Graduate Statistics: Student Attitudes

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Abstract

This study investigated the attitudes toward statistics of graduate students who used a computer program as part of the instruction, which allowed for an individualized, self-paced, student-centered, activity-based course. The twelve sections involved in this study were offered in the spring and fall 2001, spring and fall 2002, spring and fall 2003, and spring 2004 terms. There were 99 participants for whom there was complete data. All were enrolled in advanced statistics, with 70 females and 29 males. The study was a quasi-experimental pretest-posttest design with both groups of students' being taught by the same instructor. The instrument used was the Statistics Attitude Survey (Roberts and Bilderback, 1980). The calculated chi square (244.10, $p<0.0000005$) and Cohen's w (0.19) 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.

Graduate Statistics: Student Attitudes

Probably not surprisingly, students often express anxiety about taking statistics classes (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), and perhaps even more so when the class is at an advanced level. Their prior experiences, rumors, or simply fear of the unknown, likely 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. Since statistics courses tend to be among the most anxiety-provoking for college students required to take them, researchers have investigated techniques to help reduce students' anxiety and negative attitudes (Sgoutas-Emch and Johnson, 1998). Sgoutas-Emch and Johnson (1998), for example, tried asked undergraduate students to try their hands at journal writing as part of their statistics course. The journal group showed improved grades and lower anxiety before exams, compared to a control group.

Other approaches to lowering anxiety in the classroom have involved technology. For example, 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 helped give 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.

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.

Harrington (1999) offered statistics using statistical computer packages and compared traditional and programmed learning. Students rated this course positively, despite their difficulty with using the Data Desk statistics program, a nonrequired tool. Harrington had hoped that the students' computer skills would improve, but that did not appear to be the case, as 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. It was proposed that 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 about 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, for the spring of 2004, is appended to this paper. The statistical analysis program used for this course, NCSS 2004 (Hintze, 2004), was an updated version of the one used by Chermak.

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 was offered by only one 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 their study as well as the present one were from intact, rather than randomly assigned, groups. Therefore, making causal inferences based on the results should be done with caution.

Subjects

The twelve sections involved in this study were offered in the spring and fall 2001, spring and fall 2002, spring and fall 2003, and spring 2004 terms. There were 99 participants for whom there was complete data. All were enrolled in advanced statistics, and included 70 females and 29 males. 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 (244.10, $p<0.0000005$) and Cohen's w (0.19) 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 0.189786, so the resulting value of w is 0.193299 or about 0.19. In this case, then, the w of 0.19 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.

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." Some of the other comments are listed here:

“I liked everything”

“The repeated practice in class way **very** helpful.

Being able to work through the problems with Dr. Kennedy was an excellent learning experience. NCSS-Like the program!”

“I really did learn more about the application of statistics. I also really appreciated being able to decide if I need f2f instruction or web-based instruction. This is especially important since my job often takes me out of town.”

“Learning atmosphere”

“I liked the flexibility.”

“Opportunity to create a statistical problem and run it.”

“The set up of homework, answers, and discussion.”

“I really enjoyed being able to work online due to the distance from LR that is required to travel. I'm an idiot and I liked this class!!!”

“Actually, I liked the format, professor, pretty much everything.”

“I learned a lot (really!)”

“I like the format, the instructor's patience”

“I learned a lot.”

“I believe that I am better equipped for other classes in this area.”

“interactive with use of software program”

“simulations was true learning experience for me”

“I learned more than I could have ever imagined (believe it or not I've even been able to help my colleagues)”

“I learned something I did not think I could learn”

Offering the course using computers may help improve students' attitudes about certain aspects of statistics. However, since a limitation of the study would be the nonrandom sample, 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 nonrandom sample, 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, thereby allowing for 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 seems reasonable to assume that strongly held positive feelings as indicated by the shift on the attitude scale may reflect decreased negative feelings and the development of increased feelings of comfort and competence. Further research is needed to determine the relationships between cognitive and affective factors and their effect on the behavioral outcomes of doctoral research students.

