12-2009

MEASURING THE IMPACT OF VARIED INSTRUCTIONAL APPROACHES IN AN INTRODUCTORY ANIMAL SCIENCE COURSE

Brian Bolt
Clemson University, bolt@clemson.edu

MEASURING THE IMPACT OF VARIED INSTRUCTIONAL APPROACHES IN AN INTRODUCTORY ANIMAL SCIENCE COURSE

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy
in Animal Physiology

---

by
Brian Grady Bolt
December 2009

Accepted by:
Dr. K. Dale Layfield, Committee Chair
Dr. Mary M. Beck
Dr. Jean Bertrand
Dr. Thomas Dobbins

ABSTRACT

The objectives of this project were to: evaluate the impact of demographic descriptors (gender, class rank and final grade) on student's self perceived level of engagement in classroom activities; measure the impact of varying teaching styles on a student's likelihood of correctly answering a knowledge based question and: assessing the relationship of knowledge acquisition with their level of engagement. Data were collected on students in the AVS 150, introductory animal science class (n=155) at Clemson University during the fall of 2008. Ten to fifteen minutes of class time were classified as conforming exclusively to one of three types of material delivery. The three classifications were labeled as either traditional lecture,; technology-enhanced, or; web-enhanced. At the conclusion of the blocks of time students were posed a knowledge question, germane to the presented material as well as being asked to respond with their level of engagement in classroom activities. The responses were collected via a 5-point Likert-type scale (1=Completely Disaffected - 5=Completely Engaged) using the i-Clicker audience response system.

Results of the demographic descriptors show that females have a statistically significant ($P < .05$) higher final grade (M=84.35) than males (M=82.35) and that freshmen have a statistically significant ($P < .05$) higher final grade (M=84.05) than upperclassmen (M=81.07). Despite these findings there were no reliable relationships between descriptors and level of engagement. Ultimately no demographic descriptors were found to be useful in predicting level of classroom engagement.

The second objective of the project was to measure the level of engagement as compared to type of teaching and pair that with the knowledge acquisition there was a significant difference ($P < .05$) in students reported level of engagement in traditional ($M=3.41$), web-enhanced ($M=3.52$) and technology-enhanced ($M=3.70$). No significant relationships were identified between a student's level of engagement and the likelihood of answering a knowledge question correctly, suggesting that although students have a preference for how material is delivered no differences in academic performance were identified.

DEDICATION

This manuscript is dedicated to my family. Their love, support and unwavering commitment shown to me while seeing this process through have made this project possible.

To my wife, Marie, and son, John-Grady, who have inspired me to complete this project and see it through until completion, always encouraging me to do my best and making the necessary sacrifices such that I could.

To my mom and dad, Ben and Gloria, who have supported me unconditionally through all endeavors, encouraging me to value education and never allowing me to settle for less than my best effort.

To my sister, Rita, who has always served as an example of perseverance and pursuit of perfection, her assistance, encouragement and advice have been irreplaceable in completing this project.

To Mr. Elias, Mrs. Jeanne, Andy, Christie, Elias, Jacob and Madeline, thank you for all of your support and encouragement.

I offer this document as a small token of my appreciation for all of the sacrifices that you all have made for me.

Most importantly, I thank God for the opportunities and good fortune bestowed upon me.

ACKNOWLEDGMENTS

First and foremost, I would like to acknowledge the tireless efforts of Dr. Dale Layfield, my major advisor as well as my valued friend. His patience and guidance have allowed me to complete this academic journey. To the balance of my committee; Dr. Mary Beck, Dr. Jean Bertrand and Dr. Thomas Dobbins, your support of my efforts, the research project and this dissertation have allowed for me to achieve more than I ever thought possible.

To my close and dear friend, Dr. Nevil Speer, your advice, mentorship and support have always been appreciated. Your encouragement of all of my endeavors has always been especially timely and most importantly always valuable.

To my colleagues in the Animal Science Department at Clemson University, your encouragement, professionalism, humor and friendship have allowed for the completion of this project as well as still allowing me to complete my professional responsibilities.

Finally to all of the students who have been involved in this grand experiment that some have referred to as teaching, but that we have referred to as our time in the classroom. Your enthusiasm, wit and intelligence have allowed me to realize that I am truly passionate about teaching the discipline of Animal Science. For this, I offer my sincerest and humblest appreciation.

TABLE OF CONTENTS

Page

TITLE PAGE ... i

ABSTRACT ... ii

DEDICATION ... iii

ACKNOWLEDGMENTS ... v

LIST OF TABLES ... viii

CHAPTER

I. Introduction ... 13

Introduction ... 13
Purpose and Objectives of the Study ... 14
Need for the Study ... 16
Assumptions ... 16
Limitations ... 17
Operational Definitions ... 17
Organization of the Dissertation ... 18

II. Literature Review ... 19

Teaching Animal Science ... 19
Teaching and Learning Styles ... 34
The Animal Science Student and Teacher ... 38
The Introductory Animal Science Course ... 39
Improving Teaching and Teacher Effectiveness ... 40
Flow Theory ... 41
Student Engagement and Motivation ... 44
Self Reporting ... 49
Summary ... 50

IV. Methods and Procedures ... 48

Table of Contents (Continued) Page

IV. The relationship between student demographic descriptors, student's self reported levels of engagement and final grade 57

Introduction 57
Results 60
Discussion – academic class rank 74
Discussion – final grade 87
Implications 112

V. The relationship between student's self reported levels of engagement and learning 114

Introduction 114
Purpose and objectives 114
Results 115
Implications 123

V. Synthesis 125

APPENDICES 128

A: FERPA Exemption Letter 128
B: IRB Approval Letter 129

REFERENCES 130

LIST OF TABLES

Table Page

2.1 Dairy Science Education Symposium, 1965 24

2.2 American Society of Animal Science Education Symposium, 1968 25

3.1 Selected demographics of AVS 150, fall 2008 51

3.2 AVS 150 introductory animal science, fall 2008 53

3.3 Davis' descriptors 56

4.1 Demographics of AVS 150, introductory animal science, fall 2008 60

4.2 Grand means of self-reported engagement by student gender 61

4.3 Descriptive statistics of engagement, five point scale, based on gender 61

4.4 Descriptive statistics for traditional instruction by gender 62

4.5 T-test for traditional instruction by gender 63

4.6 Relationships between students' self-reported levels of engagement and gender on traditional instruction 64

4.7 Davis' rank of relationship between engagement levels based on gender for traditional instruction 65

4.8 Descriptive statistics for technology enhanced instruction by gender 66

4.9 T-test for technology enhanced instruction by gender 67

4.10 Relationship between students' self reported levels of engagement and gender based on technology-enhanced instruction 68

List of Tables (Continued)

Table Page

4.11 Davis' rank of relationship between engagement levels and gender for technology enhanced instruction 69

4.12 Descriptive statistics for web-enhanced instruction by gender....70

4.13 T-test for web-enhanced instruction by gender 71

4.14 Relationships between students' self reported levels of engagement and gender on web-enhanced instruction 72

4.15 Davis' rank of relationship between engagement levels and gender for web-enhanced instruction....73

4.16 Grand means of final grades based on gender 73

4.17 Analysis of variance (ANOVA) of student's final grade....74

4.18 Grand means of engagement by class rank....74

4.19 Descriptive statistics for traditional instruction by academic class....75

4.20 T-test for traditional instruction by academic class rank....76

4.21 Relationships between students' self reported levels of engagement and class rank on traditional instruction....77

4.22 Davis' rank of relationship between engagemen and academic class for traditional instruction 78

4.23 Descriptive statistics for technology-enhanced instruction by class rank....79

4.24 T-test for technology-enhanced instruction by class rank 80

List of Tables (Continued)

Table Page

4.25 Relationships between students' self reported levels of engagement and class rank on technology-enhanced instruction ... 81

4.26 Davis' rank of relationship between engagement levels and academic class for technology-enhanced instruction ... 82

4.27 Descriptive statistics for web-enhanced instruction by academic class ... 84

4.28 T-test for web-enhanced instruction by academic class ... 85

4.29 Relationships between students' self reported levels of engagement and class rank on web-enhanced instruction ... 86

4.30 Davis' rank of relationship between engagement levels and academic class for web-enhanced instruction ... 87

4.31 Grand means of final grade by class rank ... 87

4.32 Descriptive statistics for engagement by final grade for traditional instruction ... 88

4.33 Test of homogeneity of variances for engagement for traditional instruction by final grade ... 90

4.34 Analysis of variance (ANOVA) between level of engagement in traditional instruction and final grade ... 91

4.35 Relationship between students' self reported levels of engagement and knowledge assessment on traditional instruction ... 93

4.36 Davis' rank of relationship between engagement levels and final grade for traditional instruction ... 94

4.37 Grand mean and descriptive statistics of engagement in technology enhanced instruction by final grade 95

List of Tables (Continued)

Table Page

4.38 Analysis of variance (ANOVA) of engagement in technology-enhanced instruction by final grade 95

4.39 Descriptive statistics for engagement by final grade for technology-enhanced instruction 96

4.40 Test of homogeneity of variances for engagement for technology-enhanced instruction by final grade 98

4.41 Analysis of variance (ANOVA) between level of engagement in technology-enhanced instruction and final grade 99

4.42 Relationships between students' self reported levels of engagement and final grade on technology-enhanced instruction 101

4.43 Davis' rank of relationship between engagement levels and final grade for technology-enhanced instruction...........................102

4.44 Grand mean and descriptive statistics of engagement, on a five-point scale, in web-enhanced instruction by final grade 104

4.45 Analysis of variance (ANOVA) of engagement in web-enhanced instruction by final grade 104

4.46 Descriptive statistics for engagement by final grade for web-enhanced instruction 105

4.47 Test of homogeneity of variances for engagement for technology-enhanced instruction by final grade 107

4.48 Analysis of variance (ANOVA) between level of engagement in web-enhanced instruction and final grade..108

List of Tables (Continued)

Table Page

4.49 Relationship between students' self reported levels of engagement and final grade on web-enhanced instruction 110

4.50 Davis' rank of relationship between engagement levels and final grade for web-enhanced instruction 111

5.1 Grand means for self reported engagement on a five point scale 115

5.2 Analysis of variance (ANOVA) between self reported engagement for selected instructional delivery methods 116

5.3 Aggregate engagement level (%) of students based on correct answers 116

5.4 Relationship between students' self reported levels of engagement and knowledge assessment on traditional instruction 117

5.5 Relationships between students' self reported levels of engagement and knowledge assessment on technology-enhanced instruction 118

5.6 Relationships between students' self reported levels of engagement and knowledge assessment on web-enhanced instruction 120

5.7 Davis' rank of linear relationship for traditional instruction 122

5.8 Davis' rank of linear relationship for technology-enhanced instruction 122

5.9 Davis' rank of linear relationship for web-enhanced instruction 123

CHAPTER ONE

INTRODUCTION

Teaching is a discipline as old as time itself. To impart knowledge to someone else is a necessary part of human survival. Early teaching focused on just that, imparting survival skills to the next generation. Evidence of effective teaching was shown in the basic existence of a species, and natural selection was a means of removing bad teaching from a population. As we move forward and begin to look at teaching in the context of a modern population, discerning effective teaching is much more difficult. There are multiple measures and instruments available that should offer some indicator of good teaching, and tests available to ascertain the relative amount of knowledge imparted to the learner. In the end, the basic accumulation of useful knowledge imparted in such a way as to stimulate thinking and ultimately some rational answer to a problem would seem to be the most practical measure of effective teaching.

One overly simple tenet of teaching is that the learner must be engaged with the material that he or she is to be learning (Campbell, 1977; Svanum and Bigatti, 2009). An engaged student, one who is in the flow of the classroom information, is much more likely to internalize and truly learn the information than a learner who is disaffected by what they are to learn. In a sense, to increase student engagement would be a precursor to high-quality learning (Csikszentmihalyi, 1990).

There is a large body of research to suggest and confirm differences in how individuals learn and how teachers teach. Truly good teaching-learning occurs when the appropriate teaching style is paired with a compatible learning style, suggesting that a situation that pairs one learner with one teacher is the best possible situation, or which, on a more practical basis, would sort learners and place them collectively into a situation where they are paired with an appropriate teaching style. (Kolb, 1984; Fleming, 1995) The reality of the modern academic department is fewer teachers teaching larger classes, the result of constrained fiscal resources and increasing enrollments. This reality prevents the ideal position of pairing teaching styles with learning styles, forcing teachers to employ variety in presentation in an attempt to meet the needs of their respective learners.

The modern classroom offers multiple options for delivering material to students. The advent of learning technologies only adds to the options for relaying information to students. Traditional lecture, where a teacher stands in front of a group and offers information, can now be supplemented with varied approaches. In short, the opportunity exists for the information to be presented in a variety of formats and in a best-case scenario the learner is presented information in a way that becomes useful to him on a very individual basis.

PURPOSE AND OBJECTIVES

The purpose of the first portion, chapter 3, of this study is to examine the impact of various instructional delivery methods on students' self-reported levels of engagement as described by student gender, academic class or final grades, and to determine if any relationship between student engagement and demographic descriptors exists. Specifically, the objectives of this study are to:

1. Describe self-reported levels of engagement for traditional instruction, technology-enhanced and Web-enhanced instruction by student gender.

2. Describe the relationship, if any, between self-reported levels of engagement for traditional instruction, technology-enhanced and Web-enhanced instruction by student gender.
3. Describe self-reported levels of engagement for traditional instruction, technology-enhanced and Web-enhanced instruction by academic class (freshmen or upperclassmen).
4. Describe the relationship, if any, between self-reported levels of engagement for traditional instruction, technology-enhanced and Web-enhanced instruction by academic class (freshmen or upperclassmen).
5. Describe self-reported levels of engagement for traditional instruction, technology-enhanced and Web-enhanced instruction by students' final grades (A, B, C, D or F).
6. Describe the relationship, if any, between self-reported levels of engagement for traditional instruction, technology-enhanced and Web-enhanced instruction by students' final grades (A, B, C, D or F).

The purpose of the second portion, chapter 4, of the study is to examine the impact of various instructional delivery methods on students' self-reported levels of engagement and to determine any relationship between student engagement and knowledge gained. Specifically, the objectives of this study are to:

1. Describe students' self-reported levels of engagement for traditional instruction, technology-enhanced and Web-enhanced instruction.

2. Describe the relationship, if any, between AVS 150 students' self-reported levels of engagement and knowledge assessment scores.

NEED FOR THE STUDY

In modern animal science departments, lecture-style introductory courses with large enrollments are the reality. The introductory course is designed to serve as a foundation for the balance of a student's course work within the particular area of study. The importance of the class to an animal science student's future within the discipline coupled with what has often been described as a less than ideal learning environment (Hultz, 1930) clearly illustrates the importance of the development of a teaching and learning environment that offers the greatest chance of a successful teaching-learning outcome is important. In this study the relative efficacy of three defined teaching methods are assessed for likelihood of a desirable outcome, or chance of answering a knowledge-based question correctly.

ASSUMPTIONS

The following assumptions were made in conducting the study:

1. The students will respond truthfully and accurately about their selected answers to knowledge questions and level of engagement.
2. Most students will maintain and bring their i-clicker so as to accurately poll the students in attendance at a given lecture period
3. The teacher has no bias with regards to how material is delivered.

LIMITATIONS OF THE STUDY

The study and its findings are appropriate to describe the introductory animal science class at Clemson University. No inferences should be made to other classes, other schools or other instructors.

OPERATIONAL DEFINITIONS

Audience Response System: a tool for members of an audience to respond to request for input to a moderator.

Disaffected: the state in which a student is completely disengaged from classroom activities.

Engagement: the state in which a student is fully invested in the classroom activities, described in literature as "flow".

I-Clicker: Audience Response System that allows students to respond to questions, their response captured and archived for future analysis.

Technology enhanced lecture: style of teaching that involves the instructor using oration coupled with the aid of various pieces of technology, most often, but not limited to PowerPoint, Word, Excel, pictures, graphs and web browsers.

Traditional lecture: style of lecture that involves the instructor using only oration with the aid of a whiteboard.

Web-enhanced lecture: style of teaching that involves case based learning. Students are posed a question and are able to use their laptop computers (usually connected wirelessly to the internet) as a resource for accumulating information and ultimately solving a problem.

ORGANIZATION OF THE DISSERTATION

This dissertation is organized into six sections. Section one provides a brief overview of the role of teaching styles and a student's self-perceived level of classroom engagement in an Introductory Animal Science class, the purpose and objectives of the study, the need for conducting the proposed study, assumptions and limitation of the study as well as operational definitions of terms proposed in the work. Chapter two provides a review of literature pertinent to teaching animal science, teaching and learning styles and the importance of student engagement in educational settings. Chapter three provides an overview of the design of the study as well as the analyses employed to ascertain descriptions and relationships between study variables. Chapter four outlines the findings from the collected data as it relates to the impact of varied teaching methods on successes or failures on a question germane to the presented materials. Chapter five describes the findings based on collected data as it pertains to various demographic descriptors of the enrolled students. Chapter six provides a summary and synthesis as well as proposes future research questions discovered during the research period.

CHAPTER TWO

LITERATURE REVIEW

TEACHING ANIMAL SCIENCE

"There are as many opinions about teaching as there are teachers interested in the subject" (Taylor and Kauffman, 1983) was an opinion suggested by the article "Teaching Animal Science: Changes and Challenges." The same lack of consensus about best teaching practices continues today. The inclusion of teaching as a scholarly discipline has seen ebbs and flows throughout the history of formalized animal husbandry courses in the United States. Proceedings from the American Society of Animal Production from 1922 reflect that the art of teaching animal husbandry with laboratory practice is a discipline only 40 years old in the US and suggests that there has been meaningful progress towards both method and subject matter (Trowbridge, 1923).

Concern over methods of teaching certainly predates the advent of the domestic land-grant institution. A broader historical survey shows evidence of the teaching of agricultural production being ranked on the same order as military service during the Roman Empire (Washburn, 1958). The relative importance of the teaching of agriculture has fluctuated through the various phases of history depending on a variety of social motivations, most notably the religious beliefs and teachings of the time. It was not until the Renaissance period that teaching in general reclaimed a role of importance in society. With the advent of the printing press, teachers were thrust into a more powerful role than ever before. As a result the printed word could travel distances never before realized. The feudal or caste system, a means of ranking members of society in England, placed the crown, church and universities above all other classes of society. Education at the time was reserved for the elite and based primarily on parochial standards for teaching.

As the Americas were colonized, the animal husbandman was noticeably absent among colonists leaving England, as his position of land owning gentry was a rather comfortable one and there was no need to escape to the new world (Washburn, 1958). The colonists were largely of the merchant class and the early attempts at animal production were related to providing for their families. It would be several years later before the development of animal industries was at a point of requiring particular expertise. Education in the US at this point was primarily concerned with religion; the first university in America was Harvard, founded primarily to train preachers. In some cities and states, societies for the promotion of agriculture were formed: Philadelphia and South Carolina in 1785, Maine in 1787, New York City in 1791 and Massachusetts in 1792. George Washington, in 1796, argued for the development of a National Agriculture Board in his annual address to Congress, a group that was charged with collecting and diffusing information. It is also worth noting that in the same address Washington proposed the development of a national university, an idea that has yet to come to fruition (Washington, 1796).

At the same time that there were multiple domestic issues to be settled in the U.S. European scientists were starting to perform very basic applied research and distribute the results. In Germany, Justus von Liebig, considered to be the father of fertilizer, had discovered nitrogen and its importance to plant growth (Berl, 1938). In France, Jean B.G.D. Boussingault developed an on-farm laboratory and conducted a series of field experiments (Encyclopædia Britannica, 2009). In England, John B. Wales was experimenting with application of superphosphate on his farm and the Royal Agricultural Society was formed in 1838 (Encyclopædia Britannica, 2009). These advances demonstrate the relative importance of scientific discovery as it pertains to agriculture in the European society. Simultaneous to this in the U.S., Horace Mann was pioneering teacher training, resulting in the formation of two separate teachers' institutes, known as Normal schools, in Lexington and Bridgewater, Massachusetts, in 1837 (Hinsdale, 1898; Cheek, 2009) marking the beginning of a period where education and the associated processes are valued within the American society.

Politically, during Thomas Jefferson's administration (1801-1809) several ideas were put forward regarding the federal creation of agriculture colleges. Edmund Ruffin authored a plan to develop agricultural colleges early in the 19th century. There is some suggestion that educational leaders, like Jonathan Turner, used these essays as a basis for the Morrill Act (Grant, et al., 2000).

It was not until 1854 that formalized agricultural education and associated research was started in the US with the Pennsylvania Agricultural High School, Michigan Agricultural College and Maryland College. These schools were the predecessors to our current land grant schools. At a national level, political movements aimed at educating the working class were underway, with the passage of the Morrill Land-Grant College Act of 1862 (and subsequently 1890 and 1994). The Morrill Act was largely the work of Jonathan Baldwin Turner of Illinois College. The original draft was dedicated primarily to agriculture and was unable to garner adequate political support without the inclusion of other mechanical and military avocations. The original draft, submitted by Justin Morrill, was vetoed by President Buchanan, but was later revised with provisions to provide for military and engineering training as well as the original intent of formal agricultural education. With the secession of southern states and the ensuing Civil War, the bill had the appropriate political backing and President Lincoln signed the revised proposal into law. The approved Morrill Act provided for an allocation of land, based on representation in Congress for each state to construct a school dedicated to military, engineering and agriculture. This led to the formation of the land-grant university system.

Professor John A. Craig, a graduate of the Ontario Agricultural College, first offered the first true animal husbandry courses in 1890 at the University of Wisconsin. He was described as a teacher of “rare ability,” and other colleagues were “quick to recognize the pedagological attractiveness and value of the work that Prof. Craig was doing” (Plumb, 1917).

