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THE IMPACT OF A WEB - BASED CLASS MANAGEMENT SYSTEM ON STUDENT PERFORMANCE AND ATTITUDES IN A QUANTITATIVE STATISTICS CLASS

by

Nancy A. Petta

A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska

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DISSERTATION TITLE

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GRADUATE COLLEGE
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THE IMPACT OF A WEB-BASED CLASS MANAGEMENT SYSTEM ON STUDENT PERFORMANCE AND ATTITUDES IN A QUANTITATIVE STATISTICS CLASS

Nancy A. Petta, Ed.D.

University of Nebraska, 1999

Advisor: Tom Wandzilak

The present study investigated the impact of the use of a Web-based class management system in a statistics class on student performance and attitudes toward learning. The sample consisted of thirty-five graduate level statistics students. The subjects were assigned to a control or an experimental group based on the section of statistics for which they registered. One section used a Web-based class management system and the other section followed a traditional lecture format in the instruction of statistics. The independent variable was the use of a Web-based class management system in teaching statistics versus not using a Web-based system. The dependent variables were: a) attitudes toward computers, as measured by the Computer Attitude Scale; b) attitudes toward statistics, as measured by the Attitudes Toward Statistics scale; c) knowledge of statistics, as measured by scores on 14 identical exam questions given in both statistics sections; and d) attitude toward the use of a Web-based class management system and learning processes, as measured by structured interview questions. The statistics pretest (the Student Diagnostic Survey), the Attitudes Toward Statistics scale and the Computer Attitude Scale were administered at baseline during the five-week

summer class. The surveys were distributed again at two and one-half weeks and at the end of the five- week session. Fourteen identical exam questions were given in both statistics sections. Structured interview questions were distributed at the end of the five-week session.

Analyses of data revealed that students in the statistics session who used the Web-based class management system did not experience significantly ($p > .05$) less anxiety toward computers, more confidence toward computers or more liking toward computers compared to students who were taught in the traditional class. A Web-based system did not significantly increase knowledge of subject content. Students who used a Web-based class management system did not experience significantly better attitudes toward the use of statistics in their field of study, or a significant improvement in their attitudes toward the course of statistics in which the students were enrolled, than those taught in a class that did not use a Web-based class management system.

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Chapter 1

INTRODUCTION

An important influence on the direction of education in recent years has been technology, particularly computer technology. Technologists and futurists have been predicting a technological revolution in education for many years (Samson, Niemiec, Weinstein, & Walberg, 1986). Twenty years ago, only 50,000 computers existed on the planet. Today, 50,000 units are sold every 10 hours around the world (Jones, 1997). Personal computer prices are dropping and their capabilities rising. The number of Internet host computers has increased 2000% since 1991. If the present growth rate continues, there will be at least 101 million individual Internet users by the year 2000 (Maddux, 1996). The advent of the Internet and related information technology (IT) is a major development that will change the way knowledge is conveyed to the audiences inside and outside the classroom (Usip & Bee, 1998).

The World Wide Web began in 1990 and became immensely popular in 1993 after the introduction of Mosaic (graphical web-browsing software) (Maddux, 1996). Since then, the number of pages on the Web has doubled on the average of every 3 to 5 months. As of February 1996, there were at least 18 million people using the Web (Maddux, 1996). There has been a rapid growth of the Web since 1993 which is unparalleled in the entire modern history of spoken and written communication (Maddux, 1996).

The increased use of technology has, in turn, fostered a shift of instruction from the predominant mode of passive note-taking to more active methods of learning (Apple Classrooms of Tomorrow, 1992). Over the next decade, telecommunications technology will exert increasing influence over the ways in which learners learn and teachers teach (Graziadei,1996). Institutions of higher learning worldwide are rushing to install or upgrade the necessary telecommunications infrastructure in order to promote Web-based distance learning (WBDL). Although WBDL, or electronic distance learning, is not a substitute for the traditional classroom lectures and related protocols, it is a powerful, flexible and efficient tool for delivering instructional materials to students (Usip & Bee, 1998). "It provides new ways for us to teach and learn. It allows us to do new things, as well as do traditional things in new ways" (Burgstahler, 1997). Also, the cyberspace of the Internet's World Wide Web is emerging as the easiest and most popular medium for delivering instruction (Kahle, 1997; McManus, 1995).

Marzano (1992) stated that without positive attitudes and perceptions, students have little chance of learning proficiently, if at all. He identified two categories of attitudes and perceptions that affect learning: a) attitudes and perceptions about the learning climate and b) attitudes and perceptions about classroom tasks.

With the infusion of Web-based instruction into the educational process, professors must plan how to integrate this technology into the curriculum. Instructional strategies will need to be assessed, along with attitudes toward the use of

these strategies to determine how the students will benefit most from Web-based instruction in the educational environment. As part of this effort, the study presented here was developed to determine if the use of a Web-based class management system in a quantitative statistics class has an impact on students' attitudes toward learning. Results will have implications for planning and future use of Web-based instruction. The quantitative statistics course was selected as the curricular area of study because the overwhelming research pertaining to student attitudes toward statistics shows that numerous students are intimidated by statistics (Bibby, 1986; Clegg, 1982). A student's feelings and perceptions about statistics may influence what he/she learns in class. Research has, in fact, shown that anxiety can be detrimental to performance (Chapin, 1989; Kleijn, Van Der Ploeg, & Topman, 1994). As indicated by Chapin, Kleijn, Van Der Ploeg and Topman (1994), technological advances have changed the way statistics is taught. However, the use of technology requires additional skills of the student and may impact student performance in the statistics course.

Statement of Problem

The purpose of this study was to examine the impact of the use of a Web-based class management system in a quantitative statistics class on student performance and attitudes.

Research Questions

The following research questions were investigated in this study:

a. What is the difference in computer anxiety, computer confidence, and computer liking, as measured by the Computer Attitude Scale, over time (baseline, mid-term, and end of the semester) for students who were taught using a Web-based class-management system compared to students who did not use a Web-based class management system?

b. What is the difference in attitude toward statistics, as measured by the Attitudes Toward Statistics (ATS) scale, over time for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system?

c. What is the difference in the knowledge of statistics (as measured by scores on 14 identical exam questions given in both statistics sections) for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web- based class-management system?

d. What is the attitude toward a Web-based class management system and learning processes (as measured by student attitude interview questions) for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system?

Definition of Terms

The following definitions were assigned to terms and concepts utilized in the study:

1. Asynchronous Communication. Educational events that take place independently in time. that is. a learning exchange between students and facilitator(s) that is delayed by minutes, hours, or days (Driscoll, 1998).

2. Attitude. Personally held beliefs or principles that govern much of one's behavior (Marzano, Brandt, Hughes, Jones, Presseisen & Suhar, 1988).

3. Computer attitude. Personally held beliefs or principles toward learning about and working with computers (Loyd & Gressard, 1984).

4. Computer anxiety. Anxiety toward or fear of computers or learning to use computers, as measured by scores on a sub-scale of the Attitude Toward Computer Survey (Loyd & Gressard, 1984).

5. Computer confidence. Confidence in the ability to learn about or use computers, as measured by scores on a sub-scale of the Attitudes Toward Computers Survey (Loyd & Gressard, 1984).

6. Computer liking. Liking of computers or enjoying working with computers, as measured by scores on a sub-scale of the Attitude Toward Computers Survey (Loyd & Gressard, 1984).

7. Course Management (CM). The process of developing, managing, and delivering information related to a specific course (Graziadei, 1996).

8. Learning. An activity of the mind that involves the application of specific and controlled operations to new information, with the results that this information becomes a part of long-term memory (Keefe, Letteri, Ferrell, & Jenkins, 1988).

9. Multimedia. The use of two or more of the following elements in a computer-based training program: text, images, video, audio, and animation (Driscoll, 1998).

10. Synchronous Communication. Events that take place in real-time (Driscoll, 1998).

11. Web-based Training (WBT). Student- initiated instruction delivered over public or private computer networks and displayed by a web browser.

12. Web Class-Management System (WCMS). Platforms, applications, processes, and their requisite infrastructure designed to facilitate the class/course management process (Graziadei, 1996).

Assumptions of Study

1. The Computer Attitude Scale (CAS) is an appropriate instrument for assessing students' computer anxiety and computer confidence.

2. The Attitudes Toward Statistics (ATS) scale is an appropriate instrument for assessing students' attitudes toward statistics.

3. The questions asked in the statistics exams are a representative sample of the key concepts discussed in both statistics sections and are appropriate

instruments for assessing students' comprehensive knowledge of statistics.

4. There will be no difference between the teaching styles or effectiveness between the two instructors of the class.

Limitations of Study

1. The subjects for this study were graduate level statistics students and the results can be generalized only to this population.

2. The length of the study was for one five-week summer session.

Significance of Study

Colleges and universities are forging ahead to provide learning at a distance, and many institutions are making substantial investments in new technologies for teaching. In fact, the distance-learning market is growing at a 25 percent annual rate in the U.S. (Stein, 1998) and "driving one of the hottest emerging growth sectors in the U.S. economy–the $3.5 billion per year 'business' of post secondary education" (McClenney,1998). There is a growing number of commercially available instructional software applications for creating and managing Web-based asynchronous and/or synchronous course content. These computer-based applications are so new that there is very little experience, much less data, to assess their impact. As technology such as Web-based class management systems become a major tool for delivering instructional materials to students, its impact on student attitudes toward learning must be examined.

CHAPTER II

Review of the Literature

The preceding chapter provided the rationale for this study. This chapter considers research that relates to students' attitudes toward statistics and toward computers as well as what a Web-based class management system is and the impact these systems may have on college courses. The review of the literature focused on three areas. First, studies that relate to attitudes toward statistics were examined. Second, attitudes toward computers were addressed. Third, a Web-based class management system was explored as an innovative way of delivering instruction in college courses.

Attitudes Toward Statistics

Statistics anxiety is characterized by worry, mental disorganization and physiological arousal that appears in response to statistics as a subject area (Zeidner, 1992). Studies show that there is a statistics anxiety among college students (Roberts & Bilderback, 1980; Roberts & Saxe, 1982; Frank & Rickard, 1988; Katz & Tomazik, 1988; and Benson, 1989). Dillion's study (as cited in Sutarso, 1992) reported that there was a statisticophobia in college level statistics classes. Statistics anxiety, even less than statisticophobia, is 'dangerous' not only for the student but also for statistics itself, and for other sciences. Students who are anxious about a class will feel the course is more difficult than it should be. The instructional goals will be difficult to achieve. For statistics, this situation will lead to an attitude of disdain for statistics.

