THE EFFECTS OF EXPERIENTIAL TEACHING METHOD VERSUS LECTURE BASED TEACHING METHOD ON STUDENT ACHIEVEMENT

by

BRITTANY L. ADAMS

(Under the Direction of Dennis W. Duncan)

ABSTRACT

The purpose of this research is to determine the effect of exposure to lab based versus lecture based instruction on student test scores. The researcher sought to describe how different demographic characteristics effected the students' achievement per teaching method. The researcher measured achievement by scores on a pre and post test given at the beginning and end of the semester. The researcher collected demographic information on the participants using a demographic questionnaire. The objectives of this study were: determine the effects of the experiential teaching method on student achievement, determine the effects of the lecture based teaching method on student achievement, determine the effects of different demographic characteristics and teaching method on student achievement. Results showed that both methods increased achievement while the lecture based method showed a greater increase. Demographic characteristics had a significant effect on achievement. Further research needs to be done, with a larger sample size, for a definitive conclusion.

INDEX WORDS: Experiential teaching; Experiential learning; Lecture based teaching; Achievement

CHAPTER 1

INTRODUCTION

Aristotle once said, "For the things we have to learn before we can do them, we learn by doing them." There are dozens of different teaching methods being used in schools these days such as, informal instruction, direct instruction, inquiry-based learning, cooperative learning, and using information processing strategies. Agricultural Education (K-12 and college) has moved through the different teaching methods and now includes more methods than ever (Newsome, Wardlow, & Johnson, 2005). Informal instruction is, just as it sounds, quite informal. It more resembles a conversation between student and teacher to acquire and distribute information. Direct instruction is more formal and includes the lecture based method of teaching. Some teachers use this method almost exclusively. It allows teachers to cover a great deal of material in a short period of time, allowing for little to no hands-on work for the students. Inquiry-based learning has many names such as, critical thinking, problem based learning, hands-on learning, and experiential learning. This type of method is becoming more popular because it is very adaptable and can be modified to students of all levels. Cooperative learning uses small groups to accomplish tasks. Student ability varies throughout each group and teachers need to monitor the groups to assure the students stay on task. Finally, information processing strategies are sometimes used to assist students memorizing important facts. Examples of this method include graphic organizers, mind maps, and story webs.

During the industrial revolution, education focused on teaching and training students for a vocation more than for knowledge and retention of multiple subjects (Kliebard, 1995). From this revolution and teaching style, agricultural classrooms have kept some of the vocational type,

hands-on activities that were once taught in schools (Newsome, Wardlow, & Johnson, 2005). These vocational type, hands-on skills help the students development both psychomotor skills and ways to perform different procedures; this was a deviation from technical and scientific principles that were once taught. Although no one way of teaching is the best, it is beneficial to explore the more popular ones in detail.

The experiential teaching method is one that is often referred to as the hands-on or problem-based teaching method. There is a common adage attached to experiential learning, "Tell me and I will forget, show me and I may remember, involve me and I will understand," (Confucius). David Kolb (1984), an educational theorist, states that knowledge is gained through personal and environmental experiences. Most of the dimensions of experiential teaching are analysis, initiative, and immersion; while other forms of academic learning are focused on structure and reproductive learning (Ewing and Whittington, 2007). Experiential teaching is trying to create an experience for the student to learn from (Day, Raven, & Newman, 1998). Most schools and universities now have classes that include a lab element. This lab element is a type of experiential teaching; what is done in the lab, from watching videos to handling livestock, is a part of experiential teaching and an extension of what is covered in lecture.

Studies have found that when students are physically connected with material and more physically active in the classroom they will retain more information (Burris, Garton, & Terry, 2005; Hancock & Wingert, 1996). Experiential teaching helps stimulate students' ability to think critically. Along with increased retention, critical thinking, the mental process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and evaluating information to reach an answer or conclusion, is key (Elder, 2007). Finding the most effective way to teach students will possibly make students' rate of achievement increase.

A study done by Smith, Wardlow, & Johnson, 2001, comparing lecture versus experiential teaching method provided inconclusive data. There are mixed results from sides, saying experiential and lecture based teaching increase retention. Retention is the ability to recall or recognize what has been learned or experienced; memory. A study done by Newsome, Wardlow, and Johnson (2005) found that teaching methods affect schools differently. This study suggested that teachers themselves are the best judge at which method to use. This may be the case in some classrooms but when teaching college level courses, teachers will have a variety of students and it would be useful to know the most effective way to teach certain groups of students to increase the likelihood of retention.