In 1899 a curriculum for an animal husbandry course; Z*ootechny*, was presented to the Association of American Agricultural Colleges and Experiment Stations for consideration. “Zootechny (the science of animal husbandry) was defined as, “the theory and practice of the production of animals that are useful to man” (Washburn, 1958). The early teachers of animal science were largely untrained in the discipline of animal husbandry, owing most of their education to a more classical approach, with curricula of both bench sciences and humanities. In a sense, both the teachers and the students had to develop the animal husbandry curriculum through a process of trial and error.

Because of the speed with which many of the courses and curricula were developed, there was a desire to coordinate the course offerings at various institutions. Professors of the time noted that it would be in the best interest of the discipline to offer courses that were similar in content and credit and that consideration of the option of transferring courses between institutions be considered (Plumb, 1917).

In the early days of professional meetings, significant time and effort were dedicated to teaching. Kildee (1930) began his presentation on “The Value of Personal Contact Between Instructor and Student,” by showing his pleasure that the President and officers of the association had seen fit to offer a symposium on teaching, noting the particular importance of teaching to the discipline (Kildee, 1930).

Other presentations at the same meeting focused on a need to rethink some long-held standards. “The lecturing system is not only out of date but inefficient” and “The direct question examination is not only unfair but inadequate as a test of knowledge” were theories in “Methods of Teaching Animal Husbandry to College Students” (Hultz, 1930). Other presentations from the same meeting included ”Does High School Training in Agriculture Affect Success in College” by L.J. Horlacher and “Extension Teaching Methods” by Rex Beresford. Clearly an interest in teaching was important to early teachers, instructors and professors of animal husbandry.

A rapidly growing population demanded productivity from all agricultural endeavors as more and more resources were deployed for that purpose. Enrollment in schools of agriculture increased dramatically, requiring more courses and more faculty members to teach those courses. As an observation of the situation of teaching animal husbandry courses at the time, it was noted, “Animal Husbandry instructors as a whole are poor teachers” (McCampbell, 1925). Some of the reasons suggested for this position were: that teachers had little to no formal training; young teachers were placed into a classroom with little to no supervision; and that these young instructors had the appropriate background to thoroughly teach the materials (McCampbell, 1925).

As a solution to these issues, McCampbell (1925) suggested that young instructors, with no formal educational training, enroll in teacher training programs as part of their scholarly development. He also suggested that departmental heads should take a particular interest in observing and evaluating young faculty members, noting that this would add to the effectiveness of the individual as a teacher. Even in the early phases of the development of animal husbandry curricula it is becoming evident that not only is subject content important but also the particular methodologies with which those subject are delivered.

Through the early years of the twentieth century there were varying opinions on the primary purpose of animal husbandry departments. Coffey's paper (1915) suggested that the formal training of farmers was the most important objective. Howell (1932) expanded on this idea and offered that the responsibility of the animal husbandry teacher was not simply to train farmers but also to teach the value of both knowledge and discovery (Howell, 1932).

A few short years later a change began to occur in what some saw as the primary role of the animal husbandry department. In 1935, Kildee recounted his pleasure in hearing a recent address from the dean of Pennsylvania State College suggesting that the old practice of preparing students for farming was an outdated concept and suggested that social changes were going to dictate a broader scientific training for animal husbandry students (Kildee, 1935).

Frost (1936) suggested that while the primary consideration was to train farmers there was also the added responsibility to train minds. Years later the same debate still continues with Gustavson (1965) suggesting that the goal is "establishing a framework of accepted truths for the contemporary period, but undergraduate education fails, indeed if the student does not at the same time develop a healthy skepticism." The same debate will continue so long as animal science curricula exist, owing largely to changes in vocations available to graduates of the time.

The period from the 1940's to the 1970's saw a philosophical shift in presented papers and works on teaching. One can surmise that with the need for increased productivity in the agriculture arena for the World War II effort and the realities of the Cold War, teaching became less important and emphasis was focused on research. The Journal of Animal Science was originally published in 1942 and articles on teaching during that time were noticeably absent (Buchanan, 2008). A small number of papers appeared in the journal, such as Rice's paper from 1945, "Evaluating the Animal Science Student," which suggested that "too many colleges and students still seem to believe that one goes to college to learn what to think rather than how to think." Several changes in the relative importance of teaching can be seen in Animal Science Departments over the next few years. In 1965, the American Dairy Science Association held a conference focusing on undergraduate education in dairy science.

Table 2.1 Dairy Science Education Symposium, 1965

Author	Title	Pages
Arbuckle, W.S.	Dairy Science Education: Introduction	107
Kelly, Philip L.	Dairy Science Education: Trends in Enrollment In College and University Dairy Departments in the United States	108-114
Gries, George A.	Dairy Science Education: Educational Objectives in the Agricultural Sciences	115-119
Moise, A.W.	Dairy Science Education: Education And the Industrial Personnel Function-Teammates	119-122
Heffner, Lawrence L.	Dairy Science Education: Continuing Educational Liaison Program	122-127

In 1968, a symposium on teaching was held by the American Society of Animal Science, which appeared to be a marked departure from the obvious absence of teaching-related papers in the previous years. Papers and presenters at this symposium were as follows:

Table 2.2 American Society of Animal Science Teaching Symposium 1968

Author	Title	Pages
Bentley	New Challenges in Teaching Animal Science	863-867
Cameron	Development and Implication of Two Year Programs in Animal Science	868-873
Young	New Goals in the Introductory Animal Science Course	874-878
Hoefer	New Goals in Undergraduate Teaching in Nutrition	879-883
Visek	New Goals in Undergraduate Teaching of Physiology	884-887
Willham	New Goals in Undergraduate Teaching of Genetics	888-892
Plimpton	New Goals in Undergraduate Teaching in Animal Products	893-901
Neumann	New Goals in Undergraduate Teaching Animal Management	902-904
Hess	Is Animal Science Serving the College of Agriculture	905-910
Anonymous	Student – Teacher Interface	911-916
Tyznik	Counseling of Undergraduates in Animal Science	917-919
Castle	Teaching Evaluation and Promotion Policies	920-924
Glazener	In – Service Education for Teaching Faculty	925-927
Dreyfuss	Evolution and Promise of Educational Technology	928-937
Postlethwait	Audio – Tutorial System	938 – 940

Table 2.2 (continued) American Society of Animal Science Teaching Symposium 1968

Author	Title	Pages
Harmon and Behrens	Auto – Tutorial Resources in Animal Science Teaching	941-943
Livingston	Effectiveness of Televised Instruction	944-948
First, *et al.*	Use of Television in Teaching Introductory Animal Science	949-951
Horvath and Innskeep	Role of the Laboratory in the Teaching of Animal Science	952-955

Of special note is the apparent interest in the role of technology in assisting with various pedagological goals.

The animal science curriculum of the 1960's was rapidly evolving. Geyer (1965) reported that many departments had consolidated introductory courses in dairy, meat animal and poultry sciences in the 1950's and 1960's. A majority of departments at this point did offer multi-species and multi-discipline courses. Young (1968) reported that 17 of 18 respondents to a recent survey indicated the consolidation of dairy and meat animal science courses and in a majority of cases, poultry was also covered. Young (1968) went on to report that the new approach to teaching these courses would require new objectives, and suggested certain universal changes that would be necessary as consolidation of discipline continued. Some of the suggested changes were to demonstrate the relationship of man and animals, to develop problem-solving capabilities, to show the similarities and differences of the various biological systems across the various disciplines and to encourage more in depth work as students identified a particular area of interest. (Young, 1968) These suggested changes continue to affect how Animal Science curricula are presented currently.

In his paper, Young also realized that the discipline of animal science can not become too restrictive, noting that animal science graduates could and had made significant contributions in all fields, especially in science. As a result of all of the changes occurring within the discipline, some attempts were being made to standardize at least some elements of the curriculum. A committee of animal scientists at the Conference on Undergraduate Teaching in the Animal Sciences, held under the auspices of CEANAR, The Commission on Education in Agriculture and Natural Resources, was commissioned by the National Academy of the Sciences to study issues related to education within the respective disciplines. The committee met in May 1966, suggested the following topics for an introductory Animal Science course:

1. Product characteristics;
2. Homeostasis;
3. Productive lifecycles;
4. Growth;
5. Reproductive characteristics;
6. Behavior;
7. Milk secretion;
8. Heritability;
9. Embryology;
10. Nutrition (non-ruminant and ruminant);

11. Improvement rate by selection;
12. Animals relation to society;
13. International importance, and
14. Animal energetics.

Early in the 1970s, two papers were presented sharing concern with the lack of preparation of future teachers earning PhD degrees in animal science programs and offering some suggestions for remedying the lack of preparation. One approach suggested was to require an apprenticeship under an experienced teacher coupled with a departmental seminar devoted to college teaching. Students attending the seminar would be required to develop a lesson on a selected topic and deliver it to the group (Riley, 1971). Another approach suggested was the development of the doctorate teaching degree, a degree program that was defined as a post-B.S. degree equivalent to a Ph.D. degree, the express goal of which was to train students to teach animal science topics at the collegiate and professional levels (Acker, 1971). These two approaches were suggested in response to an increasing need for formally trained and high quality teachers of animal science, both in traditional college programs and in industry. Both of the authors above described a need for teaching to again be an important component within the animal science discipline.

Two master teachers of the decade published articles in 1977 and 1979, respectively, regarding motivation of students and personal accounts of teaching. In Campbell's 1977 article, he dealt with the topic of motivating and engaging students and posed the question why some students of the same ability will have very different outcomes. He suggested that motivation is the issue and he gave the following as reasons to motivate students: “to speed and improve learning, to decrease the number of college dropouts, to improve the training of our graduates, and to help keep teachers motivated.”

Campbell (1977) also suggested the following ways to motivate students;

- “get to know students
- show interest in students
- exhibit proper teacher attitude
- be an enthusiastic teacher
- set a good example for students
- build self-confidence-the success factor
- use successful students as examples
- expect much of students
- nurture determination and perseverance
- encourage competition and user words
- utilize the pride factor
- stimulate student interest
- show relevance and the need to learn
- encourage student involvement
- praise students generously
- be careful with criticism
- appreciate grades-the fear factor.”

He also suggested that each teacher has his own style and should be aware of his strengths and weaknesses (Campbell, 1977). The second master teacher, John F. Lasley (awarded a national teaching award in 1968) recounted his successes and failures in teaching students. His advice was based on more than 30 years of teaching experience and covered topics such as dealing with a first class, quizzes and examinations, grading and the personal rewards he had received from teaching. It was especially interesting that the author noted that in his experience he had never found an accurate method of measuring the amount of progress a student has made in the course (Lasley, 1979).

A comprehensive paper, *Teaching Animal Science*, written by Taylor and Kauffman, was prepared for the Diamond Jubilee meetings of the American Society of Animal Science in 1983. The authors (both former national teaching awardees) recounted the past 75 years of progress in teaching in the animal sciences. The authors noted that historically 21 articles on pedagogy, 19 on curriculum, 16 on course improvement and 14 on teaching technique and foreign student evaluation had been presented in various animal science journals. In the paper the following question was asked: “can teaching be improved, can it be perfected, can it be sustained and can it be evaluated systematically by an unbiased, objective approach?” Their position was that teaching can be improved and to do so input was needed from several sources. Such information as alumni surveys, student and peer reviews and performance contracts were included in a list of sources of formative input to improve teaching.

Taylor and Kauffman (1983) also suggested several upcoming changes that would affect the animal sciences in the next several years, such as plateauing enrollment, increased proportion of female students, more transfer students and fewer students having livestock experience. These changes would force a rethinking of traditional animal science teaching, most especially in the introductory courses. The paper, published in 1983, provided the authors’ position on the future of teaching in animal science programs. The authors suggested questions such as will teachers be needed in 2008 and if so what will they look like, how will they be evaluated and if teaching can be assessed, will it be appreciated? The authors were hopeful that these questions would be answered and teaching would become appreciated for the sake of teaching. The position was also forwarded that, professionally, teaching should be recognized as a scholarly activity and that more papers, awards, symposia and support should be offered by the various professional societies.

Apparently the ideas forwarded at the Diamond Jubilee meetings struck a chord and in 1984 a symposium was held at the 72nd annual meeting of the American Society of Animal Science. In one paper, “Philosophies of Teaching and Approaches to Teaching,” presented at this meeting, it was suggested that “teachers’ responsibilities are to motivate students to maximize learning; teachers should consider excellence in teaching as vital to the intellectual help of our society; teachers should enjoy teaching to be effective communicators… teachers should strive to be innovative not for its own sake but for the sake of effective teaching.”

Eight approaches considered to be important to teaching were suggested: Such things as encouraging communication, use of a wide variety of teaching styles and transitioning the lecture period from one to relay factual information but rather to use them for an exchange of ideas, the author goes on to suggest some novel approaches to teaching that all involve the teacher to alter teaching style so as to maximize the opportunity for a learner to have their particular learning style met and to take advantage of the instructor’s strengths. (Kauffman et al., 1984)

TEACHING AND LEARNING STYLES

Any study undertaken to investigate the relationship of teaching and learning must also take into account that not only do teachers have their own unique strengths so far as a method of material delivery is considered but also that learners are all uniquely different and as such there is a unique interface between the teacher and learner. The following section addresses the relevant literature to that relationship.

A study published in 1998 made note that of all the various papers and presentations dealing with teaching and learning, none dealt with the learning process. In their study, Honeyman and Miller (1998) looked at the interaction between learning styles and teaching styles focusing on field-dependent and field-independent learners. The findings of the study suggested that a combination of teaching methods was a more desirable approach to meet the needs of the various learning styles of students. In the same year, a second study was published comparing learning styles and demographic characteristics of students in animal science courses. This study found that a majority (58%) of students enrolled in selected courses preferred a field independent learning style (analytical) but found no differences between males and females with regard to learning style. The authors suggested that teachers in animal science should be aware of both their own learning style as well as their students' learning styles (Hoover and Marshall, 1998).

The relative position of teaching in the animal husbandry and animal science discipline was described earlier in the review but papers dating back to the infancy of animal husbandry departments outline the knowledge that students have tendencies related to comprehension of materials (Coffey, 1920). Given the variety of approaches to pedagogy, altering delivery of course content would seem appropriate so long as it continues to meet the class objectives. Frost offered some recommendations in the mid 1930's to teachers of animal husbandry, such as explaining the relevance of studying a particular topic, using practical examples and making students responsible for their own learning. The author also suggests that advanced assignments that require extracurricular work are particularly valuable in piquing a student's interest in the subject matter. (Frost, 1936)

The literature certainly supports the theory that students have preferred styles of learning (Whittington and Raven, 1995). Kolb suggested that individuals differ along two dimensions in learning: Abstract to Concrete and Reflective Observation to Active Experimentation. (Kolb, 1984) Psychoanalyst Carl Jung developed the Myers-Brigg learning style inventory to qualify learners with the following orientations: Extrovert/Introvert, Sensing/Intuition, Thinking/Feeling and Judgment/Perception (Murray, 1990). Barbe and Swassing (1979) suggested that learners have varying abilities based on sensory modalities; these learners are described as auditory learners, visual learners or tactile-kinesthetic learners. All of these respective papers offer evidence of the increased likelihood of a positive learning outcome when a student is introduced to various subject matters in a manner that is more appropriately matched with their particular tendencies.

During the same time educational researchers were forwarding their ideas about students' learning styles, a paper was published describing the role of Internet-based resources to supplement traditional instruction in an introductory animal and poultry science course. This paper proposed that with the changes in the ways in which students access information, Web-based resources can be of benefit to students in an introductory course (Barnes et al., 1999). In 2002, however, a paper was published in the Journal of Animal Science on critical interactive thinking exercises (CITE) in teaching reproductive physiology to undergraduates. In this paper, the authors suggested that an increasing emphasis was being placed on the use of new technologies in the classroom but that the focus should be on teaching methods that truly enhance understanding and knowledge retention. With the advent of multiple learning technologies available to teachers it is worth noting that throughout the study of relevant literature a cohesive theme of fostering critical thinking skills, improving communication skills and evaluation skills in selected classes is a worthy goal. The research shows clear validation of student satisfaction with the critical thinking exercises. The authors suggest that the same results could be seen in other animal science courses (Peters et al., 2002).

Based on the literature above it leads a teacher to the realization that each learner is unique and no one approach to teaching can meet the needs of all learners.

Advancements in technology make new abilities available as resource to a classroom. This particular study investigates the impact of employing presentation software as one of the test variables. Several studies have been undertaken to measure the impact of just such software in various classroom. Most of the discussions suggest that software such as Microsoft's PowerPoint or Apple's Keynote are present in most classrooms (Alley and Neeley, 2005; Savoy et al., 2009), all though there is little consensus as to the educational value of employing these tools. Some researchers suggest that presentation software improves learning (Lowry, 1999), keeps audiences interested for longer periods of time (Szabo and Hastings, 2000) and can make comprehension of complicated graphics (charts, tables, pictures, graphs, etc.) easier to understand (Apperson, et al., 2006). Other researchers offer that presentation software inhibits quality interactions between the teacher and student (Driessnack, 2005) prevents instruction of very detailed examples (Tufte, 2003) and reduces a student's ability to analyze complex problems (Stein, 2006).

The more obvious answer to the impact of presentation software in the classroom would appear to be in the unique application of the technology as it is appropriate to the material being taught, or case specific (Szabo and Hastings, 2000). Some classroom objectives may require students to see and understand complex graphics and in such cases presenting the material to the class in a visual form may be beneficial, while other concepts may not lend themselves to graphical presentation and to use presentation software may not be a good fit (Nielsen and Levy, 1994). It was noted that in several articles students have become accustomed to receiving slides from the class material and report a preference for having the information available (Nielsen and Levy, 1994; Babb and Ross, 2009; Savoy, et al., 2009). It was especially important to note that in several studies that student's preference for how material was presented could not be correlated with their respective performance in the class (Nielsen and Levy, 1994). One study found that students retained 15% less material delivered verbally by the instructor when PowerPoint was used (Savoy, et al., 2009). Research to date, regarding the impact of presentation software, would seem to suggest that appropriate application of the technology depends on the nature of the material and the ability of the instructor to design quality visuals appropriate to accomplish the classroom objectives.

THE ANIMAL SCIENCE STUDENT AND TEACHER

One could argue that the demographics of the typical animal science student have changed as much as the base of knowledge itself. In the late 1800s, animal husbandry was described as “men teaching boys” (Coffey, 1920). Today’s animal science student is more likely to be female, to be from an urban background and to have an interest in veterinary medicine, rather than in going back to the farm (Grant et al., 2000). A review of the Food and Agricultural Education Information System’s (FAEIS) 2006 baccalaureate degrees awarded in agriculture, agricultural operations and related sciences at 1862 institutions showed that 71.3% of degrees were awarded to females, a marked difference from the discipline 100 years ago (FAEIS, 2009).

Of special note is the relative similarity (demographically) of the teaching faculty of today compared to what it was 100 years ago. A study at the University of Florida published in 2003 reported some of the demographics of current animal science students. Sixty-one percent were from an urban background whereas only 4% were raised on a farm or ranch where the majority of family income was attributed to production agriculture. Eighty-six percent of students had minimal or no experience working with large domestic farm animals but nearly 64% wanted to pursue a career in veterinary medicine. Students who chose a minor associated with the animal sciences were interested primarily in animal behavior, while students of rural backgrounds were most interested in animal management. Because of the lack of large animal experience a multi-species large animal and production practicum was designed. Groups of students rotated between equine, beef, dairy and swine farms and were exposed to all facets of animal management. Students enrolled in this course overwhelmingly found it to be a valuable experience, indicating that it stimulated both their interest in and their mastery of animal science concepts (Reiling et al., 2003).

THE INTRODUCTORY ANIMAL SCIENCE COURSE

Animal Science as a discipline has changed from a production-oriented, farm animal based science to a much broader based science. These changes are reflected chronologically as well as in course offerings and emphasis areas in animal science departments. The traditional introductory course has also seen drastic changes, primarily to become inclusive of all the particular focus areas that modern animal science curricula represent.

Acker (1964) offered five objectives for the introductory animal science course. To paraphrase, the author suggests that students be introduced to the discipline, be shown the importance of the traditional science discipline as applied to more specific animal science curricula, be exposed to current topics and be shown the economic motives for the study of animal science.

In what appears to be one of the first attempts to discuss philosophical shortcomings of current animal science curricula, in a 1997 article, Schillo posed the question whether teaching in science is education or indoctrination. His position was that traditional curricula have long ignored the relevance of the sociological aspects of the scientific process. As a solution to this problem he suggested that teachers transition to be more of a resource in the classroom, allowing students to be more active in the learning process and in turn fostering critical thinking skills (Schillo, 1997), which he called the most important objective of an animal science curriculum.

In contrast, a paper published in the Journal of Animal Science in the year 2000 described the importance of a comprehensive education to the animal sciences, especially in the first year introductory course (Grant et al., 2000). The authors suggested that the first course in the discipline is the time to provide students with a balanced perspective. Some of the concepts that should be fostered in this introductory course are “curiosity about the world, leading to global awareness; enthusiasm for question identification and analytical problem-solving; ability to see a series of questions and applications as linked, which leads to systems-based view; and effective communication.” The authors feared too much specialization was occurring and the discipline will produce narrowly focused graduates. On the other hand, students provided too liberal an education would be ill equipped to deal with the technical aspects of animal science. Their contention was that land-grant institutions have the unique ability to strike a balance between a technical and a liberal education, generating well-rounded students prepared to meet a variety of challenges (Grant et al., 2000).

IMPROVING TEACHING AND TEACHER EFFICACY

“Teaching is a skill, an art, a craft—it can always be improved” (New York University Center for Teaching Excellence, 2008). To improve teaching would also be to improve the opportunity for learning (Bandura, 1977). The literature suggests that the teacher is a variable in the teaching-learning equation and offers two theories for the teacher’s role in student learning. Bandura (1977, 1986, 1993) suggested that the learner has a better opportunity if a teacher is more effective, based on his theory of social cognitive theory. Rotter (1966) offered the idea that the teacher is the locus of control in the classroom and from that position of authority has the ability to change educational outcomes.