Statistics attitude, as defined by Wise (1985), consists of two aspects. The first aspect is attitude towards the course, and the second aspect is attitude toward the usefulness of statistics in their field. Several scales have been developed to measure statistics attitude (Auzmendi, 1991; Lalonde & Gardner, 1993; Roberts & Bilderback, 1980; Wise, 1985). Auzmendi (1991) developed a multidimensional scale with five areas: enjoyment, anxiety, motivation, confidence, and usefulness. Lalonde and Gardner (1993) used a two part statistics attitude measure. The first part used five positively worded and five negatively worded items to assess how important the subject thought statistics was to the field. The second part measured the subject's attitude toward learning statistics; this portion was based on Gardner, Clement, Smythe, & Smythe (1979).

Using these measures, statistics attitude has been found to be positively related with course grade (Lalonde & Gardner, 1993; Roberts & Bilderback, 1980; Waters, Martelli, Zakrajsek & Popovich, 1988; Wise, 1985). Using the Student Attitude Survey (SAS), Roberts and Saxe (1982) indicated that the more positive the Student's Attitudes Toward Statistics (STATS) the higher the statistics achievement. Roberts and Reese (1987) supported this finding and discovered that regardless of gender grouping, more positive STATS tended to show a higher course grade. Even though the instruments used were different, the data analysis still revealed the same finding. This was also verified by Waters et al. (1988) when they used both the SAS and the Attitudes Toward Statistics (ATS) instrument of Wise (1985). Ware and Chastain

(1989), however, found that statistics attitude was unrelated to statistics performance when attitude was measured using a semantic differential scale (Osgood, Suci & Tannenbaum, 1957). It would appear that statistics anxiety can be adverse to performance, while a positive attitude about statistics is associated with better performance in statistics classes.

A number of studies have examined the predictors of success in statistics achievement. Some of the important predictors include mathematics ability (Elmore & Vasu, 1980a; Presley & Huberty, 1988; Woehlke and Leitner, 1980); mathematical background (Benson, 1989; Elmore & Vasu, 1980b, 1986; Feinberg & Halperin, 1978); and attitudes toward statistics (Wise, 1985). Additional computer-related variables that may contribute to the prediction of success in statistics include computer attitudes (Loyd & Gressard, 1984; Munger & Loyd, 1989), computer experience (Wise, Barnes, Harvey, & Plake, 1989), and the use of computer simulation software (Sterling & Gray, 1991).

In an attempt to use an innovative technique to improve student learning and to decrease the perceived difficulty of statistics because of the involvement of some mathematics, statistics, and computer applications. Usip and Bee (1998), surveyed undergraduate economic statistics students. They wanted to differentiate between the attitudes of users and nonusers of Web-based instruction on issues pertaining to electronic distance learning. They hoped to find how the perceptions of individuals in these two groups differed with special emphasis on the nature and extent of use by the

Internet users and the reasons why other individuals are not participants in this technological revolution. The Web-based users concluded that distance learning via the World Wide Web (WWW or the Web) was not only a good method of obtaining general information but a useful tool in improving their academic performance in a quantitative economics class.

Attitudes Toward Computers

Computer attitudes have been analyzed with various scales. The most popular was the Computer Attitude Scale (CAS) which has three sub-scales: anxiety, liking, and confidence (Loyd & Gressard, 1984). Other measures used to analyze computer attitudes include the Attitudes Towards Computers Scale (ATCS); (Rosen, Sears & Weil, 1987) and the Computer Anxiety Rating Scale (CARS); (Rosen, Sears, & Weil, 1987). The ATCS and the CARS were patterned after the Math Anxiety Rating Scale (Richardson & Suinn, 1972).

Many researchers have used the Computer Attitude Scale (CAS) to define students' attitudes about computers. Using this definition, computer attitude was determined to be positively related to statistics performance (Elmore, Lewis, & Bay, 1993) and statistics attitude, a factor that influences performance (Auzmendi, 1991).

Again using CAS's definition of computer attitudes, attitudes improved with additional computer experience (D'Souza, 1988; Hunt & Bohlin, 1991; Justen III, Adams II, & Waldrop, 1988; Loyd & Gressard, 1984; Munger & Loyd, 1989; Sigurdsson, 1991). The more experience that a student has had with a computer, the

more likely that he/she will have low levels of computer anxiety (Chu & Spires, 1991). Arthur and Olson (1991) used path analysis to select between two theoretical explanations of the relationship between computer attitude and computer experience. Their data indicated that negative attitudes were the result of negative computer experiences. As one's attitude about computers improves, anxiety associated with computers is alleviated, as measured by the CARS and ATCS (Rosen, Sears, & Weil, 1987).

Recent research reveals the power of microcomputers and other educational technologies to motivate students and to improve their attitudes about learning and themselves. Studies show that teachers' computer use encourages students to use microcomputers (Cox, Rhodes & Hall, 1988). Teacher attitudes toward computers may also influence student achievement; that is, students instructed by teachers with positive attitudes toward the technology demonstrated improved performance (Moore, 1988).

James Kulik at the University of Michigan performed a meta-analysis on several hundred well-controlled studies in a wide variety of fields at the elementary, secondary, high-and adult-education level. He found that computer-based education can increase scores from 10 to 20 percentile points and reduce time necessary to achieve goals by one-third. He found that computers improved class performance by about one-half a standard deviation. However, this analysis did not include newer studies utilizing advanced technologies and newer educational paradigms (Kulik & Kulik, 1991).

Students enjoy using computers (Forsyth,1986; Apostolides, 1987). Studies have, in fact, indicated that many students perceive computer-based instruction to be more motivating than traditional methods (Hauben & Lehman, 1983; Krendl & Lieberman, 1988; Watkins,1989). This positive feeling towards computers is felt by most elementary through college-aged students, and is a feeling common to male and female students (Krendl & Lieberman, 1988). Evidence suggests that students' positive attitude towards computers is based on actual experience.

Students liked computers because a) they enjoy being actively engaged and being able to make mistakes without embarrassment (Apostolides, 1987), b) the machine gave immediate, helpful feedback (Clement, 1981; Hauben & Lehman, 1988; Seymour, Story, & Mosley, 1986), c) they are motivated by graphics and game formats (Rowe, 1986), and d) they gave the students the feeling of being in control (Shade, Nida, Lipinski, & Watson, 1986). According to Lawton and Gerschner (1982), other researchers observed that computers worked because they a) were great motivators b) were impartial to ethnicity c) were excellent for drill and practice, and d) used a teaching process that was structured to teach in small increments.

Griswold (1985) recognized an urgent concern for an educational system that fosters awareness and knowledge of computer use. Students must be prepared for life in a computer-integrated society. Abler and Sedlacek (1987) emphasized the primary importance of computer skills for those now entering the job market.

In 1997, computers outsold televisions in the U.S. for the first time

(McClenney, 1998, Dubois, 1998). In November 1998, 13% of the U.S. heads of household said they were very likely to buy a home computer, primarily "to further their children's education" (Shankland, 1998). In short, our growing student body seems increasingly ready for what distance learning, and computer technology generally, have to offer. The number of computers now being used in educational settings would seem to have clearly validated Goodyear's (1984) prediction of a coming, ever present technology.

Web Class-Management Systems

Distance education, as a method of delivering education to students away from campus, is not a new concept. Distance learning, in the form of correspondence courses, has been offered for over 250 years (Garrison, 1985). However, the growth of distance education has surged in the 1990's, resulting in an industry that is growing by hundreds, if not thousands, of online courses each month (Gladieux & Swail, 1999).

Current methods include instruction by videodisc, computer-assisted instruction, interactive television, CD-ROM, and videoconferencing (Carey & Francis, 1993; Garrison, 1985; Graziadei, 1996; Kim & Bothell,1991). The last few years have seen the appearance and development of a new form of technology-supported instruction: Web-based instruction. Colleges and universities around the world are beginning to develop and assess Web-based materials for use in their programs. According to researchers from Cornell University, "the Web provides

significant new functionality in transmitting information to the student and providing forums for exchange. The Web is revolutionizing some areas of study through increased opportunities for learning and alternative formats for information" (Dwyer, Barbieri, & Doerr, 1995).

There are many desirable features of the Web that relate to teaching delivery in general that have been identified (Oreizy & Kaiser, 1997). Some of the most promising are:

1) Global accessibility
2) Inherently multi-media oriented
3) Inherently interactive
4) Allows group/shared work
5) Ability for uploading of submitted material
6) Team delivery possible
7) Possible integration to existing global resources
8) Possible integration to an organization's information systems
9) Asynchronous and synchronous communication possible

CourseInfo, LearningSpace, Librarian, TopClass, Web-In-The-Box, and WebCT are all examples of Web class-management systems. They are all tools that facilitate one to do the same administrative and academic practices, e.g., register users, develop, manage and deliver course content, do assignments and course evaluations, distribute and collect assignments, develop discussion forums, and

integrate existing WWW technologies and multimedia into course content.

According to CourseInfo's Website, benefits of online learning through the use of CourseInfo specifically are:

1) Enhance communication

Web-based education tools provide ways to increase communication between class members and faculty, including discussion boards, chats, and e-mails. Researchers have found that adding these elements to a course increases student motivation and participation in class discussions and projects. Students are more willing to participate and the motivator of anonymity makes people feel more empowered. They are daring and confrontational regarding the expression of ideas (Kubala. 1998).

2) Learn from participation

Online forums. like CourseInfo's discussion board and chat. provide public areas to post information. Each student can view another student's answers and learn through the exposure to different perspectives. This benefits students because they can combine new opinions with their own, and develop a solid foundation for learning.

3) Increase resources for students

Every student has a unique learning style. Some students are visual learners. some learn better when they "learn by doing." Web-based learning environments permit the instructor to deliver one course, yet upload a variety of resources, so

students can utilize materials in whichever way works best for them.

4) Provide 24 hour/7 day a week access

Using the Web to support courses allows students to access educational materials when they need them the most. Web-based learning environments are accessible 24 hours a day 7 days a week. All the students need to access this material is an Internet connection and a computer with a Web browser (Blackboard, 1999).

Summary

The need for studies evaluating different technological approaches has been a concern of the Office of Technological Assessment (1989). Effective assessments of newer technology such as Web-based class management systems are needed.

Today's university students increasingly expect to learn with computers and the latest information technology, not least because an increasingly competitive labor market demands no less. Kenneth Green says institutions engage in a "kind of educational malpractice" if they fail to provide students with technology training as part of their educational experience (Green, 1997b).