This study will use Animal and Dairy Science (ADSC) 3630- Horse Production and Management at the University of Georgia to evaluate these teaching methods and their effect on student achievement over the course of a semester.

Statement of the Problem

The research done previously has been inconclusive as to which method increases achievement the most. Achievement in this case is determined by the score on the post test as compared to the pre test. Some students learn adequately by listening to a lecture and then being tested on the material. Other students cannot fully understand a technique or idea until they experience it firsthand. Using college-age students in elective and/or major classes may have a different outcome for rate of achievement. The basis behind this statement is that students in college are able to choose the classes they want to take. When students make the choice of which classes to take, they normally pick classes they are interested in. Choosing to use only one class will decrease generalizability but also decrease the variability. Having only one

professor and one set of students limits the generalizability to the student population of this study, but also limits extraneous variability introduced when we compare "achievement" among multiple instructors.

Purpose of Study

The purpose of this research was to determine the effect of exposure to lab based versus lecture based instruction on student test scores. Objectives of this study were the following:

1. Determine the effects of the experiential teaching method on students' achievement in ADSC 3630;
2. Determine the effects of the lecture based teaching method on students' achievement in ADSC 3630;
3. Determine which of the teaching methods had an effect on students' achievement, positively or negatively;
4. Determine if demographic characteristics have an effect on achievement for either teaching method.

Hypotheses

H_{01}: There will be no difference between the teaching methods and their affect on rate of achievement. The curriculum taught using experiential methods will receive the same outcome as the curriculum taught during lectures.

H_{02}: Students taught using the experiential teaching method will have higher rate of achievement in comparison to the students taught using the lecture based method.

Justification of Study

By collecting the pretest and post test data on the ADSC 3630 class, data was aimed to determine which teaching method had the greatest effect on this populations' achievement. Choosing the proper teaching method is essential to being an effective teacher/professor/educator (Doyle and Carter, 1987). The results of this study may lead educators closer to finding the most effective method of pedagogy, and may explain why educators should continue using their chosen method of teaching, why they should change it, or why they may need a blend of multiple methods depending on curriculum.

The results of this study will add to the research previously done to determine the most effective teaching method when the goal is to enhance a learner's retention of material. The study should also provide a lead way into what other research should be performed to aid in finding the most effective teaching method. In a society driven by rate of achievement, finding the best/most effective teaching method will assist students in performing to the best of their ability.

Limitations of Study

One of the main limitations of this study was the sample size. The population was very small and specific. There were too many uncontrolled variables when using multiple classes and teachers. The demographic characteristics of the population were very similar; mostly white, middle to upper class Socioeconomic Status (SES), and undergraduate. Based on these limitations, this study cannot be generalized to animal science students from other classes or schools or general students from others schools.

Definition of Terms

Achievement rates (or rate of achievement)- Achievement rates give an indication of how effective an institution is at helping students to attain their learning goals. The rates can be split into 'achievement rates (known outcomes)' and 'achievement rates (all completers)'.Achievement rates (known outcomes) are defined as the proportion of students who complete their learning program and gain a qualification. Achievement rates (all completers) are the same as achievement rates (known outcomes), but also include instances where exams have been taken and the results are unknown. In the context of this study, 100% achievement will be defined by a student receiving 15/15 on the test.

Active teaching-When students are given information in an active way. Such as experientially, field studies, laboratory work, etc.

Animal and dairy science (ADSC) 3630 (Horse Production and Management)-Two hours of lecture and three hours of lab per week. Includes curriculum based on breeding, feeding, and management of horses. Instructor is Dr. Kari Turner.

Agricultural education-is instruction about crop production, livestock management, soil and water conservation, and various other aspects of agriculture.

Critical thinking- the mental process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and evaluating information to reach an answer or conclusion. (Elder, 2007)

Experiential teaching: teaching through direct experience. When students are placed in a situation where they think and interact; learn in and from a real-world environment. Involves active participation of the student in planning, development and execution of learning activities, is shaped by the problems and pressures arising from the real-world situation and occurs most effectively outside the classroom. (Cornell University, 2009)

Lecture based teaching: teaching through talking or showing, little interaction with students. Lecture based teaching and learning follow "a linear progression, with a beginning, middle, and end the purpose of the journey along the linear pathway seems concerned with the destination- that is, students' acquisition of specific knowledge" (Wassermann, 1994).

Passive teaching-When students are given information in a passive way. Such as lecturing, reading, watching, etc.