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Cross Tabulation Report

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Counts Section

	Rank					
Group	**1**	**2**	**3**	**4**	**5**	**Total**
1MPre	100	499	170	148	40	957
2MPost	163	507	130	143	14	957
3FPre	290	920	359	528	212	2309
4FPost	462	1065	253	416	114	2310
Total	1015	2991	912	1235	380	6533

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

Expected Counts Assuming Independence Section

	Rank					
Group	**1**	**2**	**3**	**4**	**5**	**Total**
1MPre	148.7	438.1	133.6	180.9	55.7	957.0
2MPost	148.7	438.1	133.6	180.9	55.7	957.0
3FPre	358.7	1057.1	322.3	436.5	134.3	2309.0
4FPost	358.9	1057.6	322.5	436.7	134.4	2310.0
Total	1015.0	2991.0	912.0	1235.0	380.0	6533.0

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

Chi-Square Contribution Section

	Rank					
Group	**1**	**2**	**3**	**4**	**5**	**Total**
1MPre	15.94	8.45	9.92	5.99	4.41	44.71
2MPost	1.38	10.82	0.10	7.94	31.19	51.43
3FPre	13.17	17.79	4.17	19.18	44.95	99.26
4FPost	29.62	0.05	14.97	0.98	3.09	48.71
Total	60.11	37.11	29.16	34.09	83.64	244.11

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

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Chi-Square Statistics Section

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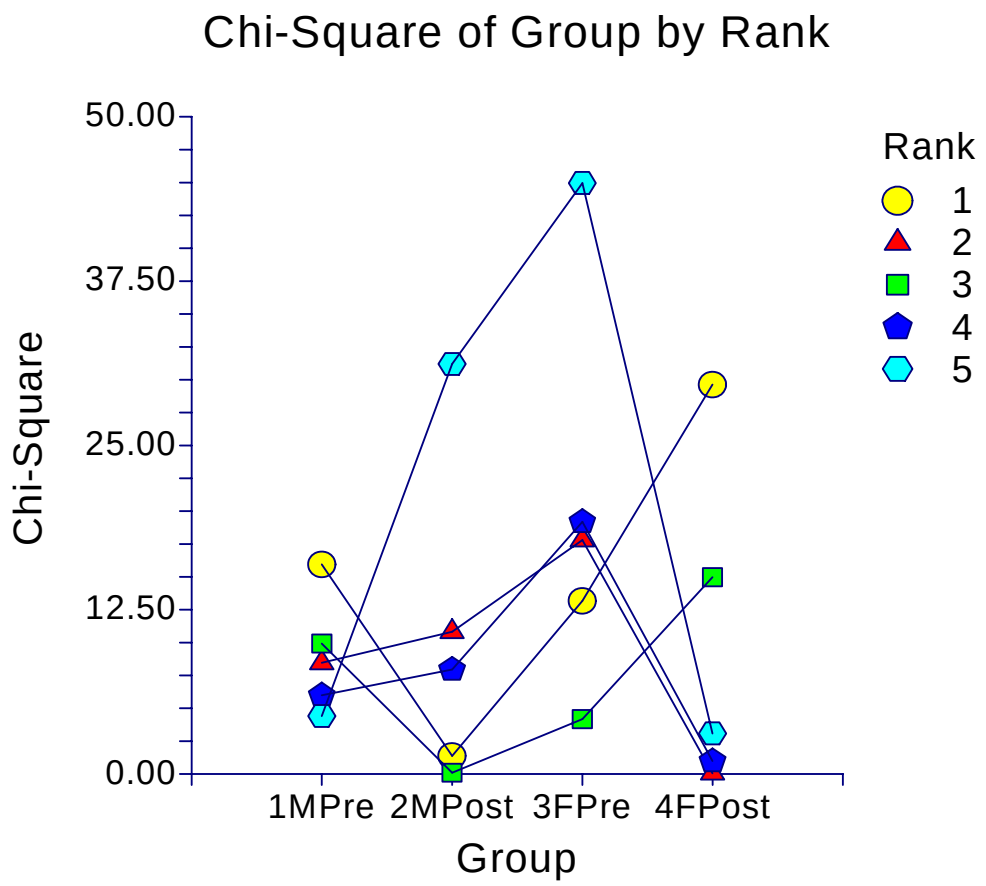
Phi	0.193299	
Cramer's V	0.111601	
Pearson's Contingency Coefficient	0.189786	
Tschuprow's T	0.103856	
Lambda A .. Rows dependent	0.074828	
Lambda B .. Columns dependent	0.000000	
Symmetric Lambda	0.040695	
Kendall's tau-B	-0.017326	
Kendall's tau-B (with correction for ties)	-0.024489	
Kendall's tau-C	-0.021654	
Gamma	-0.034685	