Society is undergoing a fundamental transformation from the Industrial Age to the Information age. All people, organizations, societies and nations are affected, although not at the same pace or to the same degree. Those who realign their practices most effectively to the Information Age standards will reap substantial benefits. Those who do not will be replaced or diminished by more nimble competitors (Dolence & Norris, 1995).

Chapter III

METHODOLOGY

Sample

The sample consisted of students registered for two sections of graduate level statistics classes during a five-week summer course. One section of the course used a Web-based class management system (n= 11); the other section did not use a Web-based class management system (n= 24).

Human subjects' approval was obtained from the Institutional Review Board of the University of Nebraska-Lincoln. The institutional consent form can be found in Appendix E. Students were informed of the voluntary nature of the study and were assured that there was no way to connect them to their responses.

Design and Setting

The research approach to this study was a quasi-experimental design with repeated measures. Unlike a true experimental design, in this type of study the groups lack randomization of the subjects. Based on the section of statistics they registered for, the subjects were assigned to a control or an experimental group. One section had a professor who used a Web-based class management system; the other section had a professor who did not use a Web-based class management system.

The independent variable is the use of a Web-based class management system versus not using a Web-based class management system. The dependent variables are a) attitude towards statistics, as measured by the Attitudes Towards Statistics (ATS)

scale; b) attitude toward computers, as measured by the Computer Attitude Scale (CAS); c) knowledge of statistics, as measured by scores on 14 identical exam questions given in both statistics sections; and d) attitude toward a Web-based class management system and learning processes, as measured by structured interview questions.

Web-Based Class Management System. The amount of classroom instruction for statistics was equal for both sections. The professor who used the Web-based class management system in the teaching of statistics included approximately one class period for the instruction of the use of the Web-based materials. The purpose of developing the Web site was to make the learning process more enjoyable and the subject matter more appealing for students by bringing instructional materials to them 24 hours a day. The intention was that since students have access to the Web site, this may help to minimize the phobia for the statistics classes experienced by many students. Students were encouraged to use the Web site. However, participation was voluntary and not required.

The instructional materials placed on the Web included the following: 1) course syllabus and course description (Appendix D); 2) unproctored on-line tests 3) video class links (each class during the five- week session was videotaped, digitized, and then made available for viewing by students 4) slides for lectures (class notes) 5) asynchronous and synchronous communication.

Statistics Sections. There was one professor for each section of statistics. Both instructors used the same general curriculum. The instructors used identical textbooks. Both professors discussed the same course information in each of their three unit exams. A thorough examination of both instructors' course outlines was reviewed by the instructors as well as the primary investigator.

Instructional Strategies. The two statistics professors employed similar instructional strategies, except for supplemental materials that included the use of the Web-based materials used by one of the professors. A thorough review of both instructors' lesson plans was conducted by the statistics' instructors and the primary investigator. Additionally, the primary investigator made four visits to each classroom when comparable content was being taught. Review of these data by the primary investigator indicated the classes were covering comparable statistics content. In both sections, instructional planning focused on and followed the content of the course outline. Both professors' instructional techniques included explanations, discussions, small group work, and problem-solving activities.

Instruments

Attitudes Toward Statistics Scale. The Attitudes Toward Statistics (ATS) scale, with sub-scales for Course and Field, developed by Wise (1985), was designed to measure students' attitudes toward the course in which they are enrolled and the students' attitudes toward the use of statistics in their Field of study (see Appendix B). Two ATS sub-scales were formed from the 29 items; a) a 20-item sub-scale labeled

Attitude Toward Field of Statistics (FIELD sub-scale) and b) a 9-item sub-scale labeled Attitude Toward Course (COURSE sub-scale). Each item uses a Likert -type format with a five-point response scale labeled Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. Both positively and negatively worded statements are included on both sub-scales. For the sub-scale labeled FIELD, scores range from 0-100 while the sub-scale labeled COURSE has ranges from 0-45. A high score indicates a negative attitude toward statistics and a low score indicates a positive attitude toward statistics.

In a study conducted with undergraduate students taking an introductory psychological statistics course and psychology students in two sections of a graduate (master's level) psychological statistics course, Shultz and Koshino (1996) reported the alpha reliability coefficients for all scales to be quite high. Retest alpha reliability coefficients for the undergraduates were .59 (Course) and .72 (Field). For the graduate students, the retest reliability coefficients were .71 (Course) and .76 (Field). The ATS has been used with undergraduates from a variety of majors (Elmore et al, 1993), and data from Elmore and Lewis (1991) for a sample of 58 graduate students, again representing a number of diverse disciplines. The alpha reliability coefficients for this sample were .90 (Course) for undergraduates and .90 and .82 for graduates. Unfortunately, Elmore et al. (1993) reversed scored (the higher the score the better, as opposed to the original survey where lower was better) the ATS Field sub-scale when they reported their results, so these figures are not directly comparable to those

obtained in the previous study. The present study continued to support previous evidence (Elmore & Lewis, 1991; Elmore et al. 1993; Wise, 1985) of the high alpha reliabilities for both ATS sub-scales, at both the beginning of the course and at the end.

Computer Attitude Scale(CAS). The Computer Attitude Scale is a 30-item, three-category rating scale that includes three10-item sub-scales measuring computer anxiety, computer confidence, and computer liking which was developed by Loyd and Gressard (1984) (see Appendix A). The survey is a Likert-type instrument that presents positively and negatively worded statements of attitudes towards computers and the use of computers. Students respond to the statements by selecting one of a set of five ordered responses ranging from "strongly agree" to "strongly disagree." The questions are coded so that the higher the score, the more positive the attitudes, e.g., a higher confidence score means more confidence and a higher anxiety score means less anxiety. Each sub-scale consists of 10 items that are distributed alternately throughout the instrument.

The reliability and factorial validity of the sub-scales were determined by internal consistency (alpha coefficient) and factor analysis. In a study conducted with students in grades 8 through 12, Loyd and Gressard (1984) reported alpha reliability coefficients calculated for the first three subject groups of .87, .91, and .91 for each sub-scale, respectively. The total score was .95. According to Loyd and Gressard, the reliability coefficients of the three sub-scales and the findings of the factor analysis

suggest that the scores of the three sub-scales were stable and can be used as separate scores. The CAS has been used with students from elementary school through college-age.

Understanding of Key Concepts. Both instructors of the statistics classes agreed to include identical questions on each of their three exams which included key concepts for the unit being tested. These pre-determined questions were used to evaluate the students' knowledge of statistics.

Student Attitude Interview Questions. Student interview questions were asked of both statistics sections to obtain qualitative data regarding their attitudes toward Web-based class management system (see Appendix C). A representative sample of students from each section were randomly selected for the interviews. The sample consisted of an equal representation of both sexes, low-ability and high ability students, and students who have used a Web-based class management system and those who did not. All students interviewed were asked the same questions in an attempt to understand students' feelings and to learn more about their attitudes toward a Web-based class management system and the learning processes:

1. How did you feel about the learning activities in the statistics class? (i.e. instructor presentations, hand-outs, assignments) What was the most beneficial activity for you?

2. How do you feel about the use of a Web-based class management system as a supplement to class lectures?

3. Do you feel a Web-based class management system was/would be a valuable tool for improving your grade in the statistics course?

4. How would you feel about taking a/ another course that used a Web-based class management system?

5. Is there anything that you would change about the statistics course?

Procedures

1. Approval was granted from the University of Nebraska-Lincoln Institutional Review Board.

2. Students registered for the five-week 1999 summer sections of the statistics course taught by two different instructors. One section of the course was taught with a Web-based class management system being used and the other section did not use a Web-based class management system. Students had no information as to which section would use the Web-based class management system prior to registration.

3. Written informed consent was obtained from students participating in this study (see Appendix E).

4. The Student Diagnostic Survey, the Attitude Toward Statistics scale and the Computer Attitude Scale were administered at baseline during the five-week 1999 summer session. The surveys were given again at the two and one-half week period and at the end of the semester (five weeks). Five identical questions on exams one and three, and four questions on exam two were given throughout the five-week

course.

5. Selected students were asked to respond at the end of the five-week summer session to structured interview questions concerning their attitudes toward the use of a Web-based class management system and learning processes.

Data Analysis

Research Question 1

What is the difference in computer anxiety, computer confidence, and computer liking, as measured by the Computer Attitude Scale over time (baseline, mid-term, and end of the semester) for students who were taught in class using a Web-based class management system compared to students who were taught in class who did not use a Web-based class management system?

A mixed model ANOVA was used to analyze the responses to the Computer Attitude Scale.

Research Question 2

What is the difference in attitude toward statistics, as measured by the Attitudes Toward Statistics (ATS) scale, over time for students who were taught in class using the Web-based class management system compared to students who were taught in class that did not use the Web-based class management system?

A mixed model ANOVA was used to analyze the responses to the Attitudes Toward Statistics scale.

Research Question 3

What is the difference in the knowledge of statistics, as measured by an understanding of key concepts in the class during the five-week session, for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system?

An independent t-test was used to analyze the responses to the 14 questions chosen to be on both instructors' statistics exams.

Research Question 4

What is the attitude toward the Web-based instruction and learning processes, as measured by student attitude interview questions, for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system?

A content analysis of subject responses was used to evaluate this question. Descriptive statistics (frequency, %) were used to clarify the data.

Chapter IV

RESULTS OF DATA ANALYSIS

The purpose of this study was to examine the impact of a Web-based class management system in a qualitative statistics class on student performance and attitudes. The purpose of this chapter is to present and discuss the results of this study. Emphasis is given to providing descriptive profiles of the subjects as well as presenting and analyzing data gathered in response to the research questions. Results of both quantitative and qualitative analyses are described. The Huynh/Feldt test of sphericity was used to assure that the assumption of homogeneity of within-group variances was not violated (Keppel, 1991).

Profile of Subjects

Sample. The sample consisted of 35 graduate students enrolled in the first five-week summer session in two graduate-level statistics sections at the University of Nebraska/Lincoln. There were 11 students enrolled in the section that used the Web-based class management system and 24 students in the section that did not use the Web-based class management system in the instruction of the statistics. When students enrolled for the statistics sections, they did not know the Web-based instruction would be used. In the Web-based section, 27% of the 11 students were males while 73% were females. The 24 students in the non-Web-based section were composed of 42% males and 58% females.

Ninety-one percent of the students in the section that used the Web-based class management system indicated that they had a year or more experience working with computers, as compared to 96% in the non Web-based section.