Social cognitive theory is based on the assumption that the person, in this case the learner, exerts some level of self-control over his or her own life. The alternative is that the teacher is the locus of control (Rotter, 1966) and determines the outcome in the classroom. To clarify the differences between the two, Goodard *et al.* (2000) offered the following: "Beliefs about one's capability to produce certain actions (perceived self-efficacy) are not the same as beliefs about whether actions affect outcomes." Recent papers suggest that Bandura's social cognitive theory offers the most plausible explanation for assessing teacher efficacy in the classroom (Tschannen-Moran et al., 1998; Goddard et al., 2000).

FLOW THEORY

Flow theory is a concept developed by Mihaly Csikszentmihalyi (1975) and is described as "the holistic experience that people feel when they act with total involvement." He continued, stating, "…flow – the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it" (Csikszentmihalyi, 1990). In the context of this study, flow theory is used to describe the state in which the learner finds him or herself during a lecture period in which their focus is solely on the topic at hand. It stands to reason that a learner immersed in the subject matter is more likely to internalize the material and learn it. Csikszentmihalyi (1990) outlined nine factors when one is experiencing flow, though not all need to be present concurrently in order to achieve it:

1) Clear goals
2) Concentrating and focusing
3) A loss of the feeling of self-consciousness
4) A distorted sense of time
5) Direct and immediate feedback
6) Balance between ability level and challenge
7) A sense of personal control over the situation or activity
8) The activity is intrinsically rewarding
9) Action awareness merging (Czikszenthihayli, 1975)

In education, designing educational experiences that completely capture a student's attention and immerse them in the educational activities creates flow. Depending on the level of the course, the topic and potentially many other factors, resources can be tailored to create just such experiences. A problem often lies in the quantity of potential distracters to students in a modern classroom. One reviewed article described the need for the learner to have fun while learning the material and pointed out that for "flow" to occur the learner has to be in charge of his or her own actions (Hoetltke, 2003).

Other support for this idea is the Theory of Engagement, a reasonably new concept dealing with technology-based learning. The theory suggests that students need to be actively engaged in classroom activities and that technology can certainly be a tool to afford the level of engagement that has long escaped the traditional lecture style classroom (Kearsley and Shneiderman, 1999).

Schneiderman (1999) went on to say that the basic principles underlying engagement theory are characterized by “Relate-Create-Donate”, implying that these activities should be group projects, have a problem-based focus and have some extracurricular focus.

The Schlecty Center For Leadership and School Reform posited, in 2009, that excerpting effort on engaging students is a meaningful activity and worth the necessary investment, ultimately creating learners better positioned to learn. (Schlecty Center, 2009)

The Schlecty Center document (2009) suggested there are five different student involvements in attacks: engagement, strategic compliance, ritual compliance, retreatism and rebellion. As a means to prevent the less desirable behaviors teachers can employ what Schlecty (2009) referred to as design qualities. Schlecty suggested that the design qualities of context are content and substance, organization of knowledge, protection from adverse consequences for initial failures and clear and compelling product standards. The design qualities of choice are product focus, affiliation, affirmation of performance, novelty and variety, choice and authenticity. While this study does not deal directly with involvement of technology in education, the theory of engagement does have application.

ENGAGEMENT AND MOTIVATION

"Learning begins with student engagement" (Shulman, 2007). There is evidence to show a strong relationship between the course engagement and final cumulative GPA, academically engaged students are more successful (Svanum and Bigatti, 2006).

Some of the earliest influences on a child's motivation to learn are parents and others in the home. As the same students enter school, teachers, administrators, classmates and school environments all influence their motivation to learn (Lumsden, 1994). Other studies have also confirmed the importance of the teacher in the role of motivating a learner (Anderman and Midgley, 1998). "To a very large extent, students expect to learn if their teachers expect them to learn"(Lumsden, 1994). As students grow older the motivations change, shifting away from parents and home influences to peers having a greater influence (MacIver, 1994). Regardless of the reason that a student may become less motivated, be it less motivation on the learner's part or practices in the school that lower the level of motivation, there is an appreciable body of research that suggests the lack of motivation can be changed (Skinner and Belmont, 1993; Dev, 1997; Brooks, 1998). Grolnick and Ryan (1992) suggested that the goal of increasing motivation to learn and engagement are, at times, more important than the delivery of classroom subject objectives. They argued that increasing the desire to learn would yield greater benefits for the learner in the long run.

Early definitions of student engagement dealt with time on task behaviors (Fisher et al., 1980; Brophy, 1983). More recent studies have focused on students' likelihood of attending class, turning in assignments on time and receiving help outside of normal classroom parameters (Chapman, 2003). Natriello (1984) defines student engagement as a student participating in those activities associated with learning. Student engagement is a topic that in recent years has evolved from rather simplistic definitions into a much broader definition. The National Survey of Student Engagement (NSSE) is a nationally recognized survey tool employed by many universities to measure how engaged students are at several interfaces within the university system (National Survey of Student Engagment, 2007). In short, engaged students are more likely to have a positive learning outcome than those who are not engaged, making student engagement a worthy goal in today's classroom. Several studies have explored the significance affective factors play in learning, particularly noting the role of student engagement.

Early studies of student engagement dealt with time-on-task behaviors (Fisher et al., 1980; Brophy, 1983). Although multiple definitions of engagement circulate in the literature, the following idea was suggested by Skinner and Belmont (1993): "Students who are engaged show sustained, positive investment in activities that will yield true learning. These same students are often pushing themselves while maintaining a positive emotional tone." In other words they enjoy learning.

Student engagement is a reliable predictor of academic performance. (Carini et al., 2006). The study suggested that the relationship is "deceptively simple" and that non-engaged students would be at a distinct disadvantage. The referenced study attempted to formalize the link between student engagement and student learning. Student learning in this sense is defined in a much broader context than the scope of the current study (which focuses on the students' relative level of engagement over the course of a fifty minute lecture period, over the course of an academic semester). The study referenced above (Carini et al., 2006) did find modest relationships between self reported levels of student engagement and RAND scores (the RAND test was developed specifically as a measure of aggregate learning at the collegiate level, integrating components of the GRE as well as components of the bar exam and critical thinking assessors). The findings of the study indicated that student engagement benefited the students who were of the lowest academic abilities. The "lowest-ability" students were defined as those most likely to leave the university prior to completing a degree.

Good Practice in undergraduate education emphasizes the following and poses ways in which technology enhanced the quality of the interaction (Chickering and Gamson, 1987). Good practice:

- Encourages contacts between students and faculty;
- Develops reciprocity and cooperation among students;
- Uses active learning techniques;
- Gives prompt feedback;
- Emphasizes time on task;
- Communicates high expectations, and
- Respects diverse talents and ways of learning.

> "… I point to the following unwelcome truth: much as we might dislike the implications, research is showing that didactic exposition of abstract ideas and lines of reasoning (however engaging and lucid we might try to make them) to passive listeners yields pathetically thin results in learning and understanding–except in the very small percentage of students who are specially gifted in the field." (Arons, 1990)

Multiple variables exist to measure student engagement. The National Survey of Student Engagement (NSSE, 2007) suggests five benchmarks of effective educational practice as appropriate variables to consider in an assessment of student engagement in the larger context.

1) Level of Academic Challenge,
2) Active and Collaborative Learning
3) Student-Faculty Interaction
4) Enriching Educational Experiences and
5) Supportive Campus Environments

The more students study or practice a subject the more they learn about it (Carini et al., 2006).

A survey of potential instructional practices in the classroom would highlight multiple opportunities to vary content and delivery methods. An analysis of all of the variables in a classroom highlighted multiple areas that can be altered to yield a more favorable learning environment. A study by Rosenshine and Furst (1971) revealed behaviors in the classroom that yield the highest educational benefit: enthusiasm, clarity, variability, business-like behavior and opportunities to learn are all associated with desirable learning outcomes.

A large portion of the likelihood of academic success depends on the teacher and their abilities to alter delivery methods and clarify topics that are perceived as difficult (Ericksen, 1978). At the same time there are several factors inherent to the learner that impact comprehension of material. A student who is motivated to work and learn is much more likely to have a positive learning outcome. Her interest in the subject matter, concepts of its usefulness, and individual self-esteem and self-perception all impact the potential learning outcomes (Bligh, 1971; Sass, 1989). Research findings indicate that there are methods to encourage self-motivation among learners (Bligh, 1971; Lowman, 1984; Weinert and Kluwe, 1987; Lucas, 1990).

The literature also suggests that there is reason to consider an alternative to traditional lecture, especially when a teacher desires a deeper level of understanding. Results from one study indicated that students involved in active learning score significantly higher on achievement tests (McManus et al., 2003). In contrast, another researcher argued against the findings, stating at California Polytechnic State University, advocating a change from traditional lecture to a more active learning environment was flawed because of the inherent lack of motivation for the students to ascertain knowledge in these studies (Mottman, 1999). The literature also shows a student preference for material delivery and alternative forms other than traditional lecture. One such example would include a problem-based learning situation where the teacher becomes more of a resource rather than the dominant individual in the room (Arambula-Greenfield, 1996). If an instructor is hoping to develop higher-order cognitive skills such as critical thinking, synthesis and evaluation, then traditional lecture methods may be limiting (Zoller, 1993). Some resources have gone so far as to describe the traditional lecture style as “failing to interest students,” imposing severe time constraints and not promoting conceptual understanding or problem-solving skills (Black, 1993).

SELF-REPORTING ENGAGEMENT

In this particular study the students are relied upon to self report their respective level of engagement. The literature suggests that there are effects on behavior when subjects realize they are being observed. The Hawthorne Effect (a term coined by Henry Landsberger, 1955) demonstrates a short-term improvement in worker performance as the result of the worker being observed. In the original study, workers were observed to measure the impact of changing illumination in the work area. Regardless of the change, there were short-term improvements in worker productivity. Later, researchers surmised that because of the fear on the part of the workers that each of them was being observed individually, short-term performance increased. In other experiments, small groups of workers were subjected to several different variations on their traditional workday (varied durations of breaks, food during breaks, shorter work days, etc.). All of the variations produced short-term increases in worker performance but none of the results were sustainable over any appreciable amount of time.

The Pygmalion Effect (Rosenthal and Jacobson, 1968, 1992) describes changes in student behavior as a result of knowing that they are being observed; student performance goes up when more is expected of the students (Feldman and Prohaska, 1979).

A recurring theme is that all studies undertaken to assess how different variables impact classroom outcomes, the teacher becomes the largest variable, offering more sources of variation than all of the rest combined (O'Shea et al., 1996) As a general rule, teachers have a huge effect on student performance but the effect is poorly understood.

In the current study, students are forced into active participation by the act of self-reporting, which in turn causes the respondent to be more involved in the class, potentially serving as a confounding variable in the process of data collection. The concern is that there are very few situations where students could be asked to self-report their level of engagement without soliciting their response.

The literature does suggest the self-reporting can be assumed to be reliable under certain conditions (Pohlman, 1974; Baird, 1976; Pace, 1984). These conditions suggest that the information the respondent is reporting is known to them, the question that is being answered is clear and is presented at a time that is recent enough that a valid response is elicited and the answer presented carries no punitive recourse.

SUMMARY

The literature supports that teachers, their teaching styles and their philosophical approaches to delivery of the material vary significantly. Simultaneously the learner's motivation and level of engagement coupled with their unique learning styles vary to the same extent. In this study it is the intention to investigate the unique relationships and interactions between those two variables as they relate to accomplishment of the educational objectives in the introductory animal science class as Clemson University. The relative importance of establishment of the fundamentals was clearly substantiated in the literature as being a tenet of the introductory class and the results of the study could serve to improve the potential for a successful outcome in that class, by equipping learners with the necessary tools to aid in their academic success.

CHAPTER THREE

METHODS AND PROCEDURES

During the fall of 2008, data were collected on the Introductory Animal Science Class (AVS 150) at Clemson University. The class is a prerequisite for students in the Animal and Veterinary Sciences major at Clemson University and is also an elective for other agriculture majors (agricultural economics, agricultural education, agricultural mechanization, etc.) Students enrolled in the class are largely interested in pursuing a career in veterinary medicine. The class primarily consists of first year full time students and a majority is female (Table 3.1). Other selected demographics are shown in Table 3.1.

Table 3.1 Selected demographics of AVS 150, fall 2008

Number of Students	155
Number of Freshmen (%)	124 (80%)
Number of Sophomores (%)	17 (10.9%)
Number of Juniors (%)	9 (5.8%)
Number of Seniors (%)	4 (2.6%)
Number of Graduate Students (%)	1 (.6%)
Number of Females (%)	114 (74%)
Number of Males (%)	41 (26%)
Average Credit Load of Students	15.86
Number of In State / Out of State	118 / 37 (76.1% / 23.9%)

The introductory course is used to form a basic understanding of the biological principles underlying the animal industries as well as management approaches unique to an animal industry. The course deals with both the food animal and companion animal industries. Historically, information was delivered via traditional lecture, supplemented with slides, overhead transparencies and supplemental readings. In recent years, with the advent of a laptop computer mandate for all students entering the university coupled with the remodeling of the lecture hall the course is taught in, students have the opportunity to access Web-based resources (either prescribed or searched out) during class time. With the technology available to the class, the opportunity to vary teaching is now much easier. Although several teaching styles (and combinations of styles) are routinely employed, the focus of this study was to identify 10-15 periods of lecture time that had a clearly describable type of teaching, either traditional lecture (TL), technology-enhanced lecture (TE) and problem based, Web-enhanced learning, (WEB). Traditional lecture was defined as only the teacher coupled with a whiteboard, willing to interact with the students and respond to questions. Technology-enhanced was defined as the teacher coupled with projector, slides and various forms of multimedia, typically projected onto one of two large screens in the front of the lecture hall. In technology enhanced the instructor was willing to interact with students and respond to questions. Web-enhanced was defined as students presented with a problem and using Web resources to find solutions. The instructor was willing to interact with the class during the Web enhanced sessions but students were encouraged to search out solutions and answers on their own. It is important to note that during all types of instruction the teacher would respond to questions and interact with the class.

The topics covered in the class (see Table 3.2) serve to build a foundation for subsequent courses and assist students in developing a level of fluency in the terminology of animal science.

Table 3.2 AVS 150 introductory animal science, fall 2008, topical outline

Topic
Introduction and Overview
Industries Overview
Products
Mammalian and Avian Reproduction- Anatomy and Physiology
Reproductive Technologies
Genetics and Animal Breeding
Nutrition- Anatomy, Physiology and Feedstuffs
Lactation
Animal Growth and Development
Animal Disease and Sanitation
Animal Behavior and Welfare
Beef Industry
Poultry Industry
Dairy Industry
Swine Industry
Equine Industry
Companion Animal Industries

Students were required to purchase I-clickers, a widely used audience response system (ARS). Audience Response Systems are small hand held (remote control-like) tools that allow students to interact with specific questions presented in a graphics presentation (PowerPoint) system where the data are then collected and saved into a database, for later analysis. An ARS was used in AVS 150 to enable students to submit answers to both knowledge questions and their relative level of engagement at various points during lecture. Students were taught material throughout the course of the semester and after 10-15 minutes of instructional time knowledge questions were posed to the class to assess the relative level of understanding. Students responded with the ARS (I-Clickers) a system that allows for anonymous submission of answers, used for several purposes but most notably as a teaching tool to increase student engagement. It is assumed that a student that answered the question correctly learned the material and the student answering incorrectly did not gain the knowledge during that same period of lecture, there is always the chance of students guessing. The relative size of the data set should control for random answers. Immediately following an allotted 30 second period of time for response to the knowledge question, students were asked to provide their level of engagement during the previous 10-15 minutes of instruction. The responses were collected via a 5-point Likert-type scale (1=Completely Disaffected, 2=Somewhat Disaffected, 3=Indifferent, 4=Somewhat Engaged, and 5=Completely Engaged). The literature suggests that disaffected students are not involved with classroom activities and are not taking advantage of taught materials (Skinner and Belmont, 1993). Students responded with the I-clicker system and data were collected using the same system as the knowledge question. There were no incentives or penalties for a student to answer either the knowledge question or the level of engagement response. Data collection relied on students being willing to attempt to answer both questions truthfully.

Students were made fully aware of the goals of the study at the beginning of the semester and were asked to reflect, several times over the course of the semester, as to what they meant when they submitted responses to the engagement questions. The students enrolled in the course were made aware that there were no penalties for their responses to either the knowledge based questions or their levels of engagement. In an attempt to gauge student learning, regular quizzes were given. It was a stated goal of the study that collection of data and study design were intended to not disrupt any of the academic goals of the course.

For the purposes of the final analysis, the engagement data were recoded into three levels, with a 3 representing self reported engagement levels of 4‘s and 5’s, 2 representing SRE level of 3’s and 1 representing SRE levels of 2‘s and 1’s. Data that were collected from the assessment of student knowledge were coded as 1 for correct and 2 for incorrect.

Although data were collected during each class meeting, the data were reduced to 33 pairs (11 pairs for Traditional, 13 pairs for Tech-enhanced and 9 for Web-enhanced). The motivation for the sorting of paired questions was to identify periods of lecture with clearly definable types of material presentation. The decision was made with the help of teaching assistants (undergraduate and graduate) in the classroom, tasked with identifying the type of material delivery specific to a knowledge question, followed with an assessment of engagement. Several periods of lecture would involve multiple types of teaching and for the purposes of this study were omitted from the analysis.

Data were collected as comma separated value files by the I-clicker system, imported into Microsoft Excel for collation and recoding and ultimately analyzed using Data was analyzed using the *Statistical Package for the Social Sciences* (SPSS 17) software. Data analyses and statistics were largely descriptive and were used to find a relationship, if any, between level of engagement and the propensity to answer the question correctly and to ultimately find significant differences between the three types of information delivery as it relates both to engagement and knowledge acquisition. The data were initially analyzed using descriptive statistics (Frequencies, Means and Standard Deviations). An analysis of variance (ANOVA) was used to determine any variation between selected styles of teaching and then to look for evidence of a relationship between a student's self-reported level of engagement and the likelihood that the student answers a knowledge question correctly. Data were recoded into a nominal format and Cramer's V (or Cramer's Φ) were used to describe the relative strength of the relationship. A Pearson's chi-square was used to describe the independence of the reported level of engagement versus the likelihood of answering a question correctly.

The decision to use inferential statistics was based on the predicted similarity of the study group with future animal science classes, this assumption justifies the use of just such statistics as directed by Oliver and Hinkle (1982). Variation and statistical significance ($P<.05$) were described using an analysis of variance (ANOVA) and t-test as appropriate for the data set Evidence of a relationship between variables was determined by using Pearson's chi-square and the relative strength of the relationship was described using Cramer's V (Cramer's Φ) correlation value (appropriate for nominal by nominal data sets.) The strength of the relationship, based on the Cramer's V value was classified using Davis' (1971) categorical descriptors (Table 3.3).

Table 3.3 Davis's Descriptors

Cramer's V value	Descriptor
0	no linear relationship
.01-.09	trivial linear relationship
.10-.29	low to moderate linear relationship
.30-.49	moderate to substantial linear relationship
.50-.69	substantial to very strong linear relationship
.70-.89	very strong linear relationship
.90+	near perfect linear relationship

CHAPTER FOUR

The relationship between student demographic descriptors, student's self reported levels of engagement and final grade

The objectives of this section include:

1. Describe the demographic profile of AVS 150, fall 2008 students
2. Describe the relationship, if any, between student gender, self-reported engagement and method of instruction;
3. Describe the relationship, if any, between academic class, self-reported engagement and method of instruction, and
4. Describe the relationship between final grade, self-reported engagement and method of instruction.

INTRODUCTION

Creating a classroom experience that is more engaging and leads to positive learning outcomes is a goal for educators. Engagement in classroom activities increases the chance of immersing the learner in a situation known as "flow" (Csikszentmihalyi, 1990), a state in which the learner is totally invested in his or her learning environment and more likely to retain the information presented. Student engagement has been linked to student learning and can be considered an imperative for true learning in the classroom setting (Shulman, 2007).

In a modern animal science department, the existence of a single section, large-enrollment introductory class is a reality. Regardless of the discipline the importance of the introductory class relative to the balance of a student's time in their chosen discipline is well documented (Young, 1968).

In this study, the roles of various demographic descriptors of undergraduates enrolled in an introductory animal science class are used as a potential predictor of self-reported engagement. The collective level of engagement will be related to the student's final grade in the class with a goal of using various constructs to describe potentials for academic success.

The demographics of animal science students have changed dramatically since the inception of animal husbandry courses in the US. Research shows large increases in the number of females enrolled in animal science programs (Beck and Swanson, 2003; Casey and Plaut, 2003; FAEIS, 2009)

Literature is divided on the differences in learning preferences and tendencies of the different genders. Several researchers suggest inherent differences between male and female learners: in learning styles (Fleming, 1995, 2009; Chang, 2004) and in science and math aptitude as a result of social expectations (Halperm, 2004). At the same time a large meta-analysis was undertaken of research into the area of gender differences in learning and found on the aggregate no fundamental differences other than those applied by society respective to learning abilities (Hyde, et.al, 1990, 2005). Within this study, the differences between male and females will be described based on level of engagement within a predefined type of content delivery.

A second demographic factor considered when measuring students' level of engagement was academic class. Although the majority of students enrolled in this class were true freshmen, there were some upperclassmen (populated almost exclusively by non-AVS majors and transfer students). The literature on the role of academic class is limited but one study suggests that upperclassmen have less motivation than freshmen in difficult college courses (Lynch, 2008).

The last descriptor analyzed was final grade. It is suggested that grades and academic performance are primary motivators for college students (Van Etten et al., 2008; Gabbin, 2009). Another study found that student motivation is a predictor of final grade (Filak and Sheldon, 2008). In the introductory animal science class, a majority of students have professional school aspirations and as such grade point average is important to future success.

Through identifying any relationships between demographic characteristics and student engagement, educators could design effective teaching strategies that may impact academic performance.