Problem-based learning- an instructional method that challenges students to "learn to learn," working cooperatively in groups to seek solutions to real world problems. These problems are used to engage students' curiosity and initiate learning the subject matter. PBL prepares students to think critically and analytically, and to find and use appropriate learning resources (Duch, 2008)

Smith-Hughes National Vocational Education Act of 1917- a landmark in the advance of federal centralization as well as in vocational Education, created the Federal Board for Vocational Education for the promotion of training in Agriculture, trades and industries, commerce, and home economics in the secondary schools. Funded by federal Grants-In-Aid to be matched by state or local contributions, the act required that state boards submit their plans for vocational education to the board for approval, thus providing for greater federal control than previous education grants. Supplementary acts have extended the original activities to vocational counseling and rehabilitation (Kantor, Harvey, & Tyack, 1982).

Socioeconomic status (SES)-An individual's or group's position within a hierarchical social structure (such as the United States). Socioeconomic status depends on a combination of variables, including occupation, education, income, wealth, and place of residence. (Dictionary.com)

Student engagement- "students make a psychological investment in learning. They try hard to learn what school offers. They take pride not simply in earning the formal indicators of success (grades), but in understanding the material and incorporating or internalizing it in their lives." (Newmann, 1992)

Summary

The purpose of this study was to determine the most effective way to increase achievement based on teaching method. The two teaching methods being tested were experiential based teaching and lecture based teaching. Additionally, this study attempted to determine any correlation between demographic characteristics and achievement, regardless of teaching method. Chapter two will discuss theories as they pertain to experiential teaching, lecture based teaching, and achievement.

CHAPTER 2

LITERATURE REVIEW

Dewey (1938) believed that "there is an intimate and necessary relation between the processes of actual experience and education." Dewey (1938) and Kolb (1984) believe that school learning should be an experientially active experience, not passive. The timeline of experiential learning dates back to 1910 with John Dewey pioneering the Experimental Laboratory School (Newsome, Wardlow, & Johnson, 2005). In 1917, Charles Prosser helped develop the Smith-Hughes Act for Vocational Education which played a large part in experiential learning. In the 1920s Jean Piaget conducted a study on his children which in turn formed his theories of experience-based learning and created the model of Learning and Cognitive Development. To assist in secondary education, Edward L. Thorndike published the first major study of the adult learner and their learning processes (Goodenough, 1950). In 1946, Kurt Lewin developed experiential learning theories through his work with groups. David Kolb published "Experiential Learning: Experience as the Source of Learning and Development" in 1984. This timeline shows that experiential learning has been part of education and learning for an extended amount of time. Most of the works (Christensen, 1985; Kraft, 1986) have been linked to collegiate and secondary education which makes it very relevant in present time when students are going on to obtain secondary and post-secondary educations.

Theoretical Framework

If a majority of students learn best with one teaching method, why not use that method? Previous research has shown that there can be a difference in achievement between teaching

methods (Day, Raven, & Newman, 1998; Newsome, Wardlow, & Johnson, 2005; and Wulff-Risner & Stewart, 1997). The following sections move through the timeline of experiential learning as described in the previous section. Starting with Dewey and ending with Kolb. Moving through each model/cycle helps explain where the ideas and theories came from. The Problem-Based Learning Approach is a theory used to describe how students begin to think critically and a method to assist them in doing so. Along with the Problem-Based Learning, thinking critically is key in increasing rates of achievement in students. Teaching students how to think critically will assist them in their everyday lives and their academic achievement may prosper also. Two theories that go hand in hand are the Instructional and Learning Theories. A diagram was developed by Driscoll (1994) to depict the relationship between the two theories stated above. All of these cycles and theories are explained in more detail in the following sections.

Dewey's Three Stage Model

John Dewey is considered by many to be the founder of modern experiential learning. He developed a three-stage model to explain the learning process. This model focuses on slowing down the learning process so that past experiences can influence what people learn in their current situation. The process goes as follows: 1.) Sizing up the situation (learning experience) at hand through the objective observation (curriculum being learned), 2.) Drawing forth knowledge about the situation by thinking about past experiences and situations (both your own and those around you), finally 3.) Judging how to process, based on the attained knowledge. Dewey also distinguished two models of educating, "traditional" education and the "progressive"

approach to education. The traditional model is not learner-centered at all; it is more teacher-driven in that the teacher delivers knowledge and skills to a student. This is comparable to lecture based teaching. The progressive approach encourages teachers to create an experience for the students rather than just delivering information. This model is comparable to experiential teaching.