Results from the Student Diagnostic Survey revealed that at baseline the mean score for the section that used the Web-based class management system was 65%, and the mean score for the section that did not use Web-based class management system was 60%.

Research Question 1

What is the difference in computer anxiety, computer confidence, and computer liking, as measured by the Computer Attitude Scale, over time (baseline, mid-term, and end of the semester) for students who were taught in class using a Web-based class management system compared to students who were taught in class who did not use a Web-based class management system?

Using a mixed model ANOVA, with class as the between subject and time as the within subject (or repeated measures) independent variable and **computer anxiety** as the dependent variable, there was not a significant class x time interaction, F (1.65, 51.14) = .16 , p= .81, on computer anxiety for students who were taught in class that used the Web-based class management system compared to students who were taught in class that did not use the Web-based system. However, there was a significant difference in computer anxiety between subjects in the classes, F (1, 31) = 6.27, p= .02. Students in the class that used a Web-based class management system in

the statistics class had a significantly lower computer anxiety mean (M= 36.42) than students in the class that did not use Web-based instruction (M= 30.91). A higher value indicates a more positive attitude, i.e. less anxiety. There was not a significant difference in anxiety for each class across time. F (1.65, 51.14)= .52, p= .56. See Table 1 for mean values, standard deviations, and the results of the mixed model ANOVA. See Figure 1 for estimated marginal means.

Table 1

Mean Values and Standard Deviations by Class for the Computer Anxiety Subscale of Mixed Model ANOVA

Class	Baseline Mean (SD)	2.5 Weeks Mean (SD)	End of 5 Weeks Mean (SD)
No Web-based Inst	30.73 (7.67)	31.18 (6.31)	30.82 (6.61)
Web-based Inst	36.09 (3.94)	36.55 (4.30)	36.64 (4.11)

Mixed Model ANOVA

Source	SS	df	MS	F	p
Class	669.17	1	669.17	6.27	.02
Error	3308.85	31	106.74		
Time	3.19	2	1.60	.52	.56
Class by Time	1.01	2	.51	.16	.81
Error	190.24	62	3.10		

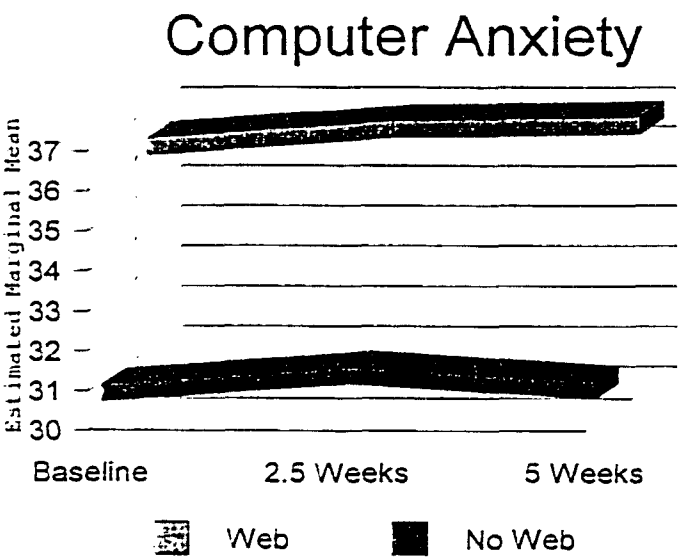

Figure 1

Estimated Marginal Means of Computer Anxiety

Using a mixed model ANOVA, with class as the between subject and time as the within subject (or repeated measures) independent variable and **computer confidence** as the dependent variable, there was not a significant class x time interaction, F (2, 62) = 2.38 . p= .10, on computer confidence for students who were taught in class that used the Web-based class management system compared to students who were taught in class that did not use the Web-based system. However, there was a significant difference in computer confidence between subjects in the classes, F (1, 31) = 4.87, p= .04. Students in the class that used a Web-based class management system in the statistics class indicated significantly more computer confidence (M= 35.58) than students in the class that did not use Web-based instruction (M= 31.06). A higher value indicates a more positive attitude. There was not a significant difference in confidence for each class across time, F (2, 62)= .15, p= .86. See Table 2 for mean values, standard deviations, and the results of the mixed model ANOVA. See Figure 2 for estimated marginal means.

Table 2

Mean Values and Standard Deviations by Class for the Computer Confidence Subscale of Mixed Model ANOVA

Class	Baseline Mean (SD)	2.5 Weeks Mean (SD)	End of 5 Weeks Mean (SD)
No Web-based Inst	30.64 (6.56)	31.50 (6.25)	31.05 (6.10)
Web-based Inst	35.82 (3.95)	35.09 (3.56)	35.82 (4.47)

Mixed Model ANOVA

Source	SS	df	MS	F	p
Class	448.51	1	448.51	4.87	.04
Error	2853.15	31	92.04		
Time	.64	2	.32	.15	.86
Class by Time	10.01	2	5.01	2.38	.10
Error	130.58	62	2.11		

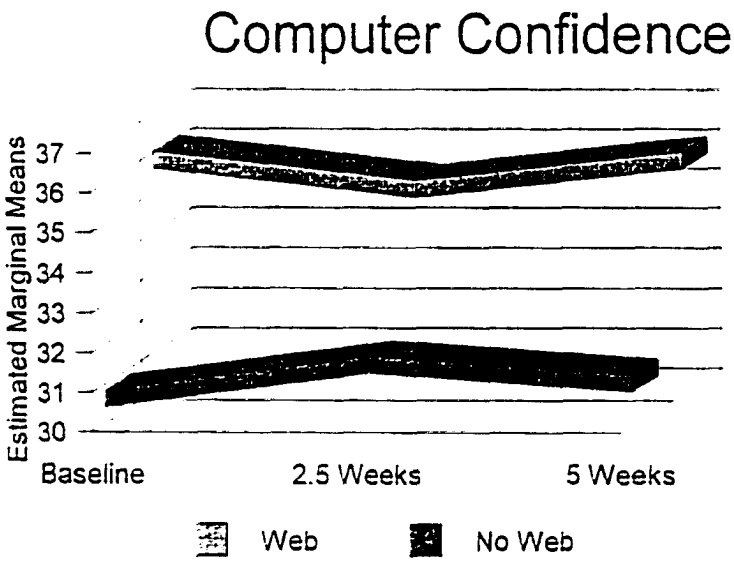

Figure 2

Estimated Marginal Means of Computer Confidence

Using a mixed model ANOVA, with class as the between subject and time as the within subject (or repeated measures) independent variable and **computer liking** as the dependent variable, there was not a significant class x time interaction, F (2, 62) = .24, p= .79, on computer liking for students who were taught in class that used the Web-based class management system compared to students who were taught in class that did not use the Web-based system. Students in the class that used Web-based instruction in the statistics class indicated they liked computers more (M= 31.88) than students in the class that did not use Web-based instruction (M= 28.83). A higher value indicates a more positive attitude, but the difference was not significant F (1, 31) = 1.31, p=.26. There was not a significant difference in computer liking for each class across time, F (2, 62) = 1.12, p= .33. See Table 3 for mean values, standard deviations, and the results of the mixed model ANOVA. See Figure 3 for estimated marginal means.

Table 3

Mean Values and Standard Deviations by Class for the Computer Liking Subscale of Mixed Model ANOVA

Class	Baseline Mean (SD)	2.5 Weeks Mean (SD)	End of 5 Weeks Mean (SD)
No Web-based Inst	28.96 (7.83)	28.55 (7.88)	29.00 (7.79)
Web-based Inst	31.82 (4.90)	31.36 (6.58)	32.46 (7.37)

Mixed Model ANOVA

Source	SS	df	MS	F	p
Class	204.05	1	204.05	1.31	.26
Error	4838.68	31	156.09		
Time	8.80	2	4.40	1.12	.33
Class by Time	1.85	2	.92	.24	.79
Error	242.64	62	3.91		

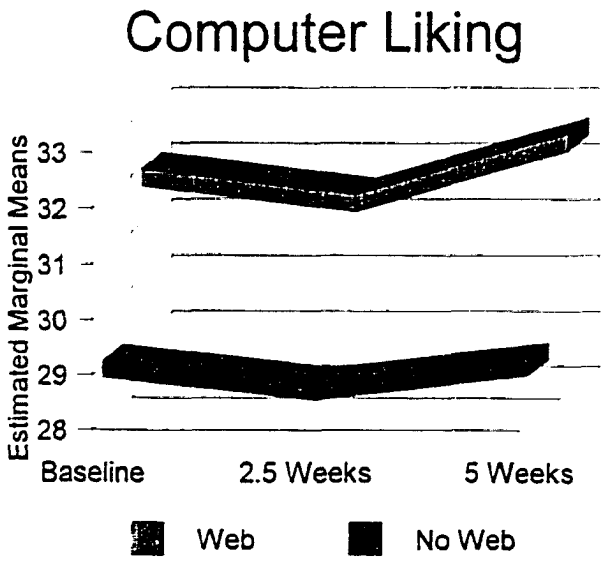

Figure 3

Estimated Marginal Means of Computer Liking

Research Question 2

What is the difference in attitude toward statistics, as measured by the Attitudes Towards Statistics (ATS) scale, over time for students who were taught in class using the Web-based class management system compared to students who were taught in class that did not use the Web-based class management system?

Using a mixed model ANOVA, with class as the between subject and time as the within subject (or repeated measures) independent variable and **Field** as the dependent variable, there was not a significant class x time interaction, F (1.83, 56.61) = 1.15 , p= .32, on students' attitude toward the use of statistics in their Field of study between students who were taught in class that used the Web-based class management system compared to students who were taught in class that did not use the Web-based system. However, there was a significant difference in students' attitudes toward the use of statistics in their Field of study between subjects in the classes, F (1, 31) = 6.35, p= .02. Students in the class who used a Web-based class management system in the statistics class indicated a more positive attitude toward the use of statistics in their Field of study (M= 36.21) than students in the class that did not use Web-based instruction (M= 46.17). A lower value indicates a more positive attitude. There was also a significant difference in student's attitude toward the use of statistics in their Field of study for each class across time, F (1.83, 56.61) = 5.10, p= .01. Follow up analysis (t- test)indicated a significant difference between baseline and

two and one-half weeks, t (32) = 3.17, p= .01 and between baseline and five weeks t (33) = 2.69, p = .01 but there was not a significant difference between two and one-half weeks and the end of the class (five weeks) t (33) = -.83, p = .42. These results indicated that attitudes of students in both statistics classes toward the use of statistics in their Field of study improved significantly between baseline and two and one-half weeks, between baseline and five weeks, but did not change significantly from two and one-half weeks until the end of the five-week session. See Table 4 for mean values, standard deviations, and the results of the mixed model ANOVA. See Figure 4 for estimated marginal means.