RESULTS

Objective 1: Describe the Demographic Profile of AVS 150, Fall 2008 Students

A total of 155 students were enrolled for the entire semester. AVS 150 is a three-hour lecture class taught for three 50-minute periods on Monday, Wednesday and Friday mornings at 8 am. Class enrollment consists primarily of freshmen animal science students. The course is a pre-requisite for all other animal science courses at Clemson. AVS 150 demographics for fall of 2008 are shown in (Table 4.1) – the total number followed by a percentage (where appropriate) are given for selected descriptors.

Table 4.1 Demographics of AVS 150, introductory animal science, fall 2008

Demographic Descriptor	Number	%
Students	155	-
Freshmen	124	80
Sophomores	17	10.9
Juniors	9	5.8
Seniors	4	2.6
Graduate Students	1	.6
Females	114	74
Males	41	26
Average Credit Load of Students	15.86	-
Number of In State / Out of State	118 / 37	76.1 / 23.9

Objective 2: Describe the Relationship, if any, Between Student Gender, Self-Reported Engagement and Method of Instruction

Results of student demographics as a predictor of SRE suggest that no particular demographic subset has a statistically higher level of engagement or final grade than others.

Evidence of practically no difference in reported levels of engagement (Table 4.2) based on student gender, with males having a slightly higher level of self-reported engagement were found.

Table 4.2 Grand means self-reported engagement (1-5) by student gender

Gender	Mean
Male	3.56
Female	3.53

Females reported a slightly higher level of engagement (Table 4.3) in Web-enhanced instruction (M = 3.51 vs. M = 3.50), while males have higher levels of engagement for both technology-enhanced (M = 3.72 vs. M = 3.68) and traditional instruction (M = 3.46 vs. M = 3.38). Females and males are consistent in their ranking of self-reported engagement based on type of instruction, ranking tech-enhanced with the highest mean, followed by Web-enhanced and rating traditional lecture the lowest.

Table 4.3 Descriptive statistics of engagement (five point scale) based on gender

Type of Instruction/ Engagement	Gender	n	Mean	Standard Deviation	Range	
					Low	High
Traditional	Female	114	3.3863	.65581	1.50	5.00
	Male	38	3.4646	.60460	2.10	5.00
	Total	157	3.4094	.64926		
Tech-enhanced	Female	114	3.6857	.66031	1.67	5.00
	Male	37	3.7224	.62422	2.00	5.00
	Total	156	3.6989	.65390		
Web	Female	114	3.5123	.61377	1.75	5.00
	Male	38	3.5078	.65434	1.67	5.00
	Total	157	3.5209	.62244		

Findings indicated that traditional instruction generated the lowest average engagement scores. Table 4.4 illustrates the average level of engagement by gender. September the 6th is the only observation to show significant differences in level of engagement males 4.10 and females at 3.75, respectively (Table 4.5). Based on Levene's test (Table 4.5) for equality of variances all of the data points conform and can be evaluated using a T-test for significance based on equal means.

Table 4.4 Descriptive statistics for traditional instruction by gender

Class Session	Gender	N	Mean	Std. Deviation	Std. Error Mean
September 2nd	Male	35	3.74 [a]	1.039	.176
	Female	103	3.39 [a]	1.031	.102
September 4th	Male	28	3.57 [a]	1.136	.215
	Female	98	3.41 [a]	.961	.097
September 6th	Male	31	4.10 [b]	.651	.117
	Female	103	3.75 [b]	.882	.087
September 18th	Male	32	3.16 [a]	1.110	.196
	Female	94	3.24 [a]	.991	.102
September 23rd	Male	30	3.27 [a]	1.258	.230
	Female	101	3.24 [a]	1.021	.102
September 30th	Male	31	3.29 [a]	.973	.175
	Female	102	3.47 [a]	1.069	.106
October 21st	Male	24	3.21 [a]	1.179	.241
	Female	86	3.24 [a]	1.062	.115
October 30th	Male	26	3.27 [a]	1.151	.226
	Female	90	3.46 [a]	1.018	.107
November 13th	Male	21	2.95 [a]	1.161	.253
	Female	82	3.23 [a]	1.046	.115
December 2nd	Male	23	3.57 [a]	.843	.176
	Female	81	3.22 [a]	1.061	.118
December 4th	Male	19	3.63 [a]	1.065	.244
	Female	76	3.46 [a]	1.089	.125

[a,b] means with different superscripts are significantly different ($P < .05$)

Table 4.5 T-test for traditional instruction by gender

Class Session	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
September 2nd	.046	.831	1.754	136	.082	.355	.202
September 4th	.215	.644	.760	124	.449	.163	.215
September 6th	5.063	.026	2.040	132	.043	.349	.171
September 18th	.377	.541	-.423	124	.673	-.088	.209
September 23rd	2.270	.134	.129	129	.897	.029	.224
September 30th	1.055	.306	-.839	131	.403	-.180	.215
October 21st	.337	.563	-.143	108	.887	-.036	.251
October 30th	.385	.536	-.798	114	.427	-.186	.234
November 13th	.000	.989	-1.068	101	.288	-.279	.262
December 2nd	.742	.391	1.426	102	.157	.343	.240
December 4th	.025	.875	.615	93	.540	.171	.278

To describe the relationship of male to female responses for the various types of instruction, data were recoded into 3 categories which were 1 and 2 = disaffected, 3 = slightly engaged/indifferent and 4 and 5 = engaged. A chi-square test and Cramer's V were used to describe the relationship between responses based on gender. The results suggest no statistical significance between male and female responses and only trivial to low moderate based on Davis' (1971) rank (Cramer's V value < .29) (Table 4.7).

Table 4.6 Relationships between students' self-reported levels of engagement and gender on traditional instruction

	Knowledge Assessment			
Level of Engagement	Female (%)	Male (%)	Chi-Square	Cramer's V
September 2nd			4.735	.130
Disaffected	18.4	11.4		
Slightly Engaged	35.0	25.7		
Engaged	46.6	62.9		
September 4th			3.437	.115
Disaffected	18.4	14.3		
Slightly Engaged	28.6	17.9		
Engaged	53.1	67.9		
September 6th			5.011	.135
Disaffected	8.7	0.0		
Slightly Engaged	25.2	16.1		
Engaged	66.0	83.9		
September 18th			1.646	.079
Disaffected	20.2	25.0		
Slightly Engaged	38.3	34.4		
Engaged	41.5	40.6		
September 23rd			1.558	.076
Disaffected	22.8	23.3		
Slightly Engaged	41.6	30.0		
Engaged	35.6	46.7		
September 30th			2.812	.102
Disaffected	19.6	19.4		
Slightly Engaged	29.4	29.0		
Engaged	51.0	51.6		

Table continued on next page

Table 4.6 (continued) Relationships between students' self-reported levels of engagement and gender on traditional instruction

	Knowledge Assessment			
Level of Engagement	Female (%)	Male (%)	Chi-Square	Cramer's V
October 21st			5.008	.148
Disaffected	24.4	25.0		
Slightly Engaged	31.4	25.0		
Engaged	44.2	50.0		
October 30th			2.591	.104
Disaffected	15.6	23.1		
Slightly Engaged	33.3	34.6		
Engaged	51.1	42.3		
November 13th			2.023	.098
Disaffected	20.7	23.8		
Slightly Engaged	37.8	42.9		
Engaged	41.5	33.3		
December 2nd			7.655	.190
Disaffected	21.0	13.0		
Slightly Engaged	43.2	26.1		
Engaged	35.8	60.9		
December 4th			2.882	.122
Disaffected	18.4	21.1		
Slightly Engaged	28.9	15.8		
Engaged	52.6	63.2		

Table 4.7 Davis' rank of relationship between engagement levels based on gender for traditional instruction

Class Session	Chi-Square	Cramer's V	Davis' Rank
September 2nd	4.735	.130	Low to Moderate
September 4th	3.437	.115	Low to Moderate
September 6th	5.011	.135	Low to Moderate
September 18th	1.646	.079	Trivial
September 23rd	1.558	.076	Trivial
September 30th	2.812	.102	Low to Moderate
October 21st	5.008	.148	Low to Moderate
October 30th	2.591	.104	Low to Moderate
November 13th	2.023	.098	Trivial
December 2nd	7.655	.190	Low to Moderate
December 4th	2.882	.122	Low to Moderate

For technology-enhanced instruction, similar results were found. Males ranked technology enhanced instruction higher (M = 3.72) than females (M = 3.69). No statistical difference was found in any of the class meetings for technology-enhanced instruction (Table 4.8 and Table 4.9). Table 4.9 illustrates the homogeneity of the variance, suggesting a t-test analysis is appropriate despite uneven sample size.

Table 4.8 Descriptive statistics for technology-enhanced instruction by gender

Class Session	Gender	N	Mean	Std. Deviation	Std. Error Mean
September 9th	Male	32	4.31	.965	.171
	Female	103	4.15	.890	.088
September 16th	Male	29	3.59	.946	.176
	Female	104	3.63	.838	.082
September 20th	Male	27	3.85	.949	.183
	Female	96	3.73	.946	.097
October 11th a	Male	26	3.46	1.240	.243
	Female	82	3.70	.965	.107
October 11th b	Male	22	3.95	1.174	.250
	Female	71	3.85	1.037	.123
October 21st	Male	23	3.35	1.152	.240
	Female	86	3.40	.974	.105
October 23rd	Male	30	3.77	.858	.157
	Female	92	3.88	.912	.095
October 30th	Male	25	3.28	1.137	.227
	Female	90	3.33	1.017	.107
November 1st	Male	22	3.68	1.086	.232
	Female	67	3.87	.886	.108
November 6th	Male	27	3.78	1.013	.195
	Female	89	3.57	.964	.102
November 11th	Male	23	3.74	1.096	.229
	Female	73	3.60	.862	.101
November 15th a	Male	21	3.10	.944	.206
	Female	70	3.07	1.068	.128
November 15th b	Male	19	3.79	.918	.211
	Female	63	3.46	1.013	.128

Table 4.9 T-test for technology-enhanced instruction by gender

Class Session	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
September 9th	.000	.996	.908	133	.366	.167	.184
September 16th	.955	.330	-.214	131	.831	-.039	.181
September 20th	1.554	.215	.595	121	.553	.123	.206
October 11th a	3.211	.076	-1.001	106	.319	-.234	.233
October 11th b	.002	.963	.419	91	.676	.109	.261
October 21st	.973	.326	-.200	107	.842	-.048	.238
October 23rd	.469	.495	-.602	120	.549	-.114	.189
October 30th	.027	.870	-.226	113	.822	-.053	.236
November 1st	2.000	.161	-.798	87	.427	-.184	.231
November 6th	.146	.704	.955	114	.341	.205	.214
November 11th	.244	.622	.619	94	.538	.136	.220
November 15th a	.040	.841	.092	89	.927	.024	.259
November 15th b	.715	.400	1.267	80	.209	.329	.260

Data collected on technology-enhanced instruction indicated one statistically significant finding (Table 4.10). The September 9th class meeting revealed a chi-square value of 12.954 and a Cramer's V of .304, placing it into the moderate to substantial category using Davis' (1971) rank.

Table 4.10 Relationships between students' self-reported levels of engagement and gender-based on technology-enhanced instruction

	Gender			
Level of Engagement	Female (%)	Male (%)	Chi-Square	Cramer's V
September 9th			12.954 [a]	.304 [a]
Disaffected	4.9	6.3		
Slightly Engaged	18.4	6.3		
Engaged	87.5	87.5		
September 16th			1.190 [b]	.093 [b]
Disaffected	9.6	13.8		
Slightly Engaged	31.7	31.0		
Engaged	58.7	55.2		
September 20th			7.019 [b]	.235 [b]
Disaffected	8.3	11.1		
Slightly Engaged	30.2	7.4		
Engaged	61.5	81.5		
October 11th			3.430 [b]	.175 [b]
Disaffected	12.2	23.1		
Slightly Engaged	22.0	11.5		
Engaged	65.9	65.4		
October 11th			3.198 [b]	.182 [b]
Disaffected	11.3	9.1		
Slightly Engaged	19.7	13.6		
Engaged	69.0	77.3		
October 21st			1.686 [b]	.122 [b]
Disaffected	17.4	21.7		
Slightly Engaged	32.6	26.1		
Engaged	50.0	52.2		
October 23rd			4.207 [b]	.183 [b]
Disaffected	5.4	3.3		
Slightly Engaged	28.3	30.0		
Engaged	66.3	66.7		

Table continued on next page

Table 4.10 (continued) Relationships between students' self-reported levels of engagement and gender-based on technology-enhanced instruction

Level of Engagement	Gender		Chi-Square	Cramer's V
	Female (%)	Male (%)		
October 30th			1.783 [b]	.087 [b]
Disaffected	21.1	16.0		
Slightly Engaged	30.0	40.0		
Engaged	48.9	44.0		
November 1st			2.585 [b]	.119 [b]
Disaffected	10.4	13.6		
Slightly Engaged	14.9	22.7		
Engaged	74.6	63.6		
November 6th			2.221 [b]	.096 [b]
Disaffected	13.5	11.1		
Slightly Engaged	29.2	18.5		
Engaged	57.3	70.4		
November 11th			2.920 [b]	.121 [b]
Disaffected	11.0	13.0		
Slightly Engaged	23.3	8.7		
Engaged	65.8	78.3		
November 15th			1.973 [b]	.103 [b]
Disaffected	27.1	28.6		
Slightly Engaged	38.6	28.6		
Engaged	34.3	42.9		
November 15th			4.352 [b]	.228 [b]
Disaffected	14.3	10.5		
Slightly Engaged	34.9	21.1		
Engaged	50.8	68.4		

[a,b] sessions with different superscripts are significantly different ($P < .05$)

Table 4.11 Davis' rank of relationship between engagement levels and gender for technology-enhanced instruction

Date	Chi-Square	Cramer's V	Davis' Rank
September 9th	12.954 [a]	.304 [a]	Moderate to Substantial
September 16th	1.190 [b]	.093 [b]	Trivial
September 20th	7.019 [b]	.235 [b]	Low to Moderate
October 11th	3.430 [b]	.175 [b]	Low to Moderate
October 11th	3.198 [b]	.182 [b]	Low to Moderate
October 21st	1.686 [b]	.122 [b]	Low to Moderate
October 23rd	4.207 [b]	.183 [b]	Low to Moderate
October 30th	1.783 [b]	.087 [b]	Trivial
November 1st	2.585 [b]	.119 [b]	Low to Moderate

Table continued on next page

Table 4.11 (continued) Davis' rank of relationship between engagement levels and gender for technology-enhanced instruction

Date	Chi-Square	Cramer's V	Davis' Rank
November 6th	2.221 [b]	.096 [b]	Low to Moderate
November 11th	2.920 [b]	.121 [b]	Low to Moderate
November 15th	1.973 [b]	.103 [b]	Low to Moderate
November 15th	4.352 [b]	.228 [b]	Low to Moderate

[a,b] sessions with different superscripts are significantly different (P < .05)

Web-enhanced instruction showed similar results to traditional and technology-enhanced instruction. Females ranked technology enhanced instruction slightly higher (M = 3.5123) than males M = 3.5078). No statistical difference was noted in any of the class meeting for technology-enhanced instruction (Table 4.12 and Table 4.13). Table 4.13 illustrates the homogeneity of the variance suggest a t-test analysis is appropriate despite uneven sample size.

Table 4.12 Descriptive statistics for web-enhanced instruction by gender

Class Session	Gender	N	Mean	Std. Deviation	Std. Error Mean
August 30th a	Male	31	3.55	1.121	.201
	Female	98	3.60	1.053	.106
August 30th b	Male	32	4.06	.840	.148
	Female	98	4.04	1.015	.102
September 9th	Male	31	3.97	.752	.135
	Female	106	3.66	.904	.088
September 20th	Male	27	3.30	1.235	.238
	Female	96	3.27	.923	.094
September 30th	Male	32	3.22	1.039	.184
	Female	97	3.56	.968	.098
October 7th	Male	31	3.48	1.061	.190
	Female	93	3.55	.961	.100
October14th	Male	30	3.43	1.040	.190
	Female	87	3.11	.982	.105
October28th	Male	29	3.07	1.252	.232
	Female	82	3.07	.940	.104
November 11th	Male	24	3.54	.721	.147
	Female	80	3.51	1.006	.113

Table 4.13 T-test for web-enhanced instruction by gender

Class Session	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
August 30th a	.295	.588	-.244	127	.808	-.054	.220
August 30th b	1.363	.245	.109	128	.913	.022	.199
September 9th	3.423	.066	1.726	135	.087	.307	.178
September 20th	5.100	.026	.117	121	.907	.025	.217
September 30th	.057	.812	-1.682	127	.095	-.338	.201
October 7th	.117	.732	-.315	122	.753	-.065	.205
October 14th	.914	.341	1.509	115	.134	.318	.211
October 28th	4.139	.044	-.019	109	.985	-.004	.222
November 11th	3.341	.070	.132	102	.895	.029	.221

The relationship between gender and self-reported level of engagement for Web-enhanced instruction is not significant (Table 4.14) and Davis' rank suggests a low to moderate linear relationship for most class meeting and trivial relationship for the rest.

Table 4.14 Relationships between students' self-reported levels of engagement and gender on web-enhanced instruction

	Gender			
Level of Engagement	Female (%)	Male (%)	Chi-Square	Cramer's V
August 30th			2.918	.106
Disaffected	15.3	19.4		
Slightly Engaged	27.6	25.8		
Engaged	57.1	54.8		
August 30th			3.020	.107
Disaffected	10.2	6.3		
Slightly Engaged	12.2	12.5		
Engaged	77.6	81.3		
September 9th			4.528	.126
Disaffected	10.4	0.0		
Slightly Engaged	29.2	29.0		
Engaged	60.4	71.0		
September 20th			4.171	.128
Disaffected	18.8	25.9		
Slightly Engaged	42.7	22.2		
Engaged	38.5	51.9		
September 30th			6.395	.156
Disaffected	11.3	25.0		
Slightly Engaged	41.2	28.1		
Engaged	47.1	46.9		
October 7th			1.280	.071
Disaffected	15.1	12.9		
Slightly Engaged	30.1	35.5		
Engaged	51.6	51.6		
October 14th			6.372	.162
Disaffected	25.3	16.7		
Slightly Engaged	44.8	36.7		
Engaged	29.9	46.7		

Table continued on next page

Table 4.14 (continued) Relationships between students' self-reported levels of engagement and gender on web-enhanced instruction

	Gender			
Level of Engagement	Female (%)	Male (%)	Chi-Square	Cramer's V
October 28th			2.814	.112
Disaffected	25.6	31.0		
Slightly Engaged	45.1	31.0		
Engaged	29.3	37.9		
November 11th			1.569	.085
Disaffected	15.0	8.3		
Slightly Engaged	30.0	33.3		
Engaged	55.0	58.3		

Table 4.15 Davis' rank of relationship between engagement levels and gender for web-enhanced instruction

Class Session	Chi-Square	Cramer's V	Davis' rank
August 30th	2.918	.106	low to moderate
August 30th	3.020	.107	low to moderate
September 9th	4.528	.126	low to moderate
September 20th	4.171	.128	low to moderate
September 30th	6.395	.156	low to moderate
October 7th	1.280	.071	trivial
October 14th	6.372	.162	low to moderate
October 28th	2.814	.112	low to moderate
November 11th	1.569	.085	trivial

An analysis of academic performance (Table 4.16 and Table 4.17) found a significant difference between male and female academic performance with females receiving an average grade of 84.35 and males earning a final grade of 82.35 (P = .026)

Table 4.16 Grand means of final grades based on gender

Gender	Final Grade
Females	84.35 [a]
Males	82.35 [b]

[a,b] grand means with different superscripts are significantly different (P = .026)

Table 4.17 Analysis of variance (ANOVA) of student's final grade

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.153	2	2.077	3.734	.026
Within Groups	83.428	150	.556		
Total	87.582	152			

DISCUSSION – ACADEMIC CLASS RANK

For purposes of this analysis, student engagement when considering class rank was recoded into freshmen and upperclassmen. An analysis of the student engagement within class rank found that upperclassmen reported being more engaged, M = 3.6703 than freshmen M = 3.5130 (Table 4.18).

Table 4.18 Grand means of engagement by class rank

Academic class rank	n	Mean Engagement	Std. Dev.	Std. Error
Freshmen	124	3.5130	.58024	.05211
Upperclassmen	28	3.6703	.56937	.10760

No statistical differences were noted between freshmen and upperclassmen for traditional instruction (Table 4.19 and Table 4.20). Table 4.21 shows one class meeting, October 21st, that had a low association (P< .05) between class rank and reported level of engagement (Cramer's V = .208). Table 4.20 illustrates the homogeneity of the variance suggest a t-test analysis is appropriate despite uneven sample size. All relationships were qualified as either trivial or low to moderate by Davis' (1971) rank, suggesting that class rank is not a reliable predictor of engagement for traditional instruction.

