at my own pace and style", "class flexibility", "relaxed environment", "liked the structure of class", "final projects", and "I feel like I have learned a lot about stat and can apply it to my profession as a useful tool."

Offering the course using computers may help improve students' attitudes about certain aspects of statistics. However, since a limitation of the study is the small sample size, any generalizations of these findings would need to be done with caution. In addition, it was not possible to have a control group since the instructor is the only person teaching this particular course. It is possible, then, that the change in attitudes could have arisen from some unidentified source other than the instructional approach investigated here. While no other cause is suspected, the possibility remains.

Given the relatively small sample size, the brevity of the intervention (15 class meetings) and the difficulty of the course work, even a small increase in the students' self-assessment may be notable. A small gain in positive feelings may result in decreased anxiety allowing better performance on examinations, improved attitude toward the dissertation and further research using quantitative methods, and an increase in the use of statistics in data-based decision-making. It may be reasonable to assume that strongly held positive feelings as indicated by the slight shift on this attitude scale may reflect decreased negative feelings and the development of increased feelings of comfort and competence. Further research is needed to elucidate the relationships between cognitive and affective factors and their effect on the behavioral outcomes of doctoral research students.

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Counts Section

	Rank					
PrePost	**1**	**2**	**3**	**4**	**5**	**Total**
0	321	1095	377	475	207	2475
1	527	1135	273	410	130	2475
Total	848	2230	650	885	337	4950

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Expected Counts Assuming Independence Section

	Rank					
PrePost	**1**	**2**	**3**	**4**	**5**	**Total**
0	424.0	1115.0	325.0	442.5	168.5	2475.0
1	424.0	1115.0	325.0	442.5	168.5	2475.0
Total	848.0	2230.0	650.0	885.0	337.0	4950.0

The number of rows with at least one missing value is 0

Chi-Square Contribution Section

	Rank					
PrePost	**1**	**2**	**3**	**4**	**5**	**Total**
0	25.02	0.36	8.32	2.39	8.80	44.89
1	25.02	0.36	8.32	2.39	8.80	44.89
Total	50.04	0.72	16.64	4.78	17.60	89.78

The number of rows with at least one missing value is 0

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0.982188161479
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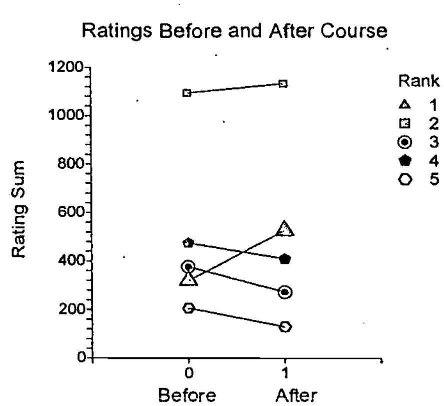
Chi-Square Statistics Section

Chi-Square	89.767425	
Degrees of Freedom	4	
Probability Level	0.000000	Reject Ho
Phi	0.134666	
Cramer's V	0.134666	
Pearson's Contingency Coefficient	0.133461	
Tschuprow's T	0.095223	
Lambda A .. Rows dependent	0.099394	
Lambda B .. Columns dependent	0.000000	
Symmetric Lambda	0.047353	
Kendall's tau-B	-0.067542	
Kendall's tau-B (with correction for ties)	-0.113031	
Kendall's tau-C	-0.084410	
Gamma	-0.188493	

Armitage Test for Trend in Proportions

Ho: p1 = p2 = p3 = ... = pk		
Armitage S	827306	
Standard Error of S	95133.2	
Z-Value (Standardized S)	8.696292	
Prob (Ha: Increasing Trend)	0.000000	Reject Ho
Prob (Ha: Decreasing Trend)	1.000000	Accept Ho
Prob (Ha: Any Trend)	0.000000	Reject Ho

Plots Section



UNIVERSITY OF ARKANSAS AT LITTLE ROCK
College of Education
Department of Educational Leadership
(revised 8/13/03)

I.	Course Prefix and Number	EDFN 8305
II.	Course Title	Advanced Statistics
III.	Credit	3 hours
IV.	Semester and Year	Fall, 2003
V.	Instructor	Rob Kennedy, Ph.D., Professor of Educational Foundations and Higher Education
VI.	Office Location	Dickinson 419B
VII.	Office Hours	By appointment
VIII.	Telephone	501-xxx-xxxx (UALR), 501-xxx-xxxx (home), rlkennedy@ualr.edu (e-mail)

IX. Course Description

Advanced methods of analyzing and interpreting educational data with computer applications; includes statistical concepts, models, estimation, hypothesis tests with continuous, discrete, and categorical data; multiple linear regression, correlation, analysis of variance and covariance.

The Conceptual Framework for programs in the College of Education is Leadership in Learning through Specialized Expertise, Communication, and Professional Development.