Table 4

Mean Values and Standard Deviations by Class for the Attitudes Toward the Field of Statistics in the Subscale of Mixed Model ANOVA

Class	Baseline Mean (SD)	2.5 Weeks Mean (SD)	End of 5 Weeks Mean (SD)
No Web-based Inst	49.14 (11.06)	44.23 (13.31)	45.14 (13.40)
Web-based Inst	37.36 (8.74)	35.82 (7.73)	35.46 (6.11)

Mixed Model ANOVA

Source	SS	df	MS	F	p
Class	2180.05	1	2180.05	6.35	.02
Error	10647.35	31	343.46		
Time	187.92	2	93.96	5.10	.01
Class by Time	42.30	2	21.15	1.15	.32
Error	1142.61	62	18.43		

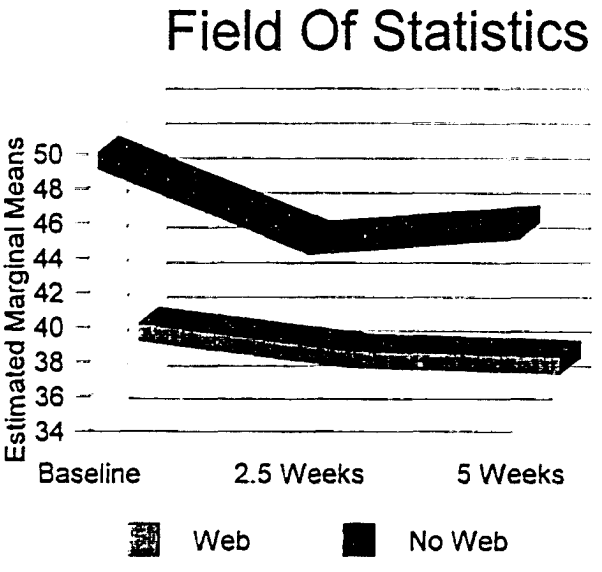

Figure 4

Estimated Marginal Means for Attitude Toward the Field of Statistics

Using a mixed model ANOVA, with class as the between subject and time as the within subject (or repeated measures) independent variable and **Course** as the dependent variable, there was not a significant class x time interaction, F (1.79, 55.52) = 1.24 , p= .29, on attitude toward the course of statistics in which the students were enrolled between those who were taught in class that used the Web-based class management system compared to those who were taught in class that did not use the Web-based system. Students who used a Web-based class management system in the statistics class indicated a more positive attitude toward the course of statistics in which they were enrolled (M= 22.06) than students in the class that did not use Web-based instruction (M= 26.86), but the difference was not significant F (1, 31)= 2.44, p= .13. A lower mean value indicates a more positive attitude. Follow up analysis indicated a significant difference in attitude toward the course of statistics in which the students were enrolled for each class across time F, (1.79, 55.52)=11.61, p= .01. There was a significant difference between baseline and two and one-half weeks, t (32) = 4.41, p= .01 and between baseline and five weeks t (33) = 4.44, p = .01 but there was not a significant difference between two and one-half weeks and the end of the class (five weeks) t (33) = 1.31, p = .20. These results indicated that for both sections of statistics, attitudes toward the course in which the students were enrolled improved significantly between baseline and two and one-half weeks, and between baseline and five weeks, but did not change significantly from two and one-half weeks until the end of the five-week session. See Table 5 for mean values, standard

deviations, and the results of the mixed model ANOVA. See Figure 5 for Estimated Marginal Means.

Table 5

Mean Values and Standard Deviations by Class for the Attitudes Toward Statistics as a Course in the Subscale of Mixed Model ANOVA

Class	Baseline Mean (SD)	2.5 Weeks Mean (SD)	End of 5 Weeks Mean (SD)
No Web-based Inst	30.00 (8.41)	25.64 (10.69)	24.96 (10.33)
Web-based Inst	23.64 (6.28)	21.82 (5.46)	20.73 (5.48)

Split-plot ANOVA

Source	SS	df	MS	F	p
Class	507.52	1	507.52	2.44	.13
Error	6437.65	31	207.67		
Time	255.77	2	127.88	1.61	.01
Class by Time	27.40	2	13.70	1.24	.29
Error	682.76	62	11.01		

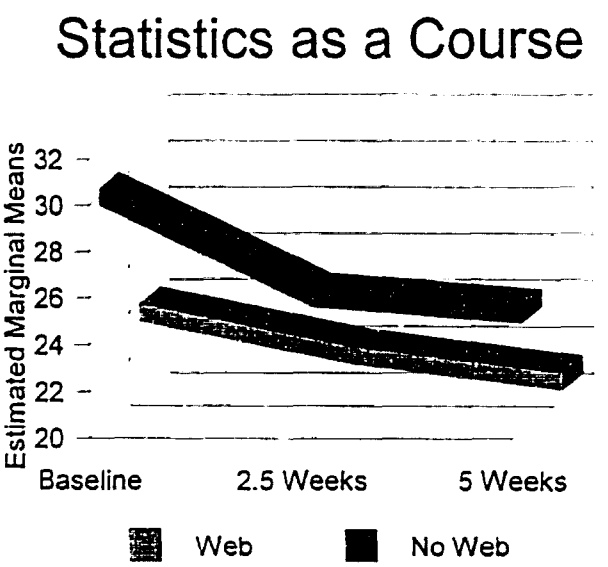

Figure 5

Estimated Marginal Means for Attitude of Statistics as a Course

Research Question 3

What is the difference in the knowledge of statistics, as measured by scores on 14 identical exam questions given in both statistics sections, for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system?

Using an independent t-test, with group as the independent variable and scores on five identical questions on exams one and three, and four questions on exam two, there was not a significant difference between the groups at the end of the year, $t(33) = .26$, $p = .80$. The mean score of the students in the section who used the Web-based management system was slightly higher ($M = 10.55$, $SD = 2.42$) than the mean score of students in the section that did not use the Web-based class management system ($M = 10.33$, $SD = 2.18$), but the difference was not significant.

Research Question 4

What is the attitude toward the Web-based instruction and learning processes, as measured by student attitude interview questions, for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system?

A content analysis was used to examine the subjects' responses to the structured interview questions. The responses were then coded and grouped on the

basis of content.

When the students were asked how they felt about the learning activities in the statistics class, i.e. what the most beneficial learning activity was for them, students in the section that did not use the Web-based system revealed that the activities primarily consisted of worksheets with sample problems to work on both at home and in class, and listening to the instructor's "step-by-step methodology." Many students appreciated the chance to purchase the overhead/notes for the class. Several students used the term "methodical" to describe the most beneficial component of the class. One student described the class as, "methodical, predictable...and I like it!" Several students commented that they appreciated the time taken in class to discuss any questions with the homework assignments.

Students in the section who used the Web-based system said the use of the Web site was very helpful. Students felt the unproctored tests available on the Web site were very beneficial to their learning, as well as the extra problems available on the web-site. Several students indicated that the handout of the copy of the slides with the lecture material was also quite useful. One student said she appreciated having the availability of the video-taped lectures on the web site. She valued having the ability of reviewing the lecture on the web, and re-studying concepts to which she was unsure. Table 6 lists the four most frequently repeated comments related to how students felt about the learning activities in the statistics class.

Table 6

Frequency and Percentage of Common Responses by Class to Student Attitude Interview Question 1: How did you feel about the learning activities in the statistics class? What was the most beneficial activity for you?

Common Responses of Students **Not** Using the Web-based Class Management System N=14	Frequency	Percent
-Excellent-step-by-step methodology very helpful	7	50%
-In-depth discussion of homework beneficial	7	50%
-Take-home practice problems very helpful	6	43%
-Notebook of the slides of lectures helpful	4	29%

Common Responses of Students Using the Web-based Class Management System N=11	Frequency	Percent
-Very helpful Web site info.including unproctored tests & practice problems in the website	7	64%
-Very helpful-was grateful for the slides of the lecture notes	3	27%
-Liked practice problems done as a group in class	2	18%

When asked about their feelings about the use of a Web-based class management system as a supplement to class lectures, the class that used the Web-based learning thought that it was "really nice", "very helpful", and "convenient".

Students in the class who did not use the Web-based instruction didn't feel as though it would be useful. Several of the students mentioned "I'm not a computer person"... indicating that they really didn't think they would enjoy the Internet and the Web-based instruction. Table 7 illustrates the three most frequently reported statements related to how the students felt about the use of a Web-based class management system.

Table 7

Frequency and Percentage of Common Responses by Class to Student Attitude Interview Question 2: How do you feel about the use of a Web-based class management system as a supplement to class lectures?

Common Responses of Students **Not** Using the Web-based Class Management System N=8	Frequency	Percent
-Would probably be ok	3	38%
-Don't have a computer..wouldn't like it	2	25%
-I'm not a computer person...	1	13%

Common Responses of Students Using the Web-based Class Management System N=11	Frequency	Percent
-Very helpful	10	91%
-Convenient	3	27%
-I commute-used it alot	1	9%

When asked if students thought a Web-based class management system was/would be a valuable tool for improving their grade in the statistics course. students in the class that did not use the Web-based instruction indicated that they did not think the use of the Web-based system would make any difference, since their instructor was so "methodical" in her teaching. Several students in the class that did not use Web-based instruction mentioned that their instructor used a "step-by-step" approach, and liked the classroom setting and the immediate feedback they could get.

Students in the class that used the Web-based instruction indicated the Web was very useful and many thought it did help them improve their grade. The students especially commented on the usefulness of the unproctored tests available on the Web site. Comments from the students included, "The Web was a helpful supplement"...and they "wished they had used it more!" "I'm not sure if it helped...but I hope so!" "I used the Web almost daily. I re-played the videos of the class and I made copies of all the problems." "I felt that if I would have used it more. it would have helped more." "It helped with communication and I think, for me, I think that is the great value of the Internet..it makes communication quick. easy and accurate and timely. I can pop off an email question and get an answer." Table 8 represents the three most frequently reported statements related to how the students felt about the Web-based class management system being a valuable tool for improving their grade in the statistics course.

Table 8

Frequency and Percentage of Common Responses by Class to Student Attitude Interview Question 3: Do you feel a Web-based class management system was/would be a valuable tool for improving your grade in the statistics course?