Plots Section



UNIVERSITY OF ARKANSAS AT LITTLE ROCK
College of Education
Department of Educational Leadership
(revised 12/29/03)

I.	**Course Prefix and Number**	**EDFN 8305**
II.	**Course Title**	**Advanced Statistics**
III.	**Credit**	**3 hours**
IV.	**Semester and Year**	**Spring, 2004**
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

Jan. 15 **Introduction, overview, picture, survey**

Jan. 22 **Review**

Jan. 29 **Review/Demonstration of scenario exercises (DemoQues and DemoAns, 1stQues)**

Feb. 5 **Scenario exercises (1stAns, 2ndQues)**

Feb. 12 **Scenario exercises (2ndAns, 3rdQues)**

Feb. 19 **ACE-D/HH (Association of College Educators of the Deaf and Hard of Hearing) Conference. No class.**

Feb. 26 **Scenario exercises (3rdAns, 4thQues)**

March 4 **Scenario exercises (4thAns, 5thQues)**

March 11 **Scenario exercises (5thAns, 6thQues)**

March 18 **Spring Break! No class.**

March 25 **Mid-term exam. Evaluation.**
Sign up for dissertation simulations.

April 1 **Scenario exercises (6thAns, 7thQues)**
Sign up for dissertation simulations.
For information, see DissSim.pdf.

April 8 **Scenario exercises (7thAns, 8thQues)**
Presentations of dissertation simulations

April 15 **Scenario exercises (8thAns, 9thQues)**
Presentations of dissertation simulations

April 22 **Scenario exercises (9thAns)**
Presentations of dissertation simulations

April 29 **4:30 pm – 6:30 pm. Final Exam over techniques used in the dissertation simulations.**
Evaluations, survey

or

May 4 **4:00 pm – 6:00 pm. Final Exam over techniques used in the dissertation simulations.**
Evaluations, survey

XV. Topical Outline

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

XVI. Bibliography

Gall, J., Gall. M. & Borg. W. (1999). Applying educational research, practical guide. New York: Addison Wesley Longman. Inc.

The first two sections of the book cover research. The third section covers quantitative research in education. This is the chapter of greatest value to me at this time. Chapter eight covers correlation research that is an area I have an interest in currently. The explanations and graphics are simple to understand. This book gives a good background for applying statistics to real educational situations. I think it is applicable to the dissertation simulations we are doing for class. Each chapter has a concrete article demonstrating the concepts taught. Chapter eight's article by Simner (as cited in Gall, Gall. & Borg, 1999) was an informative example of the predictive validity of an abbreviated version of the printing performance school readiness test. (N. Sherwood)

Huff, D. (1954). *How to lie with statistics*. New York, NY: W. W. Norton and Co.

Many of you have probably heard of this book, but may never have read it. It is fun to read, in that it gives real examples of data statistically reported on in ways that did not exactly lead to the truth. Although this book is nearly 50 years old, the examples are humorous and helped me to take a closer look at how statistics are reported in current media sources. The book actually gives great examples of how *not* to show statistical findings, and demonstrates many ways in which errors are often made by those reporting them. (P. J. White)

Jaisingh, L. (2000). *Statistics for the utterly confused*. New York, NY: McGraw Hill.

This book presents the study of statistics in a very reader-friendly (and non-confusing!) way, and is aimed at students in all disciplines. The book is arranged in a topical style, and has highlighted, summarizing "Quick Tips" in each chapter, as well as easy-to-read charts and graphs, followed by practice questions and answers. It also has technology tips relating to various forms of statistical software. The book is excellent for gaining additional insight into specific areas or topics. (P. J. White)

Kranzler, G. and J. Moursund. (1999). Statistics for the Terrified. Second Ed. Upper Saddle River, NJ: Prentice Hall.