Table 4.19 Descriptive statistics for traditional instruction by academic class

Class Session	Academic Class	N	Mean	Std. Deviation	Std. Error Mean
September 2nd	Freshman	111	3.46	1.043	.099
	Above Freshman Level	27	3.56	1.050	.202
September 4th	Freshman	101	3.44	.984	.098
	Above Freshman Level	25	3.48	1.085	.217
September 6th	Freshman	110	3.85	.859	.082
	Above Freshman Level	24	3.75	.794	.162
September 18th	Freshman	102	3.15	1.028	.102
	Above Freshman Level	24	3.54	.932	.190
September 23rd	Freshman	106	3.19	1.061	.103
	Above Freshman Level	25	3.48	1.122	.224
September 30th	Freshman	109	3.49	1.006	.096
	Above Freshman Level	24	3.17	1.204	.246
October 21st	Freshman	90	3.14	1.127	.119
	Above Freshman Level	20	3.65	.745	.167
October 30th	Freshman	98	3.41	1.083	.109
	Above Freshman Level	18	3.44	.856	.202
November 13th	Freshman	81	3.10	1.056	.117
	Above Freshman Level	22	3.45	1.101	.235
December 2nd	Freshman	85	3.26	1.037	.112
	Above Freshman Level	19	3.47	.964	.221
December 4th	Freshman	77	3.47	1.059	.121
	Above Freshman Level	18	3.61	1.195	.282

Table 4.20 T-test for traditional instruction by academic class rank

	Levene's Test for Equality of Variances		t-test for Equality of Means				
Class Session	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
September 2nd	.013	.908	-.429	136	.669	-.096	.224
September 4th	.106	.745	-.198	124	.844	-.044	.224
September 6th	.002	.964	.500	132	.618	.095	.191
September 18th	.011	.916	-1.720	124	.088	-.395	.229
September 23rd	.462	.498	-1.221	129	.224	-.291	.239
September 30th	1.778	.185	1.359	131	.177	.320	.235
October 21st	4.104	.045	-1.911	108	.059	-.506	.265
October 30th	1.248	.266	-.135	114	.893	-.036	.270
November 13th	.205	.652	-1.389	101	.168	-.356	.256
December 2nd	.008	.927	-.827	102	.410	-.215	.260
December 4th	.223	.638	-.506	93	.614	-.144	.284

Table 4.21 Relationships between students' self-reported levels of engagement and class rank on traditional instruction

	Class Rank			
Level of Engagement	Freshmen (%)	Upperclassmen (%)	Chi-Square	Cramer's V
September 2nd			2.231 [a]	.126 [a]
Disaffected	17.1	14.8		
Slightly Engaged	33.3	29.6		
Engaged	49.5	55.6		
September 4th			1.579 [a]	.110 [a]
Disaffected	17.8	16.0		
Slightly Engaged	26.7	24.0		
Engaged	55.4	60.0		
September 6th			2.134 [a]	.124 [a]
Disaffected	7.3	4.2		
Slightly Engaged	20.9	33.3		
Engaged	71.8	62.5		
September 18th			2.923 [a]	.106 [a]
Disaffected	23.5	12.5		
Slightly Engaged	37.3	37.5		
Engaged	39.2	50.0		
September 23rd			.953 [a]	.059 [a]
Disaffected	24.5	16.0		
Slightly Engaged	38.7	40.0		
Engaged	36.8	44.0		
September 30th			6.612 [a]	.156 [a]
Disaffected	16.5	33.3		
Slightly Engaged	31.2	20.8		
Engaged	52.3	45.8		
October 21st			9.852 [b]	.208 [b]
Disaffected	28.9	5.0		
Slightly Engaged	28.9	35.0		
Engaged	42.2	60.0		
October 30th			2.022 [a]	.092 [a]
Disaffected	17.3	16.7		
Slightly Engaged	34.7	27.8		
Engaged	48.0	55.6		
November 13th			4.205 [a]	.142 [a]
Disaffected	23.5	13.6		
Slightly Engaged	40.7	31.8		
Engaged	35.8	54.5		

Table continued on next page

Table 4.21 (continued) Relationships between students' self-reported levels of engagement and class rank on traditional instruction

Level of Engagement	Class Rank		Chi-Square	Cramer's V
	Freshmen (%)	Upperclassmen (%)		
December 2nd			3.379 [a]	.126 [a]
Disaffected	20.0	15.8		
Slightly Engaged	40.0	36.8		
Engaged	40.0	47.4		
December 4th			4.191 [a]	.147 [a]
Disaffected	18.2	22.2		
Slightly Engaged	29.9	11.1		
Engaged	5139	66.7		

[a,b] sessions with different superscripts are significantly different (P < .05)

Table 4.22 Davis' rank of relationship between engagement levels and academic class for traditional instruction

Class Session	Chi-Square	Cramer's V	Davis' Rank
September 2nd	2.231	.126	low to moderate
September 4th	1.579	.110	low to moderate
September 6th	2.134	.124	low to moderate
September 18th	2.923	.106	low to moderate
September 23rd	.953	.059	trivial
September 30th	6.612	.156	low to moderate
October 21st	9.852*	.208*	low to moderate
October 30th	2.022	.092	trivial
November 13th	4.205	.142	low to moderate
December 2nd	3.379	.126	low to moderate
December 4th	4.191	.147	low to moderate

[a,b] sessions with different superscripts are significantly different (P < .05)

No statistical differences were found between freshmen and upperclassmen for technology-enhanced instruction (Table 4.23 and Table 4.24). Table 4.25 shows two class meetings, September 9th (Chi-square = 11.410 and Cramer's V = .285) and October 23rd (Chi-square = 8.143 and Cramer's V = .180), respectively, that had a low significant relationship (P<.05) between class rank and reported level of engagement. All relationships (Table 4.26) were qualified as either trivial or low to moderate by Davis' (1971) rank, suggesting that class rank is not a reliable predictor of engagement for technology-enhanced instruction.

Table 4.23 Descriptive statistics for technology-enhanced instruction by class rank

Class Session	Gender	N	Mean	Std. Deviation	Std. Error Mean
September 9th	Freshman	111	4.14	.893	.085
	Above Freshman Level	24	4.38	.970	.198
September 16th	Freshman	108	3.58	.887	.085
	Above Freshman Level	25	3.76	.723	.145
September 20th	Freshman	100	3.70	.969	.097
	Above Freshman Level	23	4.00	.798	.166
October 11th a	Freshman	88	3.59	1.035	.110
	Above Freshman Level	20	3.85	1.040	.233
October 11th b	Freshman	73	3.78	1.121	.131
	Above Freshman Level	20	4.20	.768	.172
October 21st	Freshman	89	3.33	1.053	.112
	Above Freshman Level	20	3.65	.745	.167
October 23rd	Freshman	98	3.80	.941	.095
	Above Freshman Level	24	4.08	.654	.133
October 30th	Freshman	97	3.32	1.066	.108
	Above Freshman Level	18	3.33	.907	.214
November 1st	Freshman	74	3.81	.902	.105
	Above Freshman Level	15	3.87	1.125	.291
November 6th	Freshman	94	3.57	.945	.097
	Above Freshman Level	22	3.82	1.097	.234
November 11th	Freshman	80	3.56	.898	.100
	Above Freshman Level	16	4.00	.966	.242
November 15th a	Freshman	80	3.09	1.046	.117
	Above Freshman Level	11	3.00	1.000	.302

Table continued on next page

Table 4.23 (continued) Descriptive statistics for technology-enhanced instruction by class rank

Class Session	Gender	N	Mean	Std. Deviation	Std. Error Mean
November 15th b	Freshman	72	3.54	1.006	.119
	Above Freshman Level	10	3.50	.972	.307

Table 4.24 T-test for technology-enhanced instruction by class rank

	Levene's Test for Equality of Variances		t-test for Equality of Means				
Class Session	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
September 9th	.001	.971	-1.131	133	.260	-.231	.204
September 16th	2.262	.135	-.926	131	.356	-.177	.191
September 20th	3.695	.057	-1.380	121	.170	-.300	.217
October 11th a	.541	.464	-1.009	106	.315	-.259	.257
October 11th b	2.112	.150	-1.571	91	.120	-.419	.267
October 21st	3.977	.049	-1.303	107	.195	-.324	.249
October 23rd	6.470	.012	-1.413	120	.160	-.287	.203
October 30th	.853	.358	-.051	113	.959	-.014	.268
November 1st	.078	.781	-.210	87	.835	-.056	.267
November 6th	.706	.402	-1.056	114	.293	-.244	.231
November 11th	1.853	.177	-1.757	94	.082	-.438	.249
November 15th a	.161	.689	.261	89	.794	.087	.335
November 15th b	.026	.873	.123	80	.902	.042	.338

Table 4.25 Relationships between students' self-reported levels of engagement and class rank on technology-enhanced instruction

	Class Rank			
Level of Engagement	Freshmen (%)	Upperclassmen (%)	Chi-square	Cramer's V
September 9th			11.410 [a]	.285 [a]
Disaffected	5.4	4.2		
Slightly Engaged	17.1	8.3		
Engaged	77.5	87.5		
September 16th			4.622 [b]	.129 [b]
Disaffected	13.0	0.0		
Slightly Engaged	29.6	40.0		
Engaged	57.4	60.0		
September 20th			3.190 [b]	.112 [b]
Disaffected	10.0	4.3		
Slightly Engaged	27.0	17.4		
Engaged	63.0	78.3		
October 11th			1.667 [b]	.086 [b]
Disaffected	15.9	10.0		
Slightly Engaged	20.5	15.0		
Engaged	63.6	75.0		
October 11th			5.833 [b]	.173 [b]
Disaffected	13.7	0.0		
Slightly Engaged	17.8	20.0		
Engaged	68.5	80.0		
October 21st			5.012 [b]	.149 [b]
Disaffected	20.2	10.0		
Slightly Engaged	33.7	20.0		
Engaged	46.1	70.0		
October 23rd			8.143 [a]	.180 [a]
Disaffected	6.1	0.0		
Slightly Engaged	31.6	16.7		
Engaged	62.2	83.3		
October 30th			1.330 [b]	.075 [b]
Disaffected	20.6	16.7		
Slightly Engaged	33.0	27.8		
Engaged	46.4	55.6		
November 1st			2.881 [b]	.126 [b]
Disaffected	10.8	13.3		
Slightly Engaged	18.9	6.7		
Engaged	70.3	80.0		

Table continued on next page

Table 4.25 (continued) Relationships between students' self-reported levels of engagement and class rank on tech-enhanced instruction.

Level of Engagement	Class Rank		Chi-square	Cramer's V
	Freshmen (%)	Upperclassmen (%)		
November 6th			3.275 [b]	.117 [b]
Disaffected	11.7	18.2		
Slightly Engaged	29.8	13.6		
Engaged	58.5	68.2		
November 11th			3.804 [b]	.139 [b]
Disaffected	12.5	6.3		
Slightly Engaged	22.5	6.3		
Engaged	65.0	87.5		
November 15th			1.182 [b]	.080 [b]
Disaffected	27.5	27.3		
Slightly Engaged	36.3	36.4		
Engaged	36.3	36.4		
November 15th			3.377 [b]	.142 [b]
Disaffected	12.5	20.0		
Slightly Engaged	33.3	20.0		
Engaged	54.2	60.0		

[a,b] sessions with different superscripts are significantly different (P < .05)

Table 4.26 Davis' rank of relationship between engagement levels and academic class for technology-enhanced instruction

Date	Chi-square	Cramer's V	Davis' Rank
September 9th	11.410 [a]	.285 [a]	low to moderate
September 16th	4.622 [b]	.129 [b]	low to moderate
September 20th	3.190 [b]	.112 [b]	low to moderate
October 11th	1.667 [b]	.086 [b]	trivial
October 11th	5.833 [b]	.173 [b]	low to moderate
October 21st	5.012 [b]	.149 [b]	low to moderate
October 23rd	8.143 [a]	.180 [a]	low to moderate
October 30th	1.330 [b]	.075 [b]	trivial
November 1st	2.881 [b]	.126 [b]	low to moderate
November 6th	3.275 [b]	.117 [b]	low to moderate
November 11th	3.804 [b]	.139 [b]	low to moderate
November 15th	1.182 [b]	.080 [b]	trivial
November 15th	3.377 [b]	.142 [b]	low to moderate

[a,b] sessions with different superscripts are significantly different (P < .05)

Statistical differences (P< .05) were found between freshmen and upperclassmen for Web-enhanced instruction in two occurrences (Tables 4.27 and Table 4.28). The class meetings on September 20th and November 11th both showed statistically significant differences between calculated means. The September 20th class meeting mean of freshmen engagement was M=3.16 versus M=3.8 for upperclassmen and November 11th freshmen reported a mean of M=3.44 and upperclassmen reported a mean of M=3.94. Table 4.25 shows two class meetings, September 9th (Chi-square = 11.410 and Cramer's V = .285) and October 23rd (Chi-square = 8.143 and Cramer's V = .180), respectively, that had a significant relationship ($P < .05$) between class rank and reported level of engagement. All relationships (Table 4.26) were qualified as either trivial or low to moderate by Davis' (1971) rank, suggesting that class rank is not a reliable predictor of engagement for Web-enhanced instruction.

Table 4.27 Descriptive statistics for web-enhanced instruction by academic class

Class Session	Academic Class	N	Mean	Std. Deviation	Std. Error Mean
August 30th a [a]	Freshman	107	3.58	1.037	.100
	Above Freshman Level	22	3.64	1.217	.259
August 30th b [a]	Freshman	108	4.00	.986	.095
	Above Freshman Level	22	4.27	.883	.188
September 9th [a]	Freshman	113	3.72	.871	.082
	Above Freshman Level	24	3.79	.932	.190
September 20th [b]	Freshman	101	3.16	.997	.099
	Above Freshman Level	22	3.82	.795	.169
September 30th [a]	Freshman	107	3.47	.984	.095
	Above Freshman Level	22	3.50	1.058	.226
October 7th [a]	Freshman	104	3.52	1.024	.100
	Above Freshman Level	20	3.60	.754	.169
October14th [a]	Freshman	93	3.13	1.024	.106
	Above Freshman Level	24	3.46	.884	.180
October28th [a]	Freshman	88	3.06	1.032	.110
	Above Freshman Level	23	3.13	1.014	.211
November 11th [b]	Freshman	87	3.44	.985	.106
	Above Freshman Level	17	3.94	.556	.135

[a,b] sessions with different superscripts are significantly different ($P < .05$)

Table 4.28 T-test for web-enhanced instruction by academic class

	Levene's Test for Equality of Variances		t-test for Equality of Means				
Class Session	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
August 30th a	.484	.488	-.227	127	.820	-.057	.250
August 30th b	.071	.790	-1.202	128	.231	-.273	.227
September 9th	.201	.655	-.378	135	.706	-.075	.198
September 20th	1.399	.239	-2.905	121	.004	-.660	.227
September 30th	.057	.812	-.140	127	.889	-.033	.233
October 7th	2.594	.110	-.335	122	.738	-.081	.241
October 14th	.054	.816	-1.442	115	.152	-.329	.228
October 28th	.013	.909	-.306	109	.760	-.074	.241
November 11th	12.638	.001	-2.044	102	.044	-.504	.247

Table 4.29 Relationships between students' self-reported levels of engagement and class rank on web-enhanced instruction

	Class rank			
Level of Engagement	Freshmen (%)	Upperclassmen (%)	Chi-square	Cramer's V
August 30th			2.776	.103
Disaffected	16.8	13.6		
Slightly Engaged	27.1	27.3		
Engaged	56.1	59.1		
August 30th			3.276	.111
Disaffected	10.2	4.5		
Slightly Engaged	12.0	13.6		
Engaged	77.8	81.8		
September 9th			.772	.052
Disaffected	8.0	8.3		
Slightly Engaged	29.2	29.2		
Engaged	62.8	62.5		
September 20th			9.198	.198
Disaffected	23.8	4.5		
Slightly Engaged	40.6	27.3		
Engaged	35.6	68.2		
September 30th			2.273	.093
Disaffected	15.0	13.6		
Slightly Engaged	38.3	36.4		
Engaged	46.7	50.0		
October 7th			9.104	.189
Disaffected	17.3	0.0		
Slightly Engaged	26.9	55.0		
Engaged	55.8	45.0		
October 14th			6.149	.159
Disaffected	25.8	12.5		
Slightly Engaged	43.0	41.7		
Engaged	31.2	45.8		
October 28th			1.189	.073
Disaffected	27.3	26.1		
Slightly Engaged	42.0	39.1		
Engaged	30.7	34.8		
November 11th			7.361	.185
Disaffected	16.1	0.0		
Slightly Engaged	33.3	17.6		
Engaged	50.6	82.4		

Table 4.30 Davis' rank of relationship between engagement levels and academic class for web-enhanced instruction

Date	Chi-square	Cramer's V	Davis' Rank
August 30th	2.776	.103	low to moderate
August 30th	3.276	.111	low to moderate
September 9th	.772	.052	trivial
September 20th	9.198	.198	low to moderate
September 30th	2.273	.093	trivial
October 7th	9.104	.189	low to moderate
October 14th	6.149	.159	low to moderate
October 28th	1.189	.073	trivial
November 11th	7.361	.185	low to moderate

Mean scores for class rank were statistically significant (P < .05) between final grade with freshmen (M = 84.05) and upperclassmen (M = 81.07) (Table 4.31)

Table 4.31 Grand means of final grade by class rank

Academic class rank	Final Grade
Freshmen	84.05[a]
Upperclassmen	81.07[b]

[a,b] means with different superscripts are significantly different (P < .05)

DISCUSSION – FINAL GRADES

Final grades were also analyzed to determine if they were valid predictors of engagement. The students accumulated academic credit for activities throughout the course of the semester by completing daily quizzes, 3 one-hour exams and a cumulative final. Grades were normally distributed and the class average was an M = 83.4. Data were recoded into A, B, C, D and F for purposes of data analyses.

Data were described using descriptive statistics (Table 4.32). An analysis of variance was performed to attempt to describe differences among student final grades when considering student's self reported levels of engagement. The data were evaluated using crosstabs and Chi-square, Cramer's V and significance levels were reported. Data were also classified by Davis' (1971) rank of liner relationship.

For traditional instruction, no reliable relationships were reported as a result of final grade. Cramer's V values were all classified as low to moderate with the exception of one class period, September 18th with a Chi-square value of 13.948 and a Cramer's V value of .329, categorically placing it into the moderate to substantial category (Davis, 1971). As a group the collective rankings suggest that predicting engagement in traditional lecture by final grade (and predicting final grade by engagement responses) is not an appropriate model.

Table 4.32 Descriptive statistics for engagement by final grade for traditional instruction

Class Session		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
September 2nd	A	38	3.26	1.005	.163	1	5
	B	73	3.58	1.040	.122	1	5
	C	23	3.57	1.161	.242	1	5
	D	3	3.33	.577	.333	3	4
	F	1	4.00	.	.	4	4
	Total	138	3.49	1.041	.089	1	5
September 4th	A	37	3.38	.893	.147	1	5
	B	69	3.58	.976	.118	1	5
	C	19	3.11	1.243	.285	1	5
	D	1	2.00	.	.	2	2
	F	0	.	.	.	.	.
	Total	126	3.44	1.008	.090	1	5
September 6th	A	41	3.73	.923	.144	1	5
	B	72	3.92	.801	.094	2	5
	C	20	3.65	.875	.196	2	5
	D	1	4.00	.	.	4	4
	F	1	4.00	.	.	4	4
	Total	135	3.82	.845	.073	1	5

Table continued on next page

Table 4.32 (continued) Descriptive statistics for engagement by final grade for traditional instruction

Class Session		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
September 18th [a]	A	39	3.21	1.031	.165	1	5
	B	69	3.38	.972	.117	1	5
	C	18	2.78	1.166	.275	1	5
	D	2	1.50	.707	.500	1	2
	F	1	3.00	.	.	3	3
	Total	129	3.21	1.043	.092	1	5
September 23rd [b]	A	39	3.28	1.075	.172	1	5
	B	70	3.31	1.097	.131	1	5
	C	22	3.05	1.046	.223	1	5
	D	1	1.00	.	.	1	1
	F	1	4.00	.	.	4	4
	Total	133	3.25	1.090	.095	1	5
September 30th [b]	A	42	3.52	.943	.146	2	5
	B	68	3.38	1.120	.136	1	5
	C	21	3.52	1.123	.245	1	5
	D	2	3.00	.000	.000	3	3
	F	1	3.00	.	.	3	3
	Total	134	3.44	1.051	.091	1	5
October 21st [b]	A	37	3.24	1.116	.183	1	5
	B	57	3.32	1.121	.148	1	5
	C	16	3.06	.998	.249	2	5
	D	1	4.00	.	.	4	4
	F	1	3.00	.	.	3	3
	Total	112	3.26	1.088	.103	1	5
October 30th [b]	A	41	3.49	.978	.153	1	5
	B	58	3.29	1.043	.137	1	5
	C	19	3.58	1.216	.279	1	5
	D	0	.	.	.	.	.
	F	0	.	.	.	.	.
	Total	118	3.41	1.048	.096	1	5
November 13th [b]	A	35	3.09	1.040	.176	1	5
	B	58	3.29	1.108	.146	1	5
	C	11	2.73	.905	.273	1	4
	D	1	4.00	.	.	4	4
	F	0	.	.	.	.	.
	Total	105	3.17	1.069	.104	1	5

Table continued on next page

Table 4.32 (continued) Descriptive statistics for engagement by final grade for traditional instruction

Class Session		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
December 2nd [b]	A	37	3.43	.959	.158	1	5
	B	59	3.27	1.064	.139	1	5
	C	9	2.89	.928	.309	2	4
	D	1	3.00	.	.	3	3
	F	0	.	.	.	.	.
	Total	106	3.29	1.014	.098	1	5
December 4th [b]	A	34	3.47	.992	.170	1	5
	B	51	3.47	1.155	.162	1	5
	C	12	3.58	1.084	.313	2	5
	D	0	.	.	.	.	.
	F	0	.	.	.	.	.
	Total	97	3.48	1.081	.110	1	5

[a,b] different superscripts denotes significance at $P < .05$ level

Table 4.33 Test of homogeneity of variances for engagement for traditional instruction by final grade

Class Session	Levene Statistic	df1	df2	Sig.
September 2nd	.863	3	133	.462
September 4th	2.247	2	122	.110
September 6th	.809	2	130	.447
September 18th	.496	3	124	.686
September 23rd	.829	2	128	.439
September 30th	2.090	3	129	.105
October 21st	.283	2	107	.754
October 30th	.922	2	115	.400
November 13th	.831	2	101	.439
December 2nd	.086	2	102	.918
December 4th	.700	2	94	.499

Table 4.34 Analysis of variance (ANOVA) between level of engagement in traditional instruction and final grade