Communication: Students will use the expertise that they gain from Educational Foundations courses to communicate with a wide variety of audiences. They will know how to translate and evaluate current research trends and assessment practices in education. Based on their skills, these students will effectively advocate for best practices in educational improvement and thoughtful change in other work settings.

Specialized Expertise: Students will gain essential tools of their discipline in order to positively effect and measure change in students, schools, and organizations. They will gain knowledge of learning, diverse learning styles and instructional needs, lifespan growth and development, educational and psychological principles, assessment, and research.

Professional Development: Students will view themselves as professionals who are committeed to lifelong learning. They will strive to incorporate the latest in educational research, assessment, and technology into their work settings. They will be committed to data-based problem solving, to the value of inquiry in their disciplines, and to continually updating their knowledge toward teaching and learning.

X. Course Objectives

The objective is for you to become equipped to plan and implement the statistical aspects of research projects, including the dissertation. More specifically, you will be given exercises to help you:

Given a research problem and data, select an appropriate statistical analysis, conduct the analysis, and interpret the findings. (Communication, Specialized Expertise)

Comprehend and evaluate written reports of research in education and related areas of inquiry. (Arkansas Licensure Principles 1.1.1, 1.2.2, 1.3.1, 1.3.2, 1.3.4, 1.3.5, 3.1.3, 3.1.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, Specialized Expertise, Professional Development)

Analyze information through reviewing research literature. (Arkansas Licensure Principles 1.1.1, 1.2.2, 1.3.1, 1.3.2, 1.3.4, 1.3.5, 3.1.3, 3.1.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, Specialized Expertise, Professional Development)

Become familiar with the fundamentals of statistical analysis by identifying research questions and planning the statistical aspects of research projects. (Arkansas Licensure Principles 1.1.1, 1.2.2, 1.3.1, 1.3.2, 1.3.4, 1.3.5, 3.1.3, 3.1.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, Specialized Expertise, Professional Development)

Become familiar with the fundamentals of being consumers of statistics through such procedures as locating research materials; reading them for knowledge, understanding, application, analysis, and synthesis; and evaluating them on the basis of their development, execution, and delivery. (Arkansas Licensure Principles 1.1.1, 1.2.2, 1.3.1, 1.3.2, 1.3.4, 1.3.5, 2.1.6, 2.2.5, 2.3.8, 3.1.3, 3.1.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, Communication, Specialized Expertise, Professional Development)

Develop leadership and statistical skills through learning independently and making decisions based on this research. (Arkansas Licensure Principles 1.1.1, 1.2.2, 1.3.1, 1.3.2, 1.3.4, 1.3.5, 2.1.6, 2.2.5, 2.3.8, 3.1.3, 3.1.4, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2, Communication, Specialized Expertise, Professional Development)

XI. Texts, Readings, and Instructional Resources

Required Text (latest versions)

Hintze, J. L. (2001). NCSS 2001: Quick Start & Self Help, User's guide-I and II. Kaysville, UT: Number Cruncher Statistical Systems. The NCSS 2001 program requirements, according to Dr. Jerry Hintze: "Runs under Windows 95, 98, ME, 2000 or NT 4 compatible Pentium-class computers with 32 megs of RAM. Requires 30 megs of hard disk space." The program is available only for Windows.

XII. Assignments, Evaluation Procedures, and Grading Policy

Course Requirements

Students who demonstrate a commitment to the course through participation, reading, studying, and otherwise applying themselves to the course will benefit in direct proportion to that effort. If you view your coursework as an extracurricular activity that you pursue if you have some extra time, then expect to feel as though you learned little or nothing upon completing the class. If the course is to be a worthwhile experience for you, then you need to invest in it. In other words, "You get out of it what you put into it."

Evaluation Techniques/Concepts Used for Grading

Participation in Signing up for the Class List and Web Crossing (5%)
Participation (10%)
Dissertation Simulation (10%)
Mid-term Examination (35%)
Final Examination (35%)
Bibliographic Annotation (5%)

Participation in Signing up for the Class List and Web Crossing (5%)

It is important for you to further participate by signing up for the electronic class (See AdvStatSignup.pdf) and Web Crossing (See WebCrossing.pdf) so that you can benefit from the additional information available that way. Also, if I need to share updates with you about class closings, for inclement weather or other reason, then you will be able to get that information quickly, so please check your email regularly. Additionally, I will post the exercise files and answer files on a weekly basis and will use the class discussion list to make any related announcements. Signing up for the class list and Web Crossing is important so you will be expected to do this within the first week of class to receive full credit for participation in this area. After a week, one percent of the five percent credit will be deducted for each day you are late.