This text was intended for the faint of heart when the word "statistics" is brought up in the academic arena as well as for students taking a required course in statistics. The purpose set out by the authors was to ease the faint of heart into the core of statistical analysis with humor, along with step-by-step instructions in understanding and applying basic statistics to research; however, the authors also addressed the utilization and purpose of advanced statistics within their text. They cleverly intertwine the essentials of basic statistics with wit and humor to lessen the reader's fear of applying mathematical techniques to data, and in turn, applying data to interpretation. This text transports the reader from basic frequency distributions to more tasking statistical techniques such as analysis of variance. Finally, the authors offer the reader ways in

which to further alleviate math anxiety while learning various statistical methods. (K. M. McKinnon)

Licht, M.H. (1995). Multiple Regression and Correlation. In L.G. Grimm & P.R. Yarnold (Ed.), *Reading and Understanding Multivariate Statistics* (pp. 19-64). Washington, DC: American Psychological Association.

This chapter is written for those with a limited knowledge of multiple regression. The chapter is divided into two sections: applied prediction and theoretical explanation. Each section begins with a brief overview of multiple regression for the purpose, with abstract descriptions of procedures and concepts. Multiple regression for each purpose is then illustrated using numerical examples. After this general introduction, the chapter discusses several important methodological and conceptual issues, including the following: multicollinearity; assumptions involving residual scores; specification errors and measurement errors; how to handle categorical variables; and the differences among the most commonly encountered variations of multiple regression. (D. J. Fletcher)

Lloyd, R. & Jaisingh, L. R. Statistics for the Utterly Confused

Statistics for the Utterly Confused is your user-friendly introduction to elementary statistics, designed especially for non-math majors. Required courses in statistics are cause for alarm among more than 500,000 undergraduates in such disciplines as nursing, allied health, pre-law, pre-medicine, business administration, and criminal justice. This super-accessible book demystifies the dreaded subject for non-math majors. Statistics for the Utterly Confusedprovides a logical, step-by-step approach to introductory statistics, stripping away confusing material and clarifying key concepts without long, theoretical discussion and includes: Handy icons throughout the text offer easy visual aids, 500 self-testing questions, Technology Corner sections explain the latest software. Provides more than 200 examples and solved problems. A ticket to success in statistics, even for the most mathematically challenged. Shows how to grasp the meaning of many statistical concepts, how to read, understand and solve statistics problems, how to use statistics in any field, and more. Also uses simplifying icons and offers ways to integrate technology into the text. Softcover. (K. DeCorte)

Phillips, J. L. (2000). How to Think About Statistics. New York: W. H. Freeman and Company.

This book explains statistics using simple computations to explain the theory behind the concepts. The examples are detailed, yet easy to follow and understand. Applications are demonstrated also. This is not about how to compute statistics, but rather, how to understand what the programs compute. It is easy reading, and even the math-phobic can follow along and benefit from the book. Although this is the sixth edition, earlier editions can be found in the public library. This 200 page paper back is a great refresher of basic stats. (C. Overton)

Sawyer, J. (2002). Statistics: Addison Wessley's Flash Review. Boston: Pearson Education, Inc.

This book is a very mathematical explanation of the statistical process. However it is very easy to use as a quick reference – if you are mathematically minded. Even if you are not – at the end of each section it gives web sites to go to for additional examples and non-mathematical explanations. The most useful part of the book to most of the group would be the web sites, and they are very beneficial. (D. Chapman)

Slavin, S. (1999). Chances are: The only statistics book you'll ever need. 1st ed. National Book Network.

This text is an excellent resource for students beginning the study of statistics, and for those who cannot make sense of the numbers, applications, and interpretations. The text is written in conversational style and avoids mathematical jargon that may confuse readers. The book offers a step-by-step approach to problem solving, and records answers in the back of the book so students may check their work against the author's. Most impressive is the simple solutions offered to complex statistical concepts. Content includes graphs, tables, and related vocabulary. The text is inviting, not intimidating. (K. Halpern)

Statter, T. M. (2000). Stat Lite. Unpublished.