		Sum of Squares	df	Mean Square	F	Sig.
September 2nd [a]	Between Groups	2.948	4	.737	.674	.611
	Within Groups	145.523	133	1.094		
	Total	148.471	137			
September 4th [a]	Between Groups	5.688	3	1.896	1.907	.132
	Within Groups	121.304	122	.994		
	Total	126.992	125			
September 6th [a]	Between Groups	1.635	4	.409	.565	.689
	Within Groups	94.099	130	.724		
	Total	95.733	134			
September 18th [b]	Between Groups	11.176	4	2.794	2.703	.034
	Within Groups	128.173	124	1.034		
	Total	139.349	128			
September 23rd [a]	Between Groups	6.874	4	1.719	1.467	.216
	Within Groups	149.938	128	1.171		
	Total	156.812	132			
September 30th [a]	Between Groups	1.249	4	.312	.276	.893
	Within Groups	145.773	129	1.130		
	Total	147.022	133			
October 21st [a]	Between Groups	1.427	4	.357	.293	.882
	Within Groups	130.064	107	1.216		
	Total	131.491	111			

Table continued on next page

Table 4.34 (continued) Analysis of variance (ANOVA) between level of engagement in traditional instruction and final grade

		Sum of Squares	df	Mean Square	F	Sig.
October 30th [a]	Between Groups	1.582	2	.791	.717	.490
	Within Groups	126.893	115	1.103		
	Total	128.475	117			
November 13th [a]	Between Groups	3.972	3	1.324	1.164	.328
	Within Groups	114.942	101	1.138		
	Total	118.914	104			
December 2nd [a]	Between Groups	2.303	3	.768	.741	.530
	Within Groups	105.631	102	1.036		
	Total	107.934	105			
December 4th [a]	Between Groups	.134	2	.067	.056	.946
	Within Groups	112.093	94	1.192		
	Total	112.227	96			

[a,b] sessions with different superscripts are significantly different ($P < .05$)

Table 4.35 Relationships between students' self-reported levels of engagement and knowledge assessments on traditional instruction

Level of Engagement	Knowledge Assessment A (%)	B (%)	C (%)	D (%)	Chi-square	Cramer's V
September 2nd					9.071	.181
Disaffected	21.1	13.7	21.7	0.0		
Slightly Engaged	42.1	30.1	17.4	66.7		
Engaged	36.8	56.2	60.9	33.3		
September 4th					11.485	.213
Disaffected	16.2	13.0	36.8	100.0		
Slightly Engaged	32.4	24.6	15.8	0.0		
Engaged	51.4	62.3	47.4	0.0		
September 6th					3.202	.109
Disaffected	9.8	4.2	10.0	0.0		
Slightly Engaged	22.0	23.6	30.0	0.0		
Engaged	68.3	72.2	60.0	100.0		
September 18th					13.948	.329
Disaffected	23.1	15.9	38.9	100.0		
Slightly Engaged	30.8	40.6	33.3	0.0		
Engaged	46.2	43.5	27.8	0.0		
September 23rd					7.132	.164
Disaffected	23.1	21.4	22.7	100.0		
Slightly Engaged	41.0	35.7	50.0	0.0		
Engaged	35.9	42.9	27.3	0.0		
September 30th					12.032	.212
Disaffected	16.7	20.6	23.8	0.0		
Slightly Engaged	28.6	32.4	9.5	100.0		
Engaged	54.8	47.1	66.7	0.0		
October 21st					7.209	.179
Disaffected	18.9	24.6	37.5	0.0		
Slightly Engaged	37.8	24.6	25.0	0.0		
Engaged	43.2	50.9	37.5	100.0		
October 30th					3.023	.113
Disaffected	12.2	20.7	21.1			
Slightly Engaged	34.1	36.2	21.1			
Engaged	53.7	43.1	57.9			

Table continued on next page

Table 4.35 (continued) Relationships between students' self-reported levels of engagement and knowledge assessments on traditional instruction

Level of Engagement	Knowledge Assessment A (%)	B (%)	C (%)	D (%)	Chi-square	Cramer's V
November 13th					5.987	.169
Disaffected	20.0	20.7	36.4	0.0		
Slightly Engaged	45.7	32.8	45.5	0.0		
Engaged	34.3	46.6	18.2	100.0		
December 2nd					6.360	.173
Disaffected	13.5	18.6	44.4	0.0		
Slightly Engaged	40.5	42.4	22.2	100.0		
Engaged	45.9	39.0	33.3	0.0		
December 4th					3.859	.141
Disaffected	14.7	21.6	25.0			
Slightly Engaged	35.3	23.5	8.3			
Engaged	50.0	54.9	66.7			

Table 4.36 Davis' rank of relationship between engagement levels and final grade for traditional instruction

Class Session	Chi-square	Cramer's V	Davis' Rank
September 2nd	9.071	.181	low to moderate
September 4th	11.485	.213	low to moderate
September 6th	3.202	.109	low to moderate
September 18th	13.948	.329	moderate to substantial
September 23rd	7.132	.164	low to moderate
September 30th	12.032	.212	low to moderate
October 21st	7.209	.179	low to moderate
October 30th	3.023	.113	low to moderate
November 13th	5.987	.169	low to moderate
December 2nd	6.360	.173	low to moderate
December 4th	3.859	.141	low to moderate

For technology-enhanced instruction, no significant relationships were found between final grade categories. Cramer's V values were all classified as low to moderate with the exception of one class period, September 9th with a Chi-square value of 29.910 and a Cramer's V value of .330, categorically placing it into the moderate to substantial category (Davis, 1971). As a group the collective rankings suggest that predicting engagement in technology-enhanced lecture by final grade (and predicting final grade by engagement responses) is not an appropriate model.

Table 4.37 Grand mean and descriptive statistics of engagement in technology-enhanced instruction by final grade

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
A	42	3.6776	.63596	.09813	3.4795	3.8758	1.67	4.92
B	82	3.7400	.68496	.07564	3.5895	3.8905	2.00	5.00
C	25	3.5473	.60368	.12074	3.2981	3.7965	2.38	5.00
D	3	3.4952	.62684	.36190	1.9381	5.0524	3.00	4.20
F	1	4.0000	.	.	.	.	4.00	4.00
Total	153	3.6883	.65417	.05289	3.5838	3.7928	1.67	5.00

Table 4.38 Analysis of variance (ANOVA) of engagement in technology-enhanced instruction by final grade

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.930	4	.232	.537	.709
Within Groups	64.117	148	.433		
Total	65.047	152			

Table 4.39 Descriptive statistics for engagement by final grade for technology-enhanced instruction

Class Session		N	Mean	Std. Deviation	Std. Error	Min	Max
September 9th	A	39	2.72	.560	.090	1	3
	B	71	2.76	.520	.062	1	3
	C	24	2.71	.624	.127	1	3
	D	2	1.00	.000	.000	1	1
	F	1	3.00	.	.	3	3
	Total	137	2.72	.581	.050	1	3
September 16th	A	41	2.56	.634	.099	1	3
	B	72	2.49	.671	.079	1	3
	C	20	2.25	.786	.176	1	3
	D	2	1.50	.707	.500	1	2
	F	1	3.00	.	.	3	3
	Total	136	2.46	.688	.059	1	3
September 20th	A	39	2.62	.633	.101	1	3
	B	67	2.55	.681	.083	1	3
	C	18	2.56	.616	.145	1	3
	D	1	2.00	.	.	2	2
	F	0	.	.	.	.	.
	Total	125	2.57	.652	.058	1	3
October11th a	A	35	2.60	.695	.117	1	3
	B	56	2.46	.785	.105	1	3
	C	18	2.50	.707	.167	1	3
	D	2	2.50	.707	.500	2	3
	F	0	.	.	.	.	.
	Total	111	2.51	.737	.070	1	3
October11th b	A	30	2.60	.724	.132	1	3
	B	52	2.60	.664	.092	1	3
	C	13	2.62	.650	.180	1	3
	D	1	2.00	.	.	2	2
	F	0	.	.	.	.	.
	Total	96	2.59	.674	.069	1	3
October 21st	A	37	2.30	.777	.128	1	3
	B	56	2.36	.819	.109	1	3
	C	16	2.25	.577	.144	1	3
	D	1	3.00	.	.	3	3
	F	1	3.00	.	.	3	3
	Total	111	2.33	.767	.073	1	3

Table continued on next page

Table 4.39 (continued) Descriptive statistics for engagement by final grade for technology-enhanced instruction

Class Session		N	Mean	Std. Deviation	Std. Error	Min	Max
October 23rd	A	39	2.69	.521	.083	1	3
	B	69	2.57	.630	.076	1	3
	C	15	2.53	.640	.165	1	3
	D	1	3.00	.	.	3	3
	F	0	.	.	.	.	.
	Total	124	2.60	.596	.053	1	3
October 30th	A	41	2.39	.771	.120	1	3
	B	57	2.19	.766	.101	1	3
	C	19	2.32	.820	.188	1	3
	D	0	.	.	.	.	.
	F	0	.	.	.	.	.
	Total	117	2.28	.775	.072	1	3
November 1st	A	36	2.75	.604	.101	1	3
	B	40	2.50	.716	.113	1	3
	C	14	2.50	.760	.203	1	3
	D	1	3.00	.	.	3	3
	F	0	.	.	.	.	.
	Total	91	2.60	.681	.071	1	3
November 6th	A	37	2.46	.803	.132	1	3
	B	62	2.47	.695	.088	1	3
	C	18	2.50	.618	.146	1	3
	D	2	3.00	.000	.000	3	3
	F	0	.	.	.	.	.
	Total	119	2.48	.711	.065	1	3
November 11th	A	33	2.55	.754	.131	1	3
	B	51	2.65	.559	.078	1	3
	C	14	2.36	.929	.248	1	3
	D	1	3.00	.	.	3	3
	F	0	.	.	.	.	.
	Total	99	2.58	.686	.069	1	3

Table continued on next page

Table 4.39 (continued) Descriptive statistics for engagement by final grade for technology-enhanced instruction

Class Session		N	Mean	Std. Deviation	Std. Error	Min	Max
November 15th a	A	36	2.14	.867	.144	1	3
	B	43	2.09	.750	.114	1	3
	C	13	1.85	.801	.222	1	3
	D	1	3.00	.	.	3	3
	F	0	.	.	.	.	.
	Total	93	2.09	.803	.083	1	3
November 15th b	A	30	2.57	.626	.114	1	3
	B	40	2.40	.744	.118	1	3
	C	14	2.07	.829	.221	1	3
	D	0	.	.	.	.	.
	F	0	.	.	.	.	.
	Total	84	2.40	.730	.080	1	3

Table 4.40 Test of homogeneity of variances for engagement for technology-enhanced instruction by final grade

Class Session	Levene Statistic	df1	df2	Sig.
September 9th	1.223	3	132	.304
September 16th	.746	3	131	.527
September 20th	.406	2	121	.667
October11th a	.885	3	107	.452
October11th b	.108	2	92	.897
October 21st	3.724	2	106	.027
October 23rd	2.184	2	120	.117
October 30th	.273	2	114	.762
November 1st	3.396	2	87	.038
November 6th	3.562	3	115	.016
November 11th	6.528	2	95	.002
November 15th a	1.675	2	89	.193
November 15th b	1.056	2	81	.353

Table 4.41 Analysis of variance (ANOVA) between level of engagement in technology-enhanced instruction and final grade

Class Session		SS	df	MS	F	Sig.
September 9th	Between Groups	6.112	4	1.528	5.070	.001
	Within Groups	39.785	132	.301		
	Total	45.898	136			
September 16th	Between Groups	3.483	4	.871	1.890	.116
	Within Groups	60.334	131	.461		
	Total	63.816	135			
September 20th	Between Groups	.430	3	.143	.332	.802
	Within Groups	52.242	121	.432		
	Total	52.672	124			
October11th a	Between Groups	.401	3	.134	.241	.867
	Within Groups	59.329	107	.554		
	Total	59.730	110			
October11th b	Between Groups	.360	3	.120	.258	.855
	Within Groups	42.796	92	.465		
	Total	43.156	95			
October 21st	Between Groups	1.080	4	.270	.450	.772
	Within Groups	63.587	106	.600		
	Total	64.667	110			
October 23rd	Between Groups	.640	3	.213	.595	.619
	Within Groups	42.998	120	.358		
	Total	43.637	123			

Table continued on next page

Table 4.41 (continued) Analysis of variance (ANOVA) between level of engagement in technology-enhanced instruction and final grade

Class Session		SS	df	MS	F	Sig.
October 30th	Between Groups	.954	2	.477	.791	.456
	Within Groups	68.739	114	.603		
	Total	69.692	116			
November 1st	Between Groups	1.508	3	.503	1.087	.359
	Within Groups	40.250	87	.463		
	Total	41.758	90			
November 6th	Between Groups	.573	3	.191	.371	.774
	Within Groups	59.125	115	.514		
	Total	59.697	118			
November 11th	Between Groups	1.139	3	.380	.801	.497
	Within Groups	45.043	95	.474		
	Total	46.182	98			
November 15th a	Between Groups	1.686	3	.562	.868	.461
	Within Groups	57.626	89	.647		
	Total	59.312	92			
November 15th b	Between Groups	2.343	2	1.171	2.265	.110
	Within Groups	41.895	81	.517		
	Total	44.238	83			

Table 4.42 Relationships between students' self-reported levels of engagement and final grade on technology-enhanced instruction

	Final Grade						
Level of Engagement	A (%)	B (%)	C (%)	D (%)	F (%)	Chi-square	Cramer's V
September 9th						29.910 [a]	.330 [a]
Disaffected	5.1	4.2	8.3	100.0			
Slightly Engaged	17.9	15.5	12.5	0.0			
Engaged	76.9	80.3	79.2	0.0			
September 16th						7.895 [b]	.170 [b]
Disaffected	7.3	9.7	20.0	50.0	0.0		
Slightly Engaged	29.3	31.9	35.0	50.0	0.0		
Engaged	63.4	58.3	45.0	0.0	100.0		
September 20th						4.111 [b]	.128 [b]
Disaffected	7.7	10.4	5.6	0.0			
Slightly Engaged	23.1	23.9	33.3	100.0			
Engaged	69.2	65.7	61.1	0.0			
October 11th						3.155 [b]	.119 [b]
Disaffected	11.4	17.9	11.1	0.0			
Slightly Engaged	17.1	17.9	27.8	50.0			
Engaged	71.4	64.3	61.1	50.0			
October 11th						5.231 [b]	.165 [b]
Disaffected	13.3	9.6	7.7	0.0			
Slightly Engaged	13.3	21.2	23.1	100.0			
Engaged	73.3	69.2	69.2	0.0			
October 21st						12.073 [b]	.233 [b]
Disaffected	18.9	21.4	6.3	0.0	0.0		
Slightly Engaged	32.4	21.4	62.5	0.0	0.0		
Engaged	48.6	57.1	31.3	100.0	100.0		
October 23rd						2.087 [b]	.092 [b]
Disaffected	2.6	7.2	6.7	0.0			
Slightly Engaged	25.6	29.0	33.3	0.0			
Engaged	71.8	63.8	60.0	100.0			
October 30th						2.840 [b]	.110 [b]
Disaffected	17.1	21.1	21.1				
Slightly Engaged	26.8	38.6	26.3				
Engaged	56.1	40.4	52.6				
November 1st						5.234 [b]	.170 [b]
Disaffected	8.3	12.5	14.3	0.0			
Slightly Engaged	8.3	25.0	21.4	0.0			
Engaged	83.3	62.5	64.3	100.0			

Table continued on next page

Table 4.42 (continued) Relationships between students' self-reported levels of engagement and final grade on tech-enhanced instruction

Level of Engagement	Final Grade A (%)	B (%)	C (%)	D (%)	F (%)	Chi-square	Cramer's V
November 6th						6.377 [b]	.164 [b]
Disaffected	18.9	11.3	5.6	0.0			
Slightly Engaged	16.2	30.6	38.9	0.0			
Engaged	64.9	58.1	55.6	100.0			
November 11th						10.124 [b]	.226 [b]
Disaffected	15.2	3.9	28.6	0.0			
Slightly Engaged	15.2	27.5	7.1	0.0			
Engaged	69.7	68.6	64.3	100.0			
November 15th						6.187 [b]	.182 [b]
Disaffected	30.6	23.3	38.5	0.0			
Slightly Engaged	25.0	44.2	38.5	0.0			
Engaged	44.4	32.6	23.1	100.0			
November 15th						4.687 [b]	.167 [b]
Disaffected	6.7	15.0	28.6				
Slightly Engaged	30.0	30.0	35.7				
Engaged	63.3	55.0	35.7				

[a,b] sessions with different superscripts are significantly different ($P < .05$)

Table 4.43 Davis' rank of relationship between engagement levels and final grade for technology-enhanced instruction

Date	Chi-square	Cramer's V	Davis' Rank
September 9th	29.910 [a]	.330 [a]	moderate to substantial
September 16th	7.895 [b]	.170 [b]	low to moderate
September 20th	4.111 [b]	.128 [b]	low to moderate
October 11th	3.155 [b]	.119 [b]	low to moderate
October 11th	5.231 [b]	.165 [b]	low to moderate
October 21st	12.073 [b]	.233 [b]	low to moderate
October 23rd	2.087 [b]	.092 [b]	trivial
October 30th	2.840 [b]	.110 [b]	low to moderate
November 1st	5.234 [b]	.170 [b]	low to moderate
November 6th	6.377 [b]	.164 [b]	low to moderate
November 11th	10.124 [b]	.226 [b]	low to moderate
November 15th	6.187 [b]	.182 [b]	low to moderate
November 15th	4.687 [b]	.167 [b]	low to moderate

[a,b] sessions with different superscripts are significantly different ($P < .05$)

For Web-enhanced instruction, no relationships were found as a between final grade categories. Cramer's V values were all classified as low to moderate (Cramer's V value < .29) (Davis, 1971). As a group the collective rankings suggest that predicting engagement in Web-enhanced lecture by final grade (and predicting final grade by engagement responses) is not an appropriate model. There were times when individual lecture periods suggested a level of relationship higher than simply a Davis (1971) level of trivial or a chance. Further investigation is warranted to determine the factors associated with those particular instances.

Table 4.44 Grand mean and descriptive statistics of engagement (1-5 scale) in web-enhanced instruction by final grade

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
A	42	3.5074	.60481	.09332	3.3190	3.6959	1.75	5.00
B	82	3.5664	.63201	.06979	3.4275	3.7052	2.20	5.00
C	25	3.2501	.55258	.11052	3.0220	3.4782	1.67	4.67
D	3	3.9944	.51649	.29819	2.7114	5.2775	3.40	4.33
F	1	3.3333	.	.	.	.	3.33	3.33
Total	153	3.5054	.61716	.04989	3.4068	3.6039	1.67	5.00

Table 4.45 Analysis of variance (ANOVA) of engagement in web-enhanced instruction by final grade

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.682	4	.670	1.797	.132
Within Groups	55.214	148	.373		
Total	57.896	152			

Table 4.46 Descriptive statistics for engagement by final grade for web-enhanced instruction

Class Session		N	Mean	Std. Deviation	Std. Error	Min	Max
August 30th a	A	40	2.38	.774	.122	1	3
	B	67	2.43	.743	.091	1	3
	C	20	2.25	.786	.176	1	3
	D	2	3.00	.000	.000	3	3
	F	0	.	.	.	.	.
	Total	129	2.40	.754	.066	1	3
August 30th b	A	39	2.56	.718	.115	1	3
	B	70	2.76	.576	.069	1	3
	C	19	2.63	.684	.157	1	3
	D	3	3.00	.000	.000	3	3
	F	0	.	.	.	.	.
	Total	131	2.69	.633	.055	1	3
September 9th	A	40	2.58	.675	.107	1	3
	B	72	2.60	.620	.073	1	3
	C	24	2.33	.637	.130	1	3
	D	2	2.50	.707	.500	2	3
	F	1	3.00	.	.	3	3
	Total	139	2.55	.640	.054	1	3
September 20th	A	39	2.33	.701	.112	1	3
	B	67	2.22	.794	.097	1	3
	C	18	1.94	.725	.171	1	3
	D	1	2.00	.	.	2	2
	F	0	.	.	.	.	.
	Total	125	2.22	.758	.068	1	3
September 30th	A	41	2.32	.722	.113	1	3
	B	64	2.33	.714	.089	1	3
	C	22	2.36	.790	.168	1	3
	D	2	2.50	.707	.500	2	3
	F	1	2.00	.	.	2	2
	Total	130	2.33	.719	.063	1	3

Table continued on next page

Table 4.46 Descriptive statistics for engagement by final grade for web-enhanced instruction

Class Session		N	Mean	Std. Deviation	Std. Error	Min	Max
October 7th	A	41	2.49	.675	.105	1	3
	B	65	2.40	.787	.098	1	3
	C	19	2.21	.631	.145	1	3
	D	1	2.00	.	.	2	2
	F	0	.	.	.	.	.
	Total	126	2.40	.728	.065	1	3
October 14th	A	34	1.97	.758	.130	1	3
	B	65	2.18	.748	.093	1	3
	C	19	2.11	.809	.186	1	3
	D	0	.	.	.	.	.
	F	1	2.00	.	.	2	2
	Total	119	2.11	.757	.069	1	3
October 28th	A	40	2.15	.736	.116	1	3
	B	58	2.05	.759	.100	1	3
	C	14	1.71	.825	.221	1	3
	D	0	.	.	.	.	.
	F	0	.	.	.	.	.
	Total	112	2.04	.764	.072	1	3
November 11th	A	37	2.43	.765	.126	1	3
	B	54	2.44	.664	.090	1	3
	C	15	2.33	.816	.211	1	3
	D	1	3.00	.	.	3	3
	F	0	.	.	.	.	.
	Total	107	2.43	.715	.069	1	3

Table 4.47 Test of homogeneity of variances for engagement for technology-enhanced instruction by final grade

Class Session	Levene Statistic	df1	df2	Sig.
August 30th a	2.631	3	125	.053
August 30th b	3.812	3	127	.012
September 9th	.138[a]	3	134	.937
September 20th	1.630[b]	2	121	.200
September 30th	.343[c]	3	125	.794
October 7th	3.115[d]	2	122	.048
October 14th	.300[e]	2	115	.741
October 28th	.475	2	109	.623
November 11th	1.135[f]	2	103	.325