Common Responses of Students **Not** Using the Web-based Class Management System N=14	Frequency	Percent
-No...don't think it would make a difference	5	36%
-Like being IN CLASS to learn	4	29%
-Don't have a computer...	2	14%

Common Responses of Students Using the Web-based Class Management System N=11	Frequency	Percent
-Very helpful	6	55%
-Yes it helped...especially the unproctored tests/quizzes	3	27%
-Not sure–hope so!	1	9%

When the students were asked how they would feel about taking another course that used a Web-based class management system, or in the class that did not use the Web-based system, how they would feel about taking a course such as this, students in both groups expressed positive feelings toward Web-based instruction. Many students in the class that did not use the Web-based class management system had never taken any kind of an Internet class before. Students in the class that did not use Web-based instruction indicated, "I have taken some Internet classes before. I enjoyed them." "It would be ok...I have never taken any Internet classes before though."

Students in the class who used the Web-based class management system made comments like "yeah...you bet. I enjoyed the class." "Oh yes...my degree is IT...so yeah..that's what I am going to do for a living." "Sure..I would take another class like this." Table 9 depicts the two most frequently reported statements related to how the students would feel about taking another/ a Web-based class management system class.

Table 9

Frequency and Percentage of Common Responses by Class to Student Attitude Interview Question 4: How would you feel about taking a/ another course that used a Web-based class management system?

Common Responses of Students **Not** Using the Web-based Class Management System N=6	Frequency	Percent
-I have never taken any classes like that–not sure	4	67%
-Would try it...	2	33%
Common Responses of Students Using the Web-based Class Management System N=11	**Frequency**	**Percent**
-Yes..I would like it	11	100%

When the students were asked if there was anything that they would do to change the statistics course, students in both groups indicated positive feelings toward their class. Students in the class that did not use the Web-based class management system indicated, "No, she did a good job in teaching the class. Her step-by-step process worked for me." "I would like to see it more practical for research...use the professional journals more."

Students in the class that used the Web-based class management system made comments regarding working in groups. Comments from these students included, "I like the way the class is now." "I think an improvement may be more group stuff." " I would like to see more problems in class to work on as a group."

Table 10 depicts the three most frequently reported statements related to comments made about anything the students would change about the statistics course.

Table 10

Frequency and Percentage of Common Responses by Class to Student Attitude Interview Question 5: Is there anything that you would change about the statistics course?

Common Responses of Students **Not** Using the Web-based Class Management System N=8	Frequency	Percent
-No	6	75%
-Make it more practical for research-professional journal	2	25%

Common Responses of Students Using the Web-based Class Management System N=8	Frequency	Percent
-No	3	38%
-More problems in class to work on as a group	3	38%
-Studying in groups more	2	25%

Summary

This study utilized a quasi-experimental design with repeated measures. Data were collected from the administration of the Computer Attitude Scale and the Attitudes Toward Statistics scale which were administered at baseline, two and a half weeks, and at the end of the five-week session. The Student Diagnostic Survey was administered the first day of class. Three exams were given in the five-week summer session at the completion of the same material covered in each of three units. The structured interview questions were asked at the end of the five-week summer session. Descriptive analyses using frequencies and percentages were performed to determine demographic characteristics of the participating students. Inferential statistics, using an analysis of variance, determined whether the groups were significantly different on each of the sub-scales for the two scales. An additional post-hoc independent *t* test was utilized to determine if there was a significant difference between any two of the three groups' pairs of means for those components that were identified as significant by the analysis of variance.

The analysis of data for Research Question One revealed that students in the class who used the Web-based class management system in the instruction of statistics indicated a more positive attitude toward the use of computers than the class that did not use the Web-based class management system, as measured by computer anxiety, computer confidence, and computer liking. Results indicated however, that the difference in the class' attitude levels over time toward computer anxiety, computer

confidence, and computer liking was not significant. Therefore, the use of a Web-based class management system in the instruction of statistics did not seem to have an impact on a student's overall attitude about computers.

The analysis of data for Research Question Two revealed that students in the class who used the Web-based class management system in the instruction of statistics had a more positive attitude toward the use of statistics in the Field of study and in their attitude toward the Course of statistics in which they were enrolled compared to students who were taught in a class that did not use a Web-based class management system. Results showed however, that the difference in the class' attitude levels over time was not a significant difference. Therefore, the use of a Web-based class management system in the statistics course did not seem to have an impact on overall attitude toward statistics.

The analysis of data for Question Three revealed that students in the class who used a Web-based class management system scored slightly higher on the 14 identical exam questions compared to students in the class who did not use a Web-based class management system. Results showed that the difference in the class' knowledge levels was not a significant difference. Therefore, the use of a Web-based class management system in the instruction of statistics did not seem to have an impact on a student's overall knowledge of statistics content.

The analysis for Research Question Four revealed that students in the class who used a Web-based class management system tended to have a more positive

attitude toward the use of computers and a Web-based class management system compared to students who did not use a Web-based class management system in the statistics course. These findings were supported by a content analysis of student responses to the structured interview questions.

Chapter V

SUMMARY, CONCLUSIONS, DISCUSSIONS AND RECOMMENDATIONS

A summary of the purpose of the study, the methods and procedures used in the study, the research findings and a brief discussion of the study findings are presented in this chapter. Conclusions and recommendations from the study for further research are also presented.

Statement of Problem

The purpose of this study was to examine the impact of the use of a Web-based class management system in a quantitative statistics class on student performance and attitudes.

Design of the Study

The study was a quasi-experimental design with repeated measures. The qualitative component of student interview questions was utilized to assist with the quantitative analysis. The sample for this study consisted of 35 graduate-level students enrolled in quantitative statistics during the five-week summer session of 1999 at a Midwest four-year comprehensive university. The classes were similar in demographic characteristics and in years of experience working with computers. Scores on the Student Diagnostic Survey indicated that there was virtually no difference in knowledge of statistics between the two classes at the beginning of the study.

The students were assigned to a control (N=24) and an experimental group

(N=11) based on the section they registered for. Students had no information as to which section would use the Web-based class management system prior to registration. Females comprised 73% of the students in the experimental group and 58% in the control group. Each section had a different instructor. The independent variables were the use of the Web-based class management system versus not using the Web-based class management system. The dependent variables were: a) attitudes toward computers, as measured by the Computer Attitude Scale; b) attitudes toward statistics, as measured by the Attitudes Toward Statistics (ATS) scale; c) knowledge of statistics, as measured by scores on 14 identical exam questions given in both statistics sections; and d) attitude toward a Web-based class management system and learning processes, as measured by structured interview questions). The Student Diagnostic Survey was administered the first day of class. The Computer Attitude Scale and the Attitudes Toward Statistics scale were administered at baseline, two and one-half weeks, and at the end of the five-week session. Three exams were given in the five-week summer session at the completion of the same material covered in each of three units. The structured interview questions were asked at the end of the five-week summer session.

Data Analysis

The responses to the research instruments were coded and verified. The statistics were computed using the Statistical Analysis System (SAS). The data were analyzed using descriptive and inferential statistics. Descriptive statistics (mean,

standard deviation, frequency, and percent) were calculated on each item. Mixed model ANOVAs and independent t-tests were applied to answer the research questions. In addition, to provide a qualitative component, a representative sample of students was randomly selected from each class for interviews at the end of the five-week session.

Research Findings and Discussions

Research Question 1

What is the difference in computer anxiety, computer confidence, and computer liking, as measured by the Computer Attitude Scale, over time (baseline, mid-term, and end of the semester) for students who were taught in class using a Web-based class management system compared to students who were taught in class who did not use a Web-based class management system?

The Computer Attitude Scale was implemented to measure students' attitude toward computers. Separate scores were compiled for the sub-scales of computer anxiety, computer confidence, and computer liking.

There was no significant difference in computer anxiety, confidence or liking over time between the students taught in class using a Web-based class management system compared to students taught in class that did not use a Web-based class management system. The findings indicated that the use of a Web-based class management system in statistics instruction did not have a significant impact on students' attitudes about computers as measured by the sub-scales of computer

anxiety, computer confidence and computer liking. It was anticipated that the Web-based students would gain significant computer experience during this course, thereby obtaining more positive attitudes than students in a non Web-based class. These findings do not coincide with the academic literature which suggests that a positive relationship exists between the experience levels with computers and favorable attitudes toward computers (D'Souza, 1988; Hunt & Bohlin, 1991; Justen III, Adams II, & Waldrop, 1988; Loyd and Gressard, 1984; Munger & Loyd, 1989; Sigurdsson, 1991). Perhaps the difference in the attitude toward computers was not significant between the two classes because the demographics of the two classes indicated that both groups already had at least a year or more of experience working with computers. Ninety-one percent of the students in the section that used the Web-based class management system indicated that they had a year or more of experience working with computers compared with 96% in the control group. The additional experience gained using computers in the Web-based class management section of statistics did not make a significant difference. Also, the length of this course was only five weeks, which may have been too short to see any changes in attitudes.

There was a significant difference in both computer anxiety and computer confidence between the two sections of statistics. Students in the section who used a Web-based class management system indicated significantly less computer anxiety and more computer confidence at baseline and continued this pattern throughout the five-week session. Interestingly, at baseline the students in the class that used a Web-

based class management system had a mean score of 36.09 in computer anxiety and 35.82 in computer confidence. The highest possible score is 40, which indicates that this Web-based section had minimal computer anxiety and a high level of computer confidence at baseline. With these high scores, there is very little room for improvement.

Another possible reason the students in the Web-based class scored higher at baseline and continued this pattern throughout the five-week session may be due to the rather small sample size (N=11) of this experimental group. In addition, the students may have determined that computers/ technology would be used in that section of statistics because of the knowledge they had of the instructor and self-selected the section of statistics to which they would enroll.

Research Question 2

What is the difference in attitudes toward statistics, as measured by the Attitudes Toward Statistics (ATS) scale, over time for students who were taught in class using the Web-based class management system compared to students who were taught in class that did not use the Web-based class management system?

The Attitudes Toward Statistics scale was implemented to measure students' attitudes toward statistics. Separate scores were compiled for the sub-scales of students' attitudes toward the use of statistics in their **Field** of study and the students' attitudes toward the **Course** of statistics in which they were enrolled. There was no

significant difference in attitudes toward statistics over time between students who were taught in class that used a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system. The findings indicated that the use of the Web-based class management system in statistics instruction did not have a significant impact on students' attitudes toward statistics as measured by the sub-scales of Field and Course.