When I began Advanced Statistics, it had been two years since I had completed Basic Statistics. I had forgotten much of what I had learned. By reading through Stat Lite I was quickly able to bring myself up to speed. In fact, Stat Lite would have been very helpful when I was taking Basic Statistics. The step-by-step process of explaining the procedures made it much easier to understand than the textbook that we used. I also enjoyed the humorous comments that were interspersed within the text. They made the reading much more tolerable. (R. Gray)

Stockburger, D.W. (2002). www.psychstat.smsu.edu/ This website was developed by David Stockburger, a professor in the psychology department at Southwest Missouri State University. It contains resourceful information for statistic users. The format is user-friendly and easy to navigate. This site is an excellent resource tool to the basic statistic students as well as advanced statistic students. Some of the links include:

Introductory Statistics: Concepts, Models, and Applications, First Edition. This is the author's original Introductory Statistics text, first made available on the web in 1996. Permission is granted to link to these pages at will.

Introductory Statistics: Concepts, Models, and Applications, Second Edition. A revised version of the above text but has the advantage of a probability calculator.

Multivariate Statistics: Concepts, Models and Applications, First Edition. A continuation of the Introductory Statistics text covering hypothesis testing in regression, principal components, cluster analysis, discriminant function analysis, multiple regression, dummy coding, and ANOVA.

Multivariate Statistics: Concepts, Models and Applications, Second Edition. A revised version of the above link.

Handbook for a Statistics Project. A how-to manual for survey research. It covers questionnaire design, analysis with SPSS, and report format.
Interactive Exercises. A variety of exercises available to demonstrate statistical principles. (S. Y. Parchman)

Uebersax, J. (2001). Statistical methods for rater agreement. Available: http://ourworld.compuserve.com/homepages/jsuebersax/agree.htm

This Internet site is concerned with categorical rating agreement among various raters or judges. The site includes discussion of different methods and examples. Dr. Uebersax includes the Likert-type rating and interval-level ratings. His information on the Likert-type ratings will be very helpful to me as I survey gifted students for my dissertation. (S. Milton)

Witte, R.S. & Witte, J.S. (2001). *Statistics* (6th ed.). Harcourt College Publishers.

A fellow instructor who teaches statistics recommended this as a book that would help any student's understanding of the subject. Basic concepts and procedures are explained in plain English and clarifies simple topics from standard deviation to more mystifying topics such as ANOVA. It is written without the quantitative part of statistics and more of the everyday usefulness of statistics. The author states that it reveals "the beauty of statistics". Imagine that? The chapters begin with an outline, gives worked examples of each statistical test and ends with a summary of concepts. Each section of each chapter has multiple exercises, with answers in the back of the book. (D. Millard)

Web Sites

http://www.stats.gla.ac.uk/steps/glossary/index.html
http://www.statsoftinc.com/textbook/contents.html

These useful sites contain valuable information about all elements of statistics. Both begin with the basic concepts and progress into more complicated areas. The formats are simple to navigate. The explanation for each of the sections is written in a user-friendly manner. These sites were useful for those of us who need to refer back to basic statistics on a regular basis. (W. T. Thurman)

http://carbon.cudenver.edu/~lsherry/rem/ancova.html
http://sunset.backbone.olemiss.edu/~pyhan/edrs701/ancova.html

These two websites offer a plethora of information about analysis of covariance. The information is easy to comprehend and contrasts the ANOVA versus the ANCOVA technique. The assumptions according to this author are given at length. The websites discuss why the covariate is needed in instances where one group needs to be controlled. The sites also list key points of ANCOVA's and the characteristics that make a good covariate. (M. McClure)

http://www-psych.nmsu.edu/regression/home.html

This website is an excellent source for information pertaining to multiple regression. The information was comprised by three graduate students from New Mexico State University and is disseminated by a cartoon with Ren and Stimpy. In the cartoon, Ren describes multiple regression and contrasts it with other analysis techniques. Co linearity and outliers are discussed in detail. The website is very user friendly and adds a little spice to MR with the addition of the cartoon characters. (M. McClure)

Journal of Statistics Education Online **http://www.amstat.org/publications/jse**

The *Journal of Statistics Education Online* is an excellent resource for the student or instructor of statistics. The mission statement clearly identifies the intended audience and purpose to "disseminate knowledge for the improvement of statistics education at all levels, including elementary, secondary, post-secondary, post-graduate, continuing, and workplace education."