Table 4.48 Analysis of variance (ANOVA) between level of engagement in web-enhanced instruction and final grade

Class Session		Sum of Squares	df	Mean Square	F	Sig.
August 30th a	Between Groups	1.264	3	.421	.736	.532
	Within Groups	71.573	125	.573		
	Total	72.837	128			
August 30th b	Between Groups	1.286	3	.429	1.070	.364
	Within Groups	50.882	127	.401		
	Total	52.168	130			
September 9th	Between Groups	1.518	4	.380	.926	.451
	Within Groups	54.928	134	.410		
	Total	56.446	138			
September 20th	Between Groups	1.915	3	.638	1.115	.346
	Within Groups	69.253	121	.572		
	Total	71.168	124			
September 30th	Between Groups	.199	4	.050	.093	.984
	Within Groups	66.578	125	.533		
	Total	66.777	129			
October 7th	Between Groups	1.157	3	.386	.724	.540
	Within Groups	65.002	122	.533		
	Total	66.159	125			
October 14th	Between Groups	1.035	3	.345	.596	.619
	Within Groups	66.545	115	.579		
	Total	67.580	118			

Table continued on next page

Table 4.48 (continued) Analysis of variance (ANOVA) between level of engagement in web-enhanced instruction and final grade

Class Session		Sum of Squares	df	Mean Square	F	Sig.
October 28th	Between Groups	1.975	2	.987	1.714	.185
	Within Groups	62.802	109	.576		
	Total	64.777	111			
November 11th	Between Groups	.477	3	.159	.304	.822
	Within Groups	53.748	103	.522		
	Total	54.224	106			

Table 4.49 Relationships between students' self-reported levels of engagement and final grade on web-enhanced instruction

Level of Engagement	Knowledge Assessment A (%)	B (%)	C (%)	D (%)	Chi-square	Cramer's V
August 30th					2.747	.103
Disaffected	17.5	14.9	20.0	0.0		
Slightly Engaged	27.5	26.9	35.0	0.0		
Engaged	55.0	58.2	45.0	100.0		
August 30th					3.750	.120
Disaffected	12.8	7.1	10.5	0.0		
Slightly Engaged	17.9	10.0	15.8	0.0		
Engaged	69.2	82.9	73.7	100.0		
September 9th					7.747	.167
Disaffected	10.0	6.9	8.3	0.0		
Slightly Engaged	22.5	26.4	50.0	50.0		
Engaged	67.5	66.7	41.7	50.0		
September 20th					6.567	.162
Disaffected	12.8	22.4	27.8	0.0		
Slightly Engaged	41.0	32.8	50.0	100.0		
Engaged	46.2	44.8	22.2	0.0		
September 30th					3.159	.110
Disaffected	14.6	14.1	18.2	0.0		
Slightly Engaged	39.0	39.1	27.3	50.0		
Engaged	46.3	46.9	54.5	50.0		
October 7th					11.518	.214
Disaffected	9.8	18.5	10.5	0.0		
Slightly Engaged	31.7	23.1	57.9	100.0		
Engaged	58.5	58.5	31.6	0.0		
October 14th					3.411	.120
Disaffected	29.4	20.0	26.3	0.0		
Slightly Engaged	44.1	41.5	36.8	100.0		
Engaged	26.5	38.5	36.8	0.0		
October 28th					4.840	.147
Disaffected	20.0	25.9	50.0	26.8		
Slightly Engaged	45.0	43.1	28.6	42.0		
Engaged	35.0	31.0	21.4	31.3		
November 11th					3.629	.130
Disaffected	16.2	9.3	20.0	0.0		
Slightly Engaged	24.3	37.0	26.7	0.0		
Engaged	59.5	53.7	53.3	100.0		

Table 4.50 Davis' rank of relationship between engagement levels and final grade for web-enhanced instruction

Date	Chi-square	Cramer's V	Davis' Rank
August 30th	2.747	.103	low to moderate
August 30th	3.750	.120	low to moderate
September 9th	7.747	.167	low to moderate
September 20th	6.567	.162	low to moderate
September 30th	3.159	.110	low to moderate
October 7th	11.518	.214	low to moderate
October 14th	3.411	.120	low to moderate
October 28th	4.840	.147	low to moderate
November 11th	3.629	.130	low to moderate

IMPLICATIONS

Although no consistent and reliable relationships were identified as predictors of engagement and academic success, there is a body of research to suggest that gender can and does play a role in undergraduate education. This effect is seen both on the part of the teacher and the learner, and certain class meetings, suggest that there is a relationship between gender, academic class rank, academic success and engagement.

Further investigation with more sensitive data collection and analyses could assist with finding best-fits of teaching style and learning styles. This is based on the described demographics and more appropriate supplemental resources that could offer to bridge the gap for students not receiving information in the most useful form in the classroom. More work can be done to identify what factors are at work when there is a strong relationship between the investigated variables. Although there were no conclusive predictors, isolated incidents offer hope. More thorough investigation could describe what variables were manipulated to create the stronger relationships.

Further investigations need to be undertaken to more precisely describe the effect of known factors on the potential for learning and engagement. Factors such as time during the lecture, time of the week and time during the semester may play predictable roles both for females and males as well as freshmen and upperclassmen and could ultimately lead to strategic course design that maximizes opportunities and seeks to employ more novel teaching strategies during times that historically show the lowest engagement and learning. Given that no one teaching/learning style is universal, it also stands to reason that variety is an effective tool in the classroom to offer broader appeal. Not for the sake of entertainment but rather for the sake of creating a situation where meaningful learning occurs. Knowledge that is gained is useful to the learner, being able to employ this information for a variety of tasks, but most importantly being able to recall the information and apply it to a real-world situation.

CHAPTER FIVE

The relationship between student self-reported engagement and learning

INTRODUCTION

There are multiple ways to present educational material to an audience. With the advent of the printing press, telephone, television and the Internet, advances have been made in how information can be relayed to learners. The modern classroom offers unique opportunities to piece together various styles and tools to present information in ways appropriate not only to the subject matter but also the teachers and students. A question that remains to be answered is there an ideal delivery method, or is there simply a better method? Researchers have suggested that with a variety of teaching and learning styles (Kolb, 1984; Fleming, 1995, 2005) no one method would be an ideal fit for a learner and that the best approach may be one that is varied so as to appeal to a wider variety of preferences and tendencies (Chickering and Gamson, 1987).

PURPOSE AND OBJECTIVES

The purpose of this study is to examine the impact of various instructional delivery methods on student's self-reported levels of engagement and to determine any relationship between student engagement and knowledge gained. Specifically, the objectives of this study are to:

1. Describe students' self-reported levels of engagement for Web-related instruction, traditional instruction and technology-enhanced instruction.

2. Describe the relationship, if any, between AVS 150 students' self-reported levels of engagement and knowledge assessment scores.

RESULTS

Cumulative data (Table 5.1 and 5.2) suggests statistical differences ($P < .05$) between types teaching. Grand means (see table 5.1) report that Tech-enhanced (TE) has the highest level of self-reported engagement at M=3.70 (out of 5 point scale), followed by Web-enhanced (WEB) at M=3.52 and Traditional (TR) at M=3.41, respectively. Standard deviation values and variance terms suggest similarity between the variation of the collected responses.

Table 5.1 Grand Means For Self-Reported Engagement on a five point scale

Lecture Style	N	Minimum	Maximum	Grand Mean	Std Dev
Traditional	157	1.50	5.00	3.41 [a]	.65
Tech Enhanced	156	1.67	5.00	3.70 [b]	.65
Web	157	1.67	5.00	3.52 [c]	.62

[a,b,c] grand means with different superscripts denotes significance at $P < .05$ level

To describe differences between the types of content delivery an analysis of variance (Table 4.4) was used to compare the means of the individual lecture styles. The analysis showed a significant differences between traditional M=3.41, technology enhanced M=3.70 and web enhanced M=3.52, respectively, at a $P < .05$ level.

Table 5.2 Analysis of variance (ANOVA) between self-reported engagement for selected instructional delivery methods

Type of Instruction		SS	df	MS	F	sig
Traditional	Between Groups	65.532	152	.431	7.579	.030
	Within Groups	.228	4	.057		
	Total	65.759	156			
Tech Enhanced	Between Groups	66.051	151	.437	7.750	.028
	Within Groups	.226	4	.056		
	Total	66.276	155			
Web Enhanced	Between Groups	60.179	152	.396	6.081	.044
	Within Groups	.260	4	.065		
	Total	60.440	156			

An aggregate analysis of percentages of students qualifying as disaffected, slightly engaged or engaged based on their likelihood of answering a question correctly is given in Table 5.3.

Table 5.3 Aggregate engagement level (%) of students based on a correct answer

Percentage Level of Engagement	Traditional		Technology Enhanced		Web Enhanced	
	Correct (%)	Incorrect (%)	Correct (%)	Incorrect (%)	Correct (%)	Incorrect (%)
Disaffected	16.57	19.33	12.13	16.7	14.67	18.83
Slightly Engaged	30.4	30.74	25.1	27.64	29.69	35.18
Engaged	53.04	51.11	62.78	55.67	55.63	45.97

A Pearson's Chi Square analysis yielded a value of 5.930 ($P < .05$) for the September 9th Web-enhanced instruction delivery format (Table 5.4). Other Chi Square analyses of Web-enhanced instruction and self-reported engagement levels revealed no additional associations.

Table 5.4 Relationships between students' self-reported levels of engagement and knowledge assessments on traditional instruction.

	Knowledge Assessment			
Level of Engagement	Correct (%)	Incorrect (%)	Chi-Square	Cramer's V
September 2nd			2.872	.150
Disaffected	19.0	14.6		
Slightly Engaged	25.3	39.6		
Engaged	55.7	45.8		
September 4th			1.811	.121
Disaffected	12.7	22.1		
Slightly Engaged	27.3	25.0		
Engaged	60.0	52.9		
September 6th			3.418	.164
Disaffected	6.0	9.3		
Slightly Engaged	17.9	30.2		
Engaged	76.2	60.5		
September 18th			3.964	.177
Disaffected	19.0	26.5		
Slightly Engaged	46.6	29.4		
Engaged	34.5	44.1		
September 23rd			3.082	.153
Disaffected	20.2	30.2		
Slightly Engaged	37.1	41.9		
Engaged	42.7	27.9		
September 30th			3.583	.166
Disaffected	22.7	9.1		
Slightly Engaged	24.7	36.4		
Engaged	52.6	54.5		
October 21st			3.972	.192
Disaffected	8.0	26.5		
Slightly Engaged	32.0	28.9		
Engaged	60.0	44.6		
October 30th			4.305	.190
Disaffected	13.5	30.0		
Slightly Engaged	33.7	30.0		
Engaged	52.8	40.0		
November 13th			1.672	.139
Disaffected	21.4	25.8		
Slightly Engaged	46.4	32.3		
Engaged	32.1	41.9		

Table continued on next page

Table 5.4 (continued) Relationships between students' self-reported levels of engagement and knowledge assessments on traditional instruction.

Level of Engagement	Knowledge Assessment Correct (%)	Incorrect (%)	Chi-Square	Cramer's V
December 2nd			1.124	.108
Disaffected	16.7	18.5		
Slightly Engaged	35.7	44.4		
Engaged	47.6	50.0		
December 4th			.437	.127
Disaffected	23.1	0.0		
Slightly Engaged	7.7	0.0		
Engaged	69.2	100.0		

A Pearson's Chi Square analysis yielded a value of 8.121 ($P < .05$) for the October 11th technology-enhanced instruction delivery format (Table 5.4). Other Chi Square analyses of tech-enhanced instruction and self-reported engagement levels revealed no additional associations.

Table 5.5 Relationships between students' self-reported levels of engagement and knowledge assessments on technology-enhanced instruction

Level of Engagement	Knowledge Assessment Correct (%)	Incorrect (%)	Chi-Square	Cramer's V
September 9th			1.273 [a]	.098 [a]
Disaffected	5.6	16.7		
Slightly Engaged	15.9	16.7		
Engaged	78.6	66.7		
September 16th			1.471 [a]	.104 [a]
Disaffected	8.2	14.1		
Slightly Engaged	34.2	28.1		
Engaged	57.5	57.8		
September 20th			.529 [a]	.065 [a]
Disaffected	9.2	16.7		
Slightly Engaged	25.8	16.7		
Engaged	65.0	66.7		

Table continued on next page

Table 5.5 (continued) Relationships between students' self-reported levels of engagement and knowledge assessments on technology-enhanced instruction

	Knowledge Assessment			
Level of Engagement	Correct (%)	Incorrect (%)	Chi-Square	Cramer's V
October 11th			2.187 [a]	.141 [a]
Disaffected	12.6	20.0		
Slightly Engaged	22.1	6.7		
Engaged	65.3	73.3		
			8.181 b	.290 b
October 11th				
Disaffected	10.8	0.0		
Slightly Engaged	17.2	75.0		
Engaged	72.0	25.0		
October 21st			2.658 a	.161 a
Disaffected	15.1	29.4		
Slightly Engaged	31.4	35.3		
Engaged	53.5	35.3		
October 23rd			.713 a	.076 a
Disaffected	4.3	7.7		
Slightly Engaged	25.7	26.9		
Engaged	70.0	65.4		
October 30th			.131 a	.034 a
Disaffected	20.0	20.2		
Slightly Engaged	28.0	31.5		
Engaged	52.0	48.3		
November 1st			3.427 a	.197 a
Disaffected	9.4	12.5		
Slightly Engaged	20.3	4.2		
Engaged	70.3	83.3		
November 6th			.180 a	.042 a
Disaffected	13.6	13.6		
Slightly Engaged	27.3	23.7		
Engaged	59.1	62.7		
November 11th			1.668 a	.139 a
Disaffected	6.8	16.7		
Slightly Engaged	20.3	25.0		
Engaged	73.0	58.3		

Table continued on next page

Table 5.5 (continued) Relationships between students' self-reported levels of engagement and knowledge assessments on technology-enhanced instruction

Level of Engagement	Knowledge Assessment Correct (%)	Incorrect (%)	Chi-Square	Cramer's V
November 15th			1.048 [a]	.109 [a]
Disaffected	26.7	35.7		
Slightly Engaged	35.0	35.7		
Engaged	38.3	28.6		
November 15th			.582 [a]	.086 [a]
Disaffected	15.4	13.8		
Slightly Engaged	23.1	33.8		
Engaged	61.5	52.3		

[a,b] different superscripts denotes significance at $P < .05$ level

Table 5.6 Relationships between students' self-reported levels of engagement and knowledge assessments on Web-enhanced instruction

Level of Engagement	Knowledge Assessment Correct (%)	Incorrect (%)	Chi-Square	Cramer's V
August 30th			1.119 [a]	.096 [a]
Disaffected	17.5	12.2		
Slightly Engaged	28.7	24.4		
Engaged	53.8	63.4		
August 30th			.736 [a]	.077 [a]
Disaffected	4.8	8.6		
Slightly Engaged	11.9	13.6		
Engaged	83.3	77.8		
September 9th			5.930 [b]	.212 [b]
Disaffected	3.5	15.2		
Slightly Engaged	27.9	26.1		
Engaged	68.6	58.7		
September 20th			2.926 [a]	.152 [a]
Disaffected	17.6	33.3		
Slightly Engaged	40.2	33.3		
Engaged	42.2	33.3		
September 30th			2.072 [a]	.127 [a]
Disaffected	14.5	18.2		
Slightly Engaged	35.9	54.5		
Engaged	49.6	27.3		

Table continued on next page

Table 5.6 (Continued) Relationships between students' self-reported levels of engagement and knowledge assessments on Web-enhanced instruction

Level of Engagement	Knowledge Assessment Correct (%)	Incorrect (%)	Chi-Square	Cramer's V
October 7th			2.588 [a]	.144 [a]
Disaffected	11.2	23.5		
Slightly Engaged	30.8	35.3		
Engaged	57.9	41.2		
October 14th			.481 [a]	.065 [a]
Disaffected	21.9	25.0		
Slightly Engaged	41.0	50.0		
Engaged	37.1	25.0		
October 28th			3.895 [a]	.195 [a]
Disaffected	26.7	26.4		
Slightly Engaged	20.0	43.7		
Engaged	53.3	29.9		
November 11th			.569 [a]	.074 [a]
Disaffected	14.3	7.1		
Slightly Engaged	30.8	35.7		
Engaged	54.9	57.1		

[a,b] different superscripts denotes significance at $P < .05$ level

For traditional instruction, Cramer's V values suggested all relationships were low to moderate (.10-.29) (see Table 5.7) based on Davis (1971) descriptors (Table 3.3). The data suggest that no relationship exists between the traditional style of teaching and the likelihood that a student will answer a question correctly.

Table 5.7 Davis' rank of linear relationship for traditional instruction

Date	Cramer's V	Davis' Rank of Linear Relationship
September 2nd	.150	Low to Moderate
September 4th	.121	Low to Moderate
September 6th	.164	Low to Moderate
September 18th	.177	Low to Moderate
September 23rd	.153	Low to Moderate
September 30th	.166	Low to Moderate
October 21st	.192	Low to Moderate
October 30th	.190	Low to Moderate
November 13th	.139	Low to Moderate
December 2nd	.108	Low to Moderate
December 4th	.127	Low to Moderate

For technology-enhanced instruction, Cramer's V values suggested all relationships were either trivial (.01-.09) or low to moderate (.10-.29) (see Table 5.8) based on Davis (1971) descriptors (Table 3.3). The data suggest that no relationship exists between the technology-enhanced style of teaching and the likelihood that a student will answer a question correctly.

Table 5.8 Davis' rank of linear relationship for technology-enhanced instruction

Date	Cramer's V	Davis' Rank of Linear Relationship
September 9th	.098	Low to Moderate
September 16th	.104	Low to Moderate
September 20th	.065	Trivial
October 11th	.141	Low to Moderate
October 11th	.290*	Low to Moderate
October 21st	.161	Low to Moderate
October 23rd	.076	Trivial
October 30th	.034	Trivial
November 1st	.197	Low to Moderate
November 6th	.042	Trivial
November 11th	.139	Low to Moderate
November 15th	.109	Low to Moderate
November 15th	.086	Trivial

For web-enhanced instruction, Cramer's V values suggested all relationships were either trivial (.01-.09) or low to moderate (.10-.29) (see Table 5.9) based on Davis (1971) descriptors (Table 3.3). The data suggest that no relationship exists between the technology-enhanced style of teaching and the likelihood that a student will answer a question correctly.

Table 5.9 Davis' rank of linear relationship for Web-enhanced instruction

Date	Cramer's V	Davis' Rank of Linear Relationship
August 30th	.096	Trivial
August 30th	.077	Trivial
September 9th	.212	Low to Moderate
September 20th	.152	Low to Moderate
September 30th	.127	Low to Moderate
October 7th	.144	Low to Moderate
October 14th	.065	Trivial
October 28th	.195	Low to Moderate
November 11th	.074	Trivial

IMPLICATIONS

The data suggests that students do perceive teaching styles in different manners. This leads one to deduce that students like, or enjoy one form of lecture more than another. The data could be suggesting that students are more entertained and therefore more pleased with the mode of presentation.

Although no statistical difference was detected between the method of delivery and the likelihood of answering a question correctly, there were some differences. This begins the process of asking what the next steps should be? The option of measuring the dynamics of engagement over the course of the semester may lead to some predictable trends of when students are more likely to be engaged or disaffected, regardless of the type of delivery. The data were analyzed and described as an aggregate data pool, but variance terms from within group analysis does show some variation in what students report about their level of interaction with classroom material. More work could be done with other predictive factors, such as academic performance prior to entering their undergraduate studies, the level of comfort with technology and their particular type of learning styles in so much as how these interact with the level of engagement.

Chapter 6

SYNTHESIS

Teaching is an ancient discipline, which at times has been viewed as a tool to relay relevant information and at other times appreciated as an art unto itself. There is little argument amongst scholars, teachers and learners that there are multiple forms of teaching available and most (if not all) have unique application given tendencies of teachers and learners to have their own styles. This unique relationship is complicated further with the reality that each finite piece of subject matter has its own tendencies and therefore may be more successfully transferred to a learner by employing a unique style or combination of styles. The central issue remains that from good teaching can come good or true learning. Learning that the literature defines as "useful" being able to employ it towards some end to better a discipline and ultimately society.

Many descriptors exist to describe this internalization of material but in the end, the goal is to improve the learner by equipping them with useful information. To accomplish this task is to deal with multiple variables simultaneously and to be able to adapt as conditions change. Simply stated good teaching that leads to good learning is a dynamic experience. Some have suggested that as more tools are available to the teachers, most notably the rapid pace with which technology has infiltrated our classrooms, that teaching has been transformed into an entertainment venue, one in which good teaching has been replaced with theatre at the cost of relaying information. Unfortunately this conundrum has existed since the beginning of time, with some more skilled at relaying information than others, either through oratory, technical skills or social status. I submit that entertainment is a much a part of good teaching as the quality of the information presented. To steal an analogy from animal science, good nutrition is dependent on two factors, digestibility and palatability. In the case of teaching, sound delivery of information is dependent on being able to engage the learner and place them into a state in which they can ingest the information (palatability if you will) and ultimately for the information to be of a sort that has utility, is useful to the learner for their particular station in life (digestibility). The presence of one without the other leads to an imbalance that cannot hope to accomplish some of the goals described earlier.

In this study the teaching itself becomes the research subject with the learners assisting in data collection and the learners themselves offering their perception of the effectiveness of a style of material delivery. Although many variables exist the project has a unique appeal. No research design can hope to control all of the variables that exist in the classroom. The students themselves being unique individual, leads to a hopeless set of confounding variables, but in that level of confusion the outcome becomes representative of what actually occurred.

The outcome of this study is inconclusive, small differences are detected but statistics can find no level of significance, suggesting these subtle differences are due as much to chance as the test variables. In the discipline of education researchers often talk of “practical significance.” I do believe that the accumulated data does offer some practical significance. Such things as finding statistical significance between male and female perceptions, in isolated incidences, of type of instruction and engagement and finding differences, again in isolated incidents of differences in both engagement by class rank and differences in engagement by final grade.