Interestingly, there was a significant difference in both sub-scales of Field and Course for each class across time. Both the class that used a Web-based class management system and the class that did not use a Web-based class management system showed a significant positive attitude change. Follow up analysis indicated that attitudes improved significantly in both classes between baseline and two and one-half weeks, as well as baseline and the end of the five-week session, but not between two and one-half weeks and the end of the five-week session. This would indicate that the total classroom experience in both classes seemed to decrease the statistics anxiety. Results of the first exam given in the statistics courses indicated that in the class that used the Web-based class management system, 30 points were possible on exam one. The mean score was 22.64 with the SD of 2.91. The high score was 28 while the low score was an 18. In the class that did not use the Web-based instruction, 50 points were possible with a mean score of 45.33 and a standard deviation of 3.80. Previous studies indicate that regardless of gender grouping, the more positive the student's attitude toward statistics, the higher the statistics

achievement (Lalonde & Gardner, 1993; Roberts & Bilderback, 1980; Roberts & Reese, 1987; Waters et al, 1988; Wise, 1985). Results for both statistics classes indicate that anxiety levels decreased after the first statistics exam was given. It appears that the combination of the classroom experiences during the first two and one-half weeks and the high test results on the first exam were major contributing factors in the high Attitudes Toward Statistics scores that were recorded at the midterm of the semester. Therefore, a change from the two and one-half week scores to the five-week scores would have been surprising.

Research Question 3

What is the difference in the knowledge of statistics, as measured by scores on 14 identical exam questions given in both statistics sections, for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system?

Scores on five identical questions on exams one and three, and four questions on exam two were given in both sections of statistics to measure overall knowledge of statistics. No significant difference was found between the two groups at the end of the five-week session. The mean score of the students in the section that used the Web-based class management system was slightly higher ($\underline{M}$= 10.55, $\underline{SD}$= 2.42) than the mean score of students in the section that did not use the Web-based class management system ($\underline{M}$= 10.33, $\underline{SD}$= 2.18), but the difference was not significant.

The findings indicate that the use of the Web-based class management system in statistics instruction did not have a significant impact on knowledge of statistics content. These findings do not coincide with recent studies indicating that computer-based education can increase scores from 10 to 20 percentile points and reduce time necessary to achieve goals by one-third (Kulik & Kulik, 1991). Kulik found that computers improved class performance by about one-half a standard deviation (Kulik & Kulik, 1991). Perhaps the difference in the knowledge of statistics at the end of the session was not significant between the two classes because the degree to which students were evaluated on their knowledge of the content material of statistics was not indicative of higher level thinking skills necessary to become proficient in statistics. The questions which were common on both exams were lower level questions on Bloom's taxonomy of critical thinking which would not distinguish higher order gains between the two sections of statistics. Perhaps the test items selected were not capable of discriminating between varying levels of critical thinking.

Kuliks' analysis did not include newer studies utilizing advanced technologies and newer educational paradigms (Kulik & Kulik, 1991). A Web-based class management system is an advanced technology that has been developed since Kulik's research. Perhaps a novelty effect, or Hawthorne effect, could explain the findings of Kulik's earlier research. A novelty effect occurs when learners are stimulated to greater efforts simply because of the novelty of the treatment. As the treatment grows

familiar, it loses its potency.

Research Question 4

What is the attitude toward the Web-based instruction and learning processes, as measured by student attitude interview questions, for students who were taught in class using a Web-based class management system compared to students who were taught in class that did not use a Web-based class management system?

Structured interview questions were implemented to compare attitudes toward the use of a Web-based class management system and learning processes between students taught in class using a Web-based system in statistics instruction and students that did not use the Web-based system. A content analysis of responses revealed that students using the Web-based class management system experienced a more positive attitude toward the use of Web-based systems than did students taught in class that did not use a Web-based class management system.

Students who used the Web-based class management system related positive comments about what they learned with the system and how they benefitted from the use of the Web in instruction; they enjoyed working with the Web-based system; appreciated working at their own pace; commented how easily accessible it was for them, and indicated that they thought their grade may have improved because of the use of the Web-based system. The experience using the Web seemed to be very positive for those students. It may impact them more if future opportunities arise.

Students taught in the class that did not use the Web-based class management system did not think that the use of a Web-based system would improve their grade. Many students were unfamiliar with what a Web-based class management system was, while several students indicated they had taken classes previously using the Internet, and enjoyed them. Several students indicated their enjoyment of the class and the methods the instructor used in their section.

Studies by Moore (1988) suggest that teacher attitudes toward computers may influence achievement: that is, students instructed by teachers with positive attitudes toward technology demonstrated improved performance. Burgstahler (1997) stated that the Internet is a powerful, flexible, and efficient tool for delivering instructional materials to students taking classes such as statistics, math and computers. "It provides new ways for us to teach and learn. It allows us to do new things, as well as do traditional things in new ways" (Burgstahler, 1997). Other studies show that many students perceive computer-based instruction to be more motivating than traditional methods (Hauben & Lehman, 1983; Krendl & Lieberman, 1988; Watkins, 1989).

On June 5, 1998, President Clinton said, "Until every child has a computer in the classroom and the skills to use it...until every student can tap the enormous resources of the Internet...until every high-tech company can find skilled workers to fill its high-wage jobs....America will miss the full promise of the Information Age" (Clinton, 1998). In order to guarantee that students are provided every opportunity possible to experience success, educators must develop strategies to integrate

technology in the curriculum and apply effective strategies toward their use in the learning process.

Conclusions

On the basis of the findings in this study, the following conclusions were drawn.

1. The use of a Web-based class management system in the instruction of statistics did not seem to have an impact on a student's overall attitude about computers.

2. The use of a Web-based class management system in the statistics course did not seem to have an impact on overall attitudes toward statistics.

3. The use of a Web-based class management system did not significantly increase knowledge of the subject (statistics) content.

4. In general, students who were taught in the statistics section using a Web-based class management system experienced a more positive attitude toward Web-based class management systems and learning processes compared to students who were taught in the statistics class that did not use a Web-based class management system.

Recommendations for Future Research

Based on the findings of this research study, the following recommendations for research are proposed:

1. This study should be replicated using a larger sample of college

students. This would have increased the power of the study.

2. This study should be replicated using a fall or spring semester rather than a five-week summer session. Perhaps five weeks may have been too short to see any changes in attitudes.

3. This study should be replicated to see if a Web-based class management system has an impact on student performance and attitudes in other disciplines.

4. This study should be replicated using a less computer friendly/literate population. The experimental group in this study had a baseline mean score of 36 out of a possible 40 in computer anxiety and computer confidence, which indicated that this Web-based section had minimal computer anxiety and a high level of computer confidence at baseline.

5. This study should be replicated using two sections of statistics with the same instructor teaching both sections, one section using the Web-based class management and the other section not.

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APPENDIX A

Computer Attitude Scale

SURVEY OF ATTITUDES TOWARD LEARNING ABOUT AND WORKING WITH COMPUTERS

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The purpose of this survey is to gather information concerning people's attitudes toward learning about and working with computers. It should take about five minutes to complete this survey. All responses are kept confidential. Please return the survey to your instructor when you are finished. Please check the blank which applies to you.

1. Age: ( ) 22 or less ( ) 23-25 ( ) 26-30
( ) 31-35 ( ) 36-40 ( ) 41-45
( ) 46-50 ( ) 51-55 ( ) 55+

2. College level completed: ( ) 1st year ( ) 2nd year ( ) 3rd year ( ) 4th year
( ) Bachelors ( ) Masters ( ) Doctorate

3. Major area of study: _____

4. Sex: ( ) Male ( ) Female

5. Experience with learning about or working with computers:
( ) 1 week or less ( ) 1 month to 6 months ( ) 1 year or more
( ) 1 week to 1 month ( ) 6 months to 1 year

Briefly state the type of computer experience: _____

COMPUTER ATTITUDE SCALE

Below are a series of statements. There are no correct answers to these statements. They are designed to permit you to indicate the extent to which you agree or disagree with the ideas expressed. Place a check mark in the parentheses under the label which is closest to your agreement or disagreement with the statements.

	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
1. Computers do not scare me at all.	( )	( )	( )	( )
2. I'm no good with computers.	( )	( )	( )	( )
3. I would like working with computers.	( )	( )	( )	( )
4. I will use computers many ways in my life.	( )	( )	( )	( )
5. Working with a computer would make me very nervous.	( )	( )	( )	( )
6. Generally I would feel OK about trying a new problem on the computer.	( )	( )	( )	( )

	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
7. The challenge of solving problems with computers does not appeal to me.	( )	( )	( )	( )
8. Learning about computers is a waste of time.	( )	( )	( )	( )
9. I do not feel threatened when others talk about computers.	( )	( )	( )	( )
10. I don't think I would do advanced computer work.	( )	( )	( )	( )
11. I think working with computers would be enjoyable and stimulating.	( )	( )	( )	( )
12. Learning about computers is worthwhile.	( )	( )	( )	( )
13. I feel aggressive and hostile toward computers.	( )	( )	( )	( )
14. I am sure I could do work with computers.	( )	( )	( )	( )
15. Figuring out computer problems does not appeal to me.	( )	( )	( )	( )
16. I'll need a firm mastery of computers for my future work.	( )	( )	( )	( )
17. It wouldn't bother me at all to take computer courses.	( )	( )	( )	( )
18. I'm not the type to do well with computers.	( )	( )	( )	( )
19. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer.	( )	( )	( )	( )
20. I expect to have little use for computers in my daily life.	( )	( )	( )	( )
21. Computers make me feel uncomfortable.	( )	( )	( )	( )
22. I am sure I could learn a computer language.	( )	( )	( )	( )
23. I don't understand how some people can spend so much time working with computers and seem to enjoy it.	( )	( )	( )	( )
24. I can't think of any way that I will use computers in my career.	( )	( )	( )	( )
25. I would feel at ease in a computer class.	( )	( )	( )	( )
26. I think using a computer would be very hard for me.	( )	( )	( )	( )
27. Once I start to work with the computer, I would find it hard to stop.	( )	( )	( )	( )

	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
28. Knowing how to work with computers will increase my job possibilities.	( )	( )	( )	( )
29. I get a sinking feeling when I think of trying to use a computer.	( )	( )	( )	( )
30. I could get good grades in computer courses.	( )	( )	( )	( )
31. I will do as little work with computers as possible.	( )	( )	( )	( )
32. Anything that a computer can be used for, I can do just as well some other way.	( )	( )	( )	( )
33. I would feel comfortable working with a computer.	( )	( )	( )	( )
34. I do not think I could handle a computer course.	( )	( )	( )	( )
35. If a problem is left unsolved in a computer class, I would continue to think about it afterward.	( )	( )	( )	( )
36. It is important to me to do well in computer classes.	( )	( )	( )	( )
37. Computers make me feel uneasy and nervous.	( )	( )	( )	( )
38. I have a lot of self-confidence when it comes to working with computers.	( )	( )	( )	( )
39. I do not enjoy talking with others about computers.	( )	( )	( )	( )
40. Working with computers will not be important to me in my life's work.	( )	( )	( )	( )