It is important also that you keep up with your email regularly and certainly at least daily. If the class is to carry on a discussion and has questions about something that you posted, then you will need to check regularly to see if you need to respond to those questions. In addition, when I try to contact you and am kept waiting for days at a time, then you are taking my time away from other work that I need to do for the class. Although I would like for you to check your email daily, I do realize that there are circumstances in which you may be taken away from computer access from time to time. Therefore, I will not assess a penalty unless I receive no response from you over a 48-hour period, not including Saturday and Sunday. One percent of the five percent credit will be deducted for the each 48-hour period in which you do not respond to my messages. If you need to be away from your computer access for an extended period of time, simply let me know. That will at least give me an opportunity to contact you before you are away.

Participation (10%)

For almost all statistical techniques there will be annotated examples in the NCSS text that is located under Help in the NCSS program. In addition, there are files distributed at the beginning of class that provide explanations and interpretations. You should complete these examples for practice and for information. You will also be given regular exercises to do in class or at home for practice as part of your participation. You will receive a scenario and data. Then you will need to determine the problem statement, determine a statistical technique to use to analyze the data, do the analysis, and explain and interpret your findings. You will probably find it helpful to read articles in the literature which use the techniques you have selected. In these papers you can see what information is provided to gain some insight into what information to include in your reports.

Dissertation Simulation (10%)

For the dissertation simulation you will need to (1) develop a problem statement(s), (2) find or construct an appropriate instrument(s), (3) collect the data, (4) run the statistics, (5) interpret your findings, and (6) prepare and (7) present to the class the outcome. There are faculty and staff, for example, who would probably be happy to have you analyze data that they have collected, if you are interested. Check with your instructor or others. Another source of information is the School Report Card, which is available by request from the Arkansas Department of Education in a spreadsheet format importable by NCSS. Individual district data is available from their web site. See DissSim.pdf.

Mid-term Exam (35%)

The mid-term exam will be hands-on and will comprise problems similar to the homework and/or classroom exercises and will be open book and open notes. The content will include the material covered up to the time of the exam. You will be given a scenario and data and will be expected to "take it from there". You will need to specify the problem statement, determine the technique(s) needed to address the problem(s), enter the data, run the stats, interpret the results, and report your findings.

Final Exam (35%)

The final exam will be hands-on and will be similar in format to the mid-term as well as open book and open notes. The content will include material covered up to the time of the exam, on the dissertation simulations, and possibly techniques that will require some web research to discover. Again, you will be given a problem statement and data and will be expected to "take it from there". You will need to determine the technique(s) needed to address the problem statement, enter the data, run the stats, interpret the results, and report your findings.

Bibliographic Annotation (5%)

The specifications for the Bibliographic Annotation are described in the file BibAnnotation.pdf. Bibliographic annotations allow students to share with other researchers (future Advanced Statistics students) similar to the manner in which researchers in general share information through formal publications. The student should investigate sources found useful in developing understanding for the course, that is, statistics-type resources as opposed to resources related specifically to the topic being investigated with the dissertation simulation. For example, a paper on effect sizes would be helpful to everyone, but one on the joys of studying Urdu would not necessarily be. Only one annotation (for one source) is required.

Grading scale:

A:	90-100
B:	80-89
C:	70-79
D:	60-69
F:	0-59

XIII. Class Policies

Again, "You get out of it what you put into it." These words have real meaning in this class in which the discussion (in class or on line) contributes to the learning of each individual. It is important that each person be prepared to contribute to these discussions. Practicing with the applications is necessary for developing your skill with, and understanding of, statistics. Just as playing a piano requires much practice to hone ability and interpretation, so does the skill of using statistics. If you want to know the hows and whys of statistics, then you need to dig into the subject. Create your own problems and investigate them. Merely doing the assignments will enable you to get through the course, but true understanding will always require greater commitment. As an advanced student of education, you must decide if you wish to add to your credentials the word "leader". Doctoral students, in particular, should be leaders. The degree signifies to others that you can lead them to solutions to problems, and this course provides you opportunities to be a problem solver.

If you have not taken basic statistics recently or are inadequately prepared for an advanced statistics class, then it is your responsibility to do additional study to avoid slowing down the class. The purpose of having basic statistics as a prerequisite for the class is so that we may investigate additional or more advanced topics, or in more depth. If you are unfamiliar with terminology or with using a computer for data analysis, then it is unfair to those who came prepared with the necessary background, for you to hold up the class for explanations of terms or concepts which you can easily find in the Help menu of the NCSS program, in books readily available from the library, or from the internet. Remember that you are a doctoral student, a leader! Demonstrate your leadership by doing your own research to increase your understanding. Information is readily and easily available to those who will make the effort to avail themselves of it. In the process, you may even learn serendipitously about a topic or concept that you will need at another time.