A logical next step would be to investigate further the factors that cause stronger relationships between style of teaching and engagement for all students. The variation between one day's traditional lecture and the next may be substantial enough to find variables that can be altered, all for a more desirable learning outcome.

The logical next step for the research then becomes a need to work backwards and attempt to find a means of more effectively describing the differences in the students, to more closely look at extenuating factors such as time during the lecture, day of the week, time during the semester and proximity to other academic stressors (such as chemistry and biology tests, due dates for large projects and anxiety associated with mid-term and final grade reporting periods.) Maybe in these variables lie subtle hints as to things a teacher can do to improve the chances that presented material will be internalized and become useful. The teacher may be able deliver material in a different manner, choose which material is taught, offer alternative learning experiences, schedule assessments at a different time, etc. Regardless any information that leads to a situation that better learning can occur is useful. This utility can be employed in different manners but at least it becomes an attempt to explain the effects of known phenomena.

Appendix A

FERPA Exemption

From: Stan B. Smith <SBSMITH@clemson.edu>
Subject: **FW: FERPA Exception and IRB Approvals**
To: Dale Layfield <DLAYFIE@clemson.edu>, Laura Moll <lmoll@clemson.edu>, Brian Bolt <bolt@clemson.edu>

Dale. I have read over the attached research plans associated with students in AVS 150 in the fall 2008. The study qualifies for the FERBA exception. Thus, permission from individual students to use their data is not required. Best wishes with the project. Regards, Stan Smith

Stan Smith -- Registrar -- Clemson University -- 102 Sikes Hall -- 864.656.2171

From: Dale Layfield [mailto:dlayfie@exchange.clemson.edu]
To: sbsmith@clemson.edu; Laura Moll **Cc:** Brian Bolt **Subject:** FERPA Exception and IRB Approvals

Mr. Smith and Ms. Moll, On behalf of Brian Bolt (Department of Animal & Veterinary Sciences) and myself, please see the attached documents requesting FERPA Exception and IRB approvals for the intent to use data that were collected during the Fall 2008 semester in AVS 150. At the time, Mr. Bolt conducted an anecdotal review of instructional techniques through students using their iClickers. This data looks to have interesting findings and we would like to use information from the student data warehouse (and remove any identifying linkers afterwards) and the data gained in the class assessments for possible publication if approved. If you have any concerns or questions, please call me at any time at (864) 656-5676 or at my cell at (864) 906-2484. Thank you for your assistance.

Best Regards,

Dale Layfield

Appendix B

IRB approval

From: Rebecca Alley <RALLEY@exchange.clemson.edu>
Subject: **Validation of IRB protocol # IRB2009-151, entitled "Measuring the Impact of Varied Instructional Approaches in an Introductory Animal Science Course Through Assessment of Student's Self-Perceived Levels of Engagement"**
To: Dale Layfield <dlayfie@clemson.edu>

Dear Dr. Layfield,

The Chair of the Clemson University Institutional Review Board (IRB) validated the protocol identified above using Exempt review procedures and a determination was made on **May 18, 2009,** that the proposed activities involving human participants qualify as Exempt from continuing review under **Category B1,** based on the Federal Regulations (45 CFR 46). You may begin this study.

Please remember that no change in this research protocol can be initiated without prior review by the IRB. Any unanticipated problems involving risks to subjects, complications, and/or any adverse events must be reported to the Office of Research Compliance (ORC) immediately. You are requested to notify the ORC when your study is completed or terminated.

Please review the Responsibilities of Principal Investigators (available at http://media.clemson.edu/research/compliance/irb/pi-responsibilities.doc) and the Responsibilities of Research Team Members (available at http://media.clemson.edu/research/compliance/irb/research-team-responsibilities.doc) and be sure these documents are distributed to all appropriate parties.

Good luck with your study and please feel free to contact us if you have any questions. Please use the IRB number and title in all communications regarding this study.

Sincerely,
Becca

Rebecca L. Alley, J.D.
IRB Coordinator
Office of Research Compliance
Clemson University
223 Brackett Hall
Clemson, SC 29634-5704
ralley@clemson.edu
Office Phone: 864-656-0636
Fax: 864-656-4475

REFERENCES

Acker, Duane. "The Doctorate Teaching Degree." Journal of Animal Science 33 (1971): 906-909.

Acker, Duane. "What and How Should We Teach the Begining Animal Science Student." Journal of Animal Science 23 (1964): 278-282.

Alley, M., and K. Neeley. Discovering the power of PowerPoint: Rethinking the design of presentation slides from a skillfull user's perspective. In *Proceedings of the 2005 American Society of engineering education annual conference and exposition*, Portland, Oregon June 12-15

Anderman, L.H. and C. Midgley. Motivation and middle school students. Champaign: ERIC Clearinghouse on Elementary and Early Childhood Education, 1998.

Apperson, J.M., et al. "The impact of presentation graphics on student's experience in the classroom" Computers in the Classroom 36 (2006): 297-308.

Arambula-Greenfield, Teresa. "Implementing problem-based learning in a college science class." Journal of College Science Teaching 26.1 (1996): 26-31.

Arons, Arnold. A Guide to Introductory Physics Teaching. New York: Wiley, 1990.

Baird, L.L. "Biographical and Educational Correlates of Graduate and Professional School Admissions Test Scores." Educational and Psychology Measurement (1976): 415-420.

Bandura, A. "Perceived self-efficacy in cognitive development and functioning." Educational Psychologist 28.2 (1993): 117-148.

Bandura, A. "Self efficacy: Toward a unifying theory of behavioral change." Psychological Review 84 (1977): 191-215.

Bandura, A. Social foundations of thought and action: A social cognitive theory. Englewood Cliffs: Prentice-Hall, 1986.

Barbe, Walter and Raymond Swassing. Teaching through Modality Strengths: Concepts and Practices. Columbus: ZanerBloser, 1979.

Barkley, A. "Learning Styles and Student Achievment: Bringing Psychology into the Agricultural Classroom." NACTA Journal (1995): 10-12.

Barnes, D.M., J.P. Sims and W. Jamison. "Use of Internet-based resources to support an introductory animal into a science course." Journal of Animal Science 77 (1999): 1306-1313.

Beck, M.M and J.C. Swanson. "Value-added animal agriculture: Inclusion of race and gender in the professional formula." Journal of Animal Science 81 (2003): 2895-2903.

Berl, E. "Justus Liebig May14, 1803-April 18, 1873." Journal of Chemical Education 15 (1938): 553-562.

Black, Kersey A. "What to do when you stop lecturing: become a guide and a resource." Journal of Chemical Education 70.2 (1993): 140-145.

Bligh, D.A. What's the Use of Lecturing? University of Exeter. Devon, 1971.

Brooks, S.R., Freiburger, S.M., and Grotheer, D.R. " Improving elementary student engagement in the learning process through integrated thematic instruction. Unpublished master's thesis, Saint Xavier University, Chicago, I." 1998. ERIC Document Reproduction Service. 20 May 2009.

Brophy, J. "Conceptualizing Student Motivation." Educational Psychologist (1983): 200-215.

Buchanan, D.S. "ASAS Centennial Paper: Animal Science Teaching: A Century of Excellence." Journal of Animal Science 86 (2008): 3640-3646.

Campbell, John R. "Motivating Students." Journal of Animal Science 44 (1977): 889-895.

Carini, Rober M., George D. Kuh and Stephen P. Klein. "Student Engagement and Student Learning: Testing the Linkages." American Educational Research Association. San Diego: Research in Higher Education, 2006. 42.

Casey, T.M. and K. Plaut. "Women and minorities in animal science: Do issues exist?" Journal of Dairy Science 86 (2003): E35-E46.

Chang, W.C. "Learning goals and styles by gender - a study of NUS students." 2004.

Chapman, Elaine. "Assessing Student Engagement Rates." September 2003. ERIC Digest. 18 May 2009 <http://www.ericdigests.org/2005-2/engagement.html>.

Cheek, Karen. "The Normal School." 27 May 2009 <http://www.nd.edu/~rbarger/www7/normal.html>.

Chickering, ArthurW and Zelda F Gamson. Seven Principles for Good Practice in Undergraduate Education. March 1987.

Coffey, W.C. "Teaching Animal Husbandry in War Time." American Society of Animal Production. 1920. 50-52.

Csikszentmihalyi, Mihaly. Flow: The Psychology of Optimal Experience. New York: Harper and Row, 1990.

Czikszenthihayli, Mihaly. Beyond Boredom and Anxiety. San Francisco: Jossey-Bass, 1975.

Davis, J.A. Elementary Survey Analysis. Englewood CLiffs: Prentice-Hall, 1971.

Dev, P.C. "Intrinsic motivation and academic achievement: What does their relationship imply for the classroom teacher? ." Remedial and Special Education (1997): 12-19.

Driesnack, M. “A closer look at PowerPoint Feature Article” Journal of Nursing Education 44 (2005): 347.

Encyclopædia Britannica. "Jean-Baptiste Boussingault (french chemist)." 2009. 27 May 2009 <http://www.britannica.com/EBchecked/topic/75934/Jean-Baptiste-Boussingalt>.

Ericksen, S.C. "The Lecture." Memo to the Faculty 1978.

FAEIS. "Baccalaureate Degrees Awarded in Agriculture, Agriculture Operations and Related Sciences at 1862 Institutions." 2009. FAEIS Reports. USDA. 28 May 2009 <http://faeis.ahnrit.vt.edu/reports/reports 2006_2007/degrees/degrees_ag/degrees_ag_1862_bacc.html>.

Feldman, Robert and Thomas Prohaska. "The Student as Pygmalion: Effect of Student Expectation on the Teacher ." American Psychological Association (1979): 485-493.

Filak, Vincent F. and Kenon M. Sheldon. "Teacher support, student motivation, student need satisfaction, and college teacher course evaluations: Testing a sequential model." Educational Psychology 28.6 (2008): 711-724.

Fisher, C., et al. "Teaching Behaviors, Academic Learning Time and Student Achievement: An Overview." C.Denham and A Lieberman (Eds) Time to Learn. Washington: National Institute of Education, 1980.

Fleming, N.D. "I'm different; not dumb. Modes of presentation (VARK) in the tertiary classroom." 1995 Annual Conference of the Higher Education and Research Development Society of Australasia. Ed. Zelmer A. 1995. 308–313.

Fleming, N.D. VARK, a Guide to Learning Styles. 2005. 25 June 2009 <http://www.vark-learn.com/english/index.asp>.

Frost, J.T. "Improving Instruction." American Society of Animal Production. 1936. 172-177.

Gabbin, Alexander L. "Exploratory evidence of accounting majors' motivation to learn." Assessment Update 21.1 (2009): 4-6.

Geyer, Richard E. "Report on Consolidation and Curricula in the Animal Sciences." Conference on Undergraduate Education in Dairy Science. Lincoln: Journal of Dairy Science, 1965. 552-561.

Goddard, Roger D., Wayne K. Hoy and Anita Woolfolk Hoy. "Collective teacher efficacy: Its meaning, measure and impact on student improvement." American Educational Research Journal 37.2 (2000): 479-507.

Grant, P.M., et al. "the importance of comprehensive agricultural education in land-grant institutions: a historical perspective." *Journal of Animal Science* 78 (2000): 1684-1689.

Grolnick, W.S. and R.M. Ryan. "Parental Resources and the Developing Child in School." Procidano, M and C (Eds) Fisher. *Contemporary Families a Handbook for School Professionals*. New York: Teachers College Press, 1992. 275-291.

Gustavson, R.G. "What is an Educated Man." *Conference on Undergraduate Education in Dariy Science*. Lincoln: Journal of Dairy Science, 1965. 532-535.

Halperm, Diane F. "A cognitive-process taxonomy for sex differences in cognitive abilities." *Current Directions in Psychological Science* (2004): 138-139.

Hinsdale, Burke A. *Horace Mann and the Common School Revival in the United States*. New York: Charles Scribner's Sons, 1898.

Hoetltke, Beverly. "Key Learning Community-Flow Theory." 2003. *Indianapolis Public Schools*. 1 June 2009 <http://www.616.ips.k12.in.us/Theories/Flow/default.aspx>.

Honeyman, M.S. and G.S. Miller. "the effect of teaching approaches on achievement and satisfaction of field-dependent and field-independent learners in animal science." *Journal of Animal Science* 76 (1998): 1710-1750.

Hoover, T.S. and T.T. Marshall. " a comparison of learning styles and demographic characteristics of students enrolled in selected animal science courses." *Journal of Animal Science* 76 (1998): 3169-3173.

Howell, C.E. "The Objectives of Under-Graduate Education in Animal Husbandry." *American Society of Animal Production*. 1932. 101-104.

Hultz, Fred S. "Methods of Teaching Animal Husbandry to College Students." *American Society of Animal Production*. 1930. 151-155.

Hyde, J. S. "The gender similarities hypothesis." *American Psychologist* 60.6 (2005).

Hyde, J. S.,, E., Fennema and S. Lamon. "Gender differences in mathematics performance: A meta-analysis ." *Psychological Bulletin* 107 (1990): 139-155.

Kauffman, R.G., et al. "Philosophies of Teaching and Approaches to Teaching." *Journal of Animal Sciences* 59 (1984): 542-546.

Kearsley, Greg and Ben Shneiderman. "Engagement Theory: A framework for technology-based teaching and learning." 5 April 1999. 1 June 2009 <http://home.sprynet.com/~gkearsley/engage.htm>.

Kildee, H.H. "A Suggested Introductory Course in Animal Husbandry." *American Society of Animal Production*. 1935. 165-170.

Kildee, H.H. "The Value of Personal Contact Between Instructor and Student." American Society of Animal Production. 1930. 155-159.

Kolb, David. Experiential Learning. Englewood Cliffs: Prentice-Hall, 1984.

Lasley, John F. "My Successes and Failures in Teaching Students on Campus." Journal of Animal Sciences 48 (1979): 711-714.

liver, J.D. and D.E. Hinlek. "Occupational education research: Selecting statistical procedures." Journal of Studies in Technical Careers 9 (1982): 199-207.

Lowman, J. Mastering the Techniques of Teaching. San Francisco: Jossey-Bass, 1984.

Lowry, R.B. "Electronic presentation of lecture – Effect upon student performance." University Chemistry Education, 3, 158-160.

Lucas, A.F. "Using Psychological Models to Understand Student Motivation." Svinicki, M.D. The Changing Face of College Teaching. New Directions for Teaching and Learning. Vol. 42. San Francisco: Jossey-Bass, 1990.

Lumsden, Linda. "Student Motivation to Learn." Emergency Librarian (1994): 31-32.

Lynch, Douglas J. "Confronting challenges: Motivational beliefs and learning strategies in diffficult college courses." College Student Journal 42.2 (2008): 416-421.

MacIver, D.J., and Reuman, D.A. "Giving their best: Grading and recognition practices that motivate students to work hard." American Educator (1994): 24-31.

McCampbell, C.W. "Teaching Animal Husbandry Courses." American Society of Animal Production. 1925. 67-70.

McManus, Deborah O'Connell, Rita Dunn and Stephen J. Denig. "Effects of traditional lecture versus teacher-constructed and student-constructed self teaching instructional resources on short-term science achievement and attitudes." The American Biology Teacher (2003).

Mottman, John. "Innovations in physics teaching-a cautionary tale." The Physics Teacher 37.2 (1999): 74.

Murray, John B. "Review of Research on the Myers-Brigg Type Indicator." Perceptual and Motor Skills (1990): 1187-1202.

National Survey of Student Engagment. NSSE: Experiences That Matter: Enhancing Student Learning and Success. Bloomington: Center for Postsecondary Research, School of Education, Indiana University Bloomington, 2007.

Natriello, Gary. "Problems in the evaluation of students and student disengagement from secondary schools." Journal of Research and Development in Education (1984): 14-24.

Neilsen, J. and J. Levy. “Measuring usability: Preference vs. Performance” Communications of the ACM 37 (1994): 66-75.

New York University Center for Teaching Excellence. "NYU Center for Teaching Excellence." 2008. Faculty Testimonials. 22 June 2009 <http://www.nyu.edu/cte/testimonials.htm>.

O'Shea, T., S. Bearman and A. Downes. "'Quality Assurance and Assessment in Distance Learning." R., Mills and Tait A. Supporting the Learner in Open and Distance Learning. London: Pitman Publishing, 1996.

Pace, C.R. Measuring the Quality of College Student Experiences. Los Angeles: Higher Education Research Institute, 1984.

Peters, M.W., M.F. Smith and G.W. Smith. "Use of critical interactive thinking exercises in teaching reproductive physiology to undergraduate students." Journal of Animal Science 80 (2002): 862-865.

Plumb, Charles S. "Coordination of Courses in Animal Husbandry." American Society of Animal Production. 1917. 70-76.

Pohlman, J.T. "A Description of Effective College Teaching in Five Disciplines as Measured bu Student Ratings." Research in Higher Education (1974): 335-346.

Quiggin, John. "Economic Rationalism." Crossings (1997): 3-12.

Reiling, B.A., et al. "Experiential learning in the animal sciences: Development of a multi-species large-animal management and production practicum." Journal of Animal Sciences 81 (2003): 3202-3210.

Rice, V.A. "Evaluating the Animal Science Student." Journal of Animal Science 4 (1945): 453-462.

Riley, Jack G. "is Animal Science Training Future Teachers?" Journal of Animal Science 33 (1971): 179-181.

Rosenshine, B and N Furst. "Research on Teacher Performance Criteria. Research in Teacher Education: A Symposium." B.O. Smith (Ed). Englewood Cliffs: Prentice Hall, 1971.

Rosenshine, B. and M. Furst. "Research on teacher performance criteria." Smith, B.O. Research in teaching education. Englewood Cliffs: Prentice Hall, 1971. 27-72.

Rosenthal, R. and L. Jacobson. Pygmalion in the classroom: Teacher expectation and pupils' intellectual development. New York: Irvington Publishers, 1968, 1992.

Rotter, J.B. "Generalized expectancies for internal versus external control of reinorcement." Psychological Monographs. Vol. 80. 1966. 1-28.

Sass, E.J. "Motivation in the College Classroom: What Students Tell Us." Teaching of Psychology 16.2 (1989): 86-88.

Savoy, April, et al., “Information retention from PowerPoint and traditional lectures.” Computers & Education 52 (2009) 858-867.

Schillo, Keith K. "Teaching Animal Science; Education or Indoctrination." Journal of Animal Science 75 (1997): 950-953.

Schlecty Center. "Theory of Engagement." 2009. 1 June 2009 <http://www.schlechtycenter.org/pdfs/theoryofengagement.pdf>.

Shulman, Lee S. "Making Differences: A Table of Learning." 2007. The Carnegie Foundation for the Advancement of Teaching. 2 September 2008 <http://www.carnegiefoundation.org/publications/sub.asp?key=452andsubkey=612>.

Skinner, E.A. and M.J. Belmont. "Motivation in the Classroom: Reciprocal effects of Teacher Behavior and Student Engagement Across the School Year." Journal of Educational Psychology (1993): 571-581.

Stein, K., “The dos and don’ts of PowerPoint presentations.” Journal of the American Dietetic Association 106 (2006) 11. 1745-1748

Svanum, Soren and Silvia M. Bigatti. "Academic Course Engagement during One Semester Forecast College Success: Engaged Students Are More Likely to Earn a Degree, Do it Faster, and Do It Better." Journal of College Student Development 50.1 (2009): 120-132.

Svanum, Soren and Silvia M. Bigatti. "The Influences of Course Effort and Outside Activities on Grades in a College Course." Journal of College Student Development 47.5 (2006): 564-576.

Szabo, A., and N. Hastings, “PowerPoints power in the classroom: Enhancing students’ self efficacy and attitudes.” Computers and Education. 45 (2000) 203-215.

Taylor, R.E. and R.G. Kauffman. "Teaching Animal Science: Changes and Challenges." Journal of Animal Science 57 (1983): 171-196.

Trowbridge, E.A. "Some Problems in Teaching Animal Husbandry." Proceedings from the American Society of Animal Production. American Society of Animal Production, 1923. 136-140.

Tschannen-Moran, M, A. Woolfolk Hoy and W.K. Hoy. "Teacher efficacy: Its meaning and measure." Review of Educational Research 68 (1998): 202-248.

Tufte, E. The cognitive style of powerpoint November 2, 2009 <www.edwardtufte.com/tufte/PowerPoint>

Van Etten, Shawn, et al. "College seniors' theory of their academic motivation." Journal of Educational Psychology 100.4 (2008): 812-828.

Washburn, L.E. "Fifty Years of Progress in Teaching Animal Science." Journal of Animal Science 17 (1958): 1101-1118.

Washington, George. "Eigth Annual Message of George Washington." 7 December 1796. The Avalon Project- Documents in Law, History and Diplomacy. Yale Law School. 27 May 2009 <http://avalon.law.yale.edu/18th_century/wash08.asp>.

Weinert, F.E. and R.H. Kluwe. Metacognition, Motivation and Understanding. Hillsdale: Erlbaum, 1987.

Wendorf, Craig. 12 March 2004. 23 September 2008 <http://www.uwsp.edu/psych/cw/statmanual/index.html>.

Whittington, M.S. and M Raven. "Learning Styles: An Assessment- An Application." NACTA Journal (1995): 6-9.

Whittington, M.S. "Classroom Behaviors: What Lessons Can Professors Learn?" NACTA Journal (1997): 37-42.

Whittington, M.S. "Increasing Opportunities for Students to Think in College Classrooms: A Faculty Intercession Program." NACTA Journal (1999): 28-32.

Young, E.P. "New Goals in the Introductory Animal Science Course." Journal of Animal Science 27 (1968): 874-878.

Zoller, Uri. "Are lecturers and learning compatible? Maybe for LOCS: unlikely for HOCS." Journal of Chemical Education 70.3 (1993): 195-198.