APPENDIX B

Attitude Towards Statistics Scale

ATTITUDES TOWARD STATISTICS

Directions: For each of the following statements mark the rating category that most indicates how you currently feel about the statement. Please respond to all of the items.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I feel that statistics will be useful to me in my profession.	____	____	____	____	____
2. The thought of being enrolled in a statistics course makes me nervous.	____	____	____	____	____
3. A good researcher must have training in statistics.	____	____	____	____	____
4. Statistics seems very mysterious to me.	____	____	____	____	____
5. Most people would benefit from taking a statistics course.	____	____	____	____	____
6. I have difficulty seeing how statistics relates to my field of study.	____	____	____	____	____
7. I see being enrolled in a statistics course as a very unpleasant experience.	____	____	____	____	____
8. I would like to continue my statistical training in an advanced course.	____	____	____	____	____
9. Statistics will be useful to me in comparing the relative merits of different objects, methods, programs, etc.	____	____	____	____	____
10. Statistics is not really very useful because it tells us what we already know anyway	____	____	____	____	____
11. Statistical training is relevant to my performance in my field of study.	____	____	____	____	____
12. I wish that I could have avoided taking my statistics course.	____	____	____	____	____
13. Statistics is a worthwhile part of my professional training.	____	____	____	____	____

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
14. Statistics is too math oriented to be of much use to me in the future.	____	____	____	____	____
15. I get upset at the thought of enrolling in another statistics course.	____	____	____	____	____
16. Statistical analysis is best left to the "experts" and should not be part of a lay professional's job.	____	____	____	____	____
17. Statistics is an inseparable aspect of scientific research.	____	____	____	____	____
18. I feel intimidated when I have to deal with mathematical formulas.	____	____	____	____	____
19. I am excited at the prospect of actually using statistics in my job.	____	____	____	____	____
20. Studying statistics is a waste of time.	____	____	____	____	____
21. My statistical training will help me better understand the research being done in my field of study.	____	____	____	____	____
22. One becomes a more effective "consumer" of research findings if one has some training in statistics.	____	____	____	____	____
23. Training in statistics makes for a more well-rounded professional experience.	____	____	____	____	____
24. Statistical thinking can play a useful role in everyday life.	____	____	____	____	____
25. Dealing with numbers makes me uneasy.	____	____	____	____	____

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
26. I feel that statistics should be required early in one's professional training.	____	____	____	____	____
27. Statistics is too complicated for me to use effectively.	____	____	____	____	____
28. Statistical training is not really useful for most professionals.	____	____	____	____	____
29. Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.	____	____	____	____	____

APPENDIX C

Student Attitude Interview Questions

Interview Questions

1. How did you feel about the learning activities in the statistics class? (i.e. instructor presentations, hand-outs, assignments) What was the most beneficial activity for you?
2. How do you feel about the use of a Web-based class management system as a supplement to class lectures?
3. Web-based class: How often did you use it? WHEN did you use it? Did you have any difficulties? Did you have your own computer and were you able to access the website at home...or at work...or at school?
4. Do you feel a Web-based class management system was a valuable tool for improving your grade in the statistics course? (Discuss how much they used it...)
5. Were the strategies used in class effective for you in promoting learning?
6. How would you feel about taking another course that used a Web-based class management system?
7. What improvements/changes would you make in the web process?
8. Is there anything else that you would change about the course?

APPENDIX D

Statistics Class Syllabi

Department of Educational Psychology
University of Nebraska-Lincoln

EP 859 - Statistical Methods

Objectives

By the conclusion of this semester you should be able to do the following:

1. Organize large collections of data by constructing frequency distributions.
2. Summarize large collections of data by calculating measures of central tendency and measures of variability.
3. Compute percentiles and percentiles ranks from grouped and ungrouped data.
4. Calculate measures of relationship between variables.
5. Interpret measures of relationship between variables.
6. Understand the various characteristics of the normal distribution.
7. Calculate various forms of standard scores.
8. Perform the steps of hypothesis testing for hypotheses involving means.
9. Use computer mainframe programs to analyze data.

REQUIRED TEXTBOOK

Gravetter, F.J., Wallnau, L.B. (1996). Statistics for the Behavioral Sciences 4th ed. St. Paul: West Publishing Company.

Course Outline

UNIT I–Chapters 1, 2, 3, 4

1. Introduction to Statistics 1, 2, 3, 4
2. Frequency Distributions
3. Central Tendency
4. Variability

Unit II– Chapters 16, 5, 6, 7

1. Correlation
2. Simple Regression
3. Normal Distributions and Standard Scores
4. Probability
5. Probability and Samples: Distribution of Sample Means

Unit III–Chapters 8, 9, 10, 11

1. Hypothesis Testing
2. Introduction to the t statistic
3. Hypothesis Testing With Two Independent Samples
4. Hypothesis Testing With Related Samples

COURSE REQUIREMENTS

You must complete the three multiple-choice examinations for this class at the specified times. Be certain to contact the instructor before the scheduled time of an examination if you have a very good reason for not completing it.

The computer will be used to a considerable extent in teaching this class. You will be given a UNL computer account which will enable you to send and receive electronic mail. You will have access to a system which will enable you to obtain information from the instructor regarding the class. This information will be explained to you during the early part of the semester. You are asked to try and become familiar with the computer system as soon as possible.

E-mail: cansorge@unlinfo.unl.edu

Charles J. Ansorge
Mabel Lee Hall 202
Telephone: 472-1702

EDPS 859
STATISTICAL METHODS

Instructor:	Sharon Evans, Ph.D.	Office Hours:
Office:	246 MABL	MTWR 11:00-12:00
	Noon	
Phone:	472-2867	and by appointment
e-mail:	sevans@unlinfo.unl.edu	

Description:
This is a course in descriptive statistics and the elements of inferential statistics. Concepts covered in this course include the computation and interpretation of measures of central position, variability, correlation, and regression. In addition, students will be introduced to concepts involving sampling, probability, and hypothesis testing.

Scholar-Practitioner Model:
Teachers College at UNL has adopted the Scholar-Practitioner Model, which is a conceptual framework for student learning. The model focuses on four areas of student learning: the profession, and the teaching process. EDPS 859, Statistical Methods reflects the Scholar-Practitioner Model in that it provides a foundation of knowledge in the descriptive and inferential statistics. The content learned in this course provides the initial background for students to become consumers of research literature and to formulate research questions.

Course Materials:
Gravetter, F.J. & Wallnau, L.B. (1996). Statistics for the behavioral sciences. (4th ed.). Minneapolis: West Publishing (required).

Gravetter, F.J., & Wallnau, L.B. (1996). Study guide to accompany statistics for the behavioral sciences. (4th ed.).Gravetter, F.J. & Wallnau, L.B. (1996). Statistics for the behavioral sciences. (4th ed.). Minneapolis: West Publishing (required).

There is a packet for this course, available at Copyworks(optional).

Grading

There will be three exams in this course, each worth 50 points. The course grade will be based on the percentage of total points earned on the three exams. I do not plan on giving extra assignments as a way of earning points toward a higher grade. The following scale will be used to determine finals grades.

A+	95-100%
A	90-94%
B+	85-89%
B	80-84%
C+	75-79%
C	70-74%
D+	65-69%
D	60-64%
F	below 60%

Additional notes

Although homework will not be collected and graded in this class, it is recommended that you complete the exercises in the text and the student workbook. These exercises will aid in learning and reviewing the material.

Mathematical prerequisites will be held to a minimum in this class, however, some mathematical skills will be required (elementary algebra).

Use of a calculator is required for this class. A simple calculator with a square root key and a single memory will be sufficient.

Graduate students who are taking this course under a PASS/NO PASS option must achieve at least a B in order to receive a PASS.

COURSE OUTLINE

Chapter	Problem set
1. Introduction to statistics	1-25 (odd)
2. Frequency distributions	1-27 (odd)
3. Central tendency	1-27 (odd)
4. Variability	1-29 (odd)
Exam 1	
16. Correlation and regression	1-9 (odd), 15, 17, 20, 21, 23
5. Z-scores: location of scores and standardized distributions	1-23 (odd)
6. Probability	1-29 (odd), handout
7. Probability and samples: The distribution of sample means	1-23 (odd)
Exam 2	
8. Introduction to hypothesis testing	1-19 9odd), 25, 27
9. Introduction to the t-statistic	1-25 (odd)
Hypothesis tests: One sample case for other statistics	handout
10. Hypothesis tests with two independent samples	1-19 (odd)
11. Hypothesis tests with two related samples	1-19 (odd)
12. Estimation	1-19 (odd)
Exam 3	

APPENDIX E

Permissions

University of Nebraska Lincoln

Research Compliance Services
Institutional Review Board
103 Whittier Bldg.
2255 'W' Street
P.O. Box 830849
Lincoln, NE 68583-0849
(402) 472-6965
FAX (402) 472-9323

May 27, 1999

Ms. Nancy Petta
Health and Human Performance
Union College
Lincoln NE 68506

IRB # 99-05-330 EP

TITLE OF PROJECT: **The Impact of Web Class-Management Systems on Attitudes Toward Learning in a Quantitative Statistics Class**

Dear Ms. Petta:

This letter is to officially notify you of the approval of your project by the Institutional Review Board for the Protection of Human Subjects. It is the committee's opinion that you have provided adequate safeguards for the rights and welfare of the subjects in this study. Your proposal seems to be in compliance with DHHS Regulations for the Protection of Human Subjects (45 CFR 46).

1. Enclosed is the IRB approved Informed Consent form for this project. Please use this form when making copies to distribute to your participants. If it is necessary to create a new informed consent form, please send us your original so that we may approve and stamp it before it is distributed to participants.

We wish to remind you that the principal investigator or project director is responsible for keeping this Board informed of any changes involved with the procedures or methodology in this study. You should report any unanticipated problems involving risks to the subjects or others to the Board. It is also the responsibility of the principal investigator to provide the Board with an annual review and update of the research projects each year the project is in effect.

If I can provide you with additional information, please call me.

Sincerely,

Robert Reid, Chair
for the IRB

xc: Dr. Donald Helmuth
Faculty Advisor
Unit Review Committee