In addition, as part of the materials distributed the first night of class, you have the *Stat Lite* book which I have spent several years developing with the help of many previous classes, and reference materials from the basic statistics classes I taught. The book and materials provide you with the opportunity to study basic statistics in the comfort of your own home. You can prepare yourself and gain confidence in your ability at the same time, and then be a fully contributing member of the class.

The weekly exercises will involve subject matter which will not necessarily be of great interest to you. For example, the topics include cereal, auto pollution, teacher salaries, magazine ads, enrollment forecasts, hot dogs, and reading test scores, among many others. A leader will appreciate the fact that the scenarios provide an opportunity for greater understanding of the statistical techniques, as well as providing a chance for greater transfer of that understanding. Few studies are available which offer both published papers and the real data on which the study was based, and that have also been released for teaching purposes. As a result, it seemed preferable to me to use this variety of topics and have actual case studies rather than to have contrived studies generally of interest to no one.

The scenarios are "messy" because they are real. I was part of a group which heard Dr. Grant Wiggins, a noted evaluation specialist, speak at the University of Kentucky several years ago and he encouraged us to use messy data because that is the way life really is. His suggestion makes sense. No one in life gives you four or five nicely prepared choices and a clearly articulated problem and says pick an answer. Instead, you encounter a situation and have to determine what the problem is and then what to do about it. This is precisely what you do with your dissertation. You sort through a topical area and then focus on a problem. Consequently, the scenarios purposely do not make the problem crystal clear, but instead require you to analyze the situation and determine what the likely problem is which must be solved. Then you determine a suitable statistical analysis to address that problem. This is a "thinking" exercise. It is not easy, but then, being a leader is not easy either.

Since immediate reinforcement is suitable only for simple learning of factual knowledge, solutions to the exercises will not be accessible immediately. Solutions to higher order thinking skills type problems are more optimally revealed after a number of days of thought and reflection. Therefore, I will wait a few days after you access the exercises for the week before I post the answers to ensure that you have time to reflect on your own answers. As soon as you know the solution you no longer have an incentive to think about the problem, so having to wait will allow you to have more time to develop those higher order thinking skills. Asking for "hints" is tantamount to asking for the answer since hints tend to close the doors on at least some approaches to solving problems. You will receive the solutions soon enough. Spend the few days developing your analytical skills.

It is natural to wish to converse during class. However, if you must speak, please do so quietly to avoid distracting the other students who are also paying for the instruction they are trying to hear. If conversing with your friends about unrelated topics is more important to you than listening to this instruction, then please step into the hallway to have the necessary discussion. Additionally, note that because the lab in which we will be working contains a large amount of very expensive equipment, please do not bring in food or drinks. This practice can be messy and distract other students. Even small, individually-wrapped candies or peanuts in bags are noisy as you unwrap them or dig into the bag. Also, left-behind food, drink cans, and other debris reflects poorly on you as a professional. If you need to eat during class time, then you are welcome to visit the break lounge near the elevators.

If you must be available for communication, please show other class members the courtesy of setting your cellular phone, pager, beeper, or other device on vibrate so that it does not annoy or distract the other students in the class should it activate. No doubt, everyone would enjoy hearing "Variations on a Theme by Eric Satie" or the Homer Simpson theme song, but probably not while they are trying to concentrate on the subject at hand. If you do need to take the call, please step out into the hallway to converse.

XIV. Class Schedule

Aug 27/28	Introduction, overview, picture, survey
Sep 3/4	Review
Sep 10/11	Review/Demonstration of scenario exercises (DemoQues and DemoAns, 1stQues)
Sep 17/18	Scenario exercises (1stAns, 2ndQues)
Sep 24/25	Scenario exercises (2ndAns, 3rdQues)
Oct 1/2	Scenario exercises (3rdAns, 4thQues)
Oct 8/9	Scenario exercises (4thAns, 5thQues)
Oct 15/16	Scenario exercises (5thAns, 6thQues)
Oct 22/23	Scenario exercises (6thAns, 7thQues) Sign up for dissertation simulations. For information, see DissSim.pdf.
Oct 29/30	Mid-term exam. Evaluation. Sign up for dissertation simulations.
Nov 5/6	Mid-South Educational Research Association (MSERA) meeting. No class.
Nov 12/13	Scenario exercises (7thAns, 8thQues) Presentations of dissertation simulations
Nov 19/20	Scenario exercises (8thAns, 9thQues) Presentations of dissertation simulations
Nov 26/27	Thanksgiving. No class.
Dec 3/4	Scenario exercises (9thAns) Presentations of dissertation simulations

Dec 11 4:00 pm – 6:00 pm. Final Exam over topics used in the dissertation simulations. Evaluations, survey

or

Dec 15 6:00 pm - 8:00 pm. Final Exam over topics used in the dissertation simulations. Evaluations, survey

XV. Topical Outline

Descriptive statistics
Correlation
Regression
T-test
Analysis of variance
Analysis of covariance

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