The website is clearly organized with excellent links to the current issue, an extensive archive of previous issues dating back to 1993, and other statistics organizations, publications, and online discussion groups. It requires no special logon identification/password to use the materials found on the site. The language of the articles is sensible and easy to follow without losing the significance of the research conducted or the analysis of the results. Of particular interest to statistics students is the availability of datasets in PDF format that can be downloaded (either a .txt file or a .dat file) with suggestions for additional study. This is a very complete website that should be bookmarked as a "favorite." (J. Townsend)
Probability and Statistical Resources http://ubmail.ubalt.edu/~harsham/statistic/REFSTAT.htm

This web site provides a wealth of links to many areas of concern to the novice statistician as well as the "veteran" statistician. The author of the site, Dr. Hossein Arsham, provides a large annotated review of many of the links contained on the web site. Some of these links include textbook references, dictionary sites, interactive statistic sites, data sets, software, sites for selecting the appropriate statistic, and sites for various specific statistical methods and computations. Other useful links on this web site include links to statistical organizations, statistical resources, data analysis, methodology options, journal web sites, journal articles and book references. All linkages are direct and no fees are involved. The annotated review facilitates appropriate selection of needed resources.

This rather large web site provides a plethora of information for students and educators to learn or practice statistical skills. The comprehensive features of this site for beginning statistician and researchers may justify its being bookmarked as a "favorite." (G. McKissic)

VassarStats: Statistical Computation Web Site http://faculty.vassar.edu/~lowry/VassarStats.html Web site for statistical computation; probability; linear correlation and regression; chi-square; t-procedures; t-tests; analysis of variance; ANOVA; analysis of covariance; ANCOVA; parametric; nonparametric; binomial; normal distribution; Poisson d http://faculty.vassar.edu/~lowry/VassarStats.html

HyperStat Online: An Introductory Statistics Book <http://davidmlane.com/hyperstat> Check out this online text complete with tutorials and related sites. Topics include distributions, hypothesis testing and power calculations. Free Statistical Analysis Tools and Instructional Demos were most helpful. http://davidmlane.com/hyperstat

AS - IS: Arkansas School Information Site <http://www.as-is.org/> Arkansas Fast Facts How To Use This Site | Contact AS-IS Arkansas Dept. of Education | Arkansas Website School Directory | General Information | Educational Indicators Statistical Trends | Report Cards | Classifieds |

This website is comprised of data submitted by the 310 school districts and 15 co-operatives in Arkansas. A great source of Arkansas education data. http://www.as-is.org (B. Brown)

http://ubmail.ubalt.edu/~harsham/statistics/REFSTAT.HTM

This internet site will lead viewers to a tremendous amount of statistical information. This site list hundreds of other sites that could answer any statistical question or provide information about every aspect of statistics, whether a beginner or an expert. The site continues with sample questions and answers for different educational levels, and the site also provide viewers with a list of statistical software programs and hundreds of book and internet references. This internet source provides a list of journal websites for statistics, probability resources, how to design questionnaires resources, statistical societies and organization and many other resources and statistical information. I am confident that the class will find this resource extremely helpful. (W. Hunter)

Students with Disabilities

It is the policy of UALR to accommodate students with disabilities, pursuant to federal law and state law. Any student with a disability who needs accommodation, for example in arrangements for seating, examinations, note-taking, or access to information on the web, should inform the instructor at the beginning of the course. The chair of the department offering this course is also available to assist with accommodations. Students with disabilities are encouraged to contact Disability Support Services telephone 501-569-3143 (v/tty), and on the Web at http://www.ualr.edu/dssdept/.

It is the policy and practice of UALR to make all web information accessible to students with disabilities. If you, as a student with a disability, have difficulty accessing any part of the online course materials for this class, please notify the instructor immediately.