Piaget's Experiential Learning Process

Jean Piaget's theory claims that experience is what shapes intelligence and that intelligence is a product of the interaction between a person and their environment. People learn from different experiences in different ways. Piaget believed that people either assimilate or accommodate the lessons from each experience. He states that our ways of knowing change, "qualitatively in identifiable stages, moving from an inactive stage, where knowledge is represented in concrete actions and is not separable from the experiences that spawn it, to an iconic stage, where knowledge is represented in images that have an increasingly autonomous status from the experiences they represent, to stages of concrete and formal operations" (Kolb, 1984).

When a person experiences something they are satisfied with, sometimes thought of as a success, we interpret the experience in a way that assimilates the new information into our existing understandings. When a person experiences something they are dissatisfied with, sometimes thought of as a failure, we are forced to accommodate the experience by challenging and/or changing our beliefs and knowledge. The figure below diagrams this idea (Kelly, 2009).

Figure 2.1 Piaget's Experiential Learning Processes (Kelly, 2009).

Lewin's Experiential Learning Model

Kurt Lewin, sometimes called the father of social psychology, developed a four-stage model to describe what people do when faced with certain situations. This model consists of concrete experience, from which observations and reflections are made, that lead to the formation of abstract concepts and generalizations, following which comes the testing of the implications of these concepts in new situations. Each step leads to the next which strongly affirms his belief that experiential learning is a continuous cycle. This model is the precursor to the Kolb Cycle. The cycle goes as follows: 1.) Reflect on what you already know, 2.) Plan how you intend to process, 3.) Act out your plan, and finally 4.) Observe the results your actions bring.

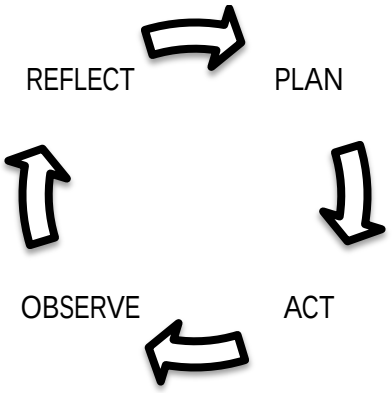

Figure 2.2 Kurt Lewin's Four-Stage Model (Kelly, 2009).

Kolb's Experiential Learning

David Kolb (1984) created a theory that builds on the foundations of John Dewey, Kurt Lewin, and Jean Piaget. After studying the prior cycles and stages of Dewey, Lewin, and Piaget, Kolb (1984) developed a cycle to describe how we learn from experience. The cycle begins when the learner is involved in a concrete experience (CE). The learner then reflects on the experience and gives it meaning (Reflective Observation, RO). The learner moves on to formulate explanations and/or conclusions drawn from others about the experience (Abstract Conceptualization, AC). These conclusions then guide the learner through decision making and planning for related actions that can be implemented to form new concrete experiences (Active Experimentation, AE) (Mackeracher, 2004).

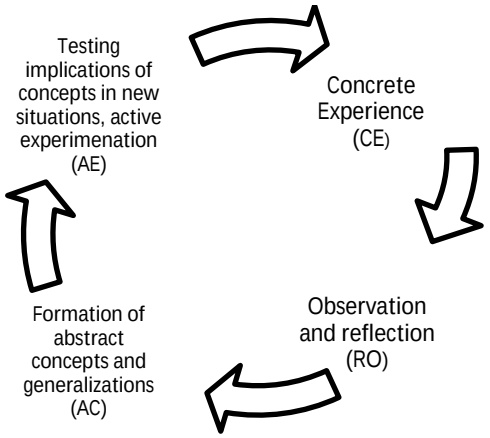

Figure 2.3 Kolb's Experiential Learning Cycle (Kolb, 1984).

These concrete experiences occur daily in many forms such as family, workplace, and/or community experiences. More importantly for this discussion, experiences can be deliberate, such as during a classroom experience. When this technique of experiential learning is used, it maximizes learners' skills by allowing them to learn from their own experiences (Kolb & Lewis, 1986). This is when the full potential of learning can be realized (Kolb & Lewis, 1986).

Kolb (1984) also uses three characteristics to describe experiential learning. First, learning is best described as a process where concepts are derived from and modified by experience, not outcomes. Next, learning is continuous. Finally, the process of learning requires resolutions for conflicts to use in everyday life.

Figure 2.3 shows is a diagram that Kolb created based off of Piaget's idea of assimilating and accommodating. It shows the four learning styles he believes each person fits into. Divergers are learners who take concrete experiences and learn from them. According to Kolb, these types of learners like to learn through lecture and/or experiential learning. Convergers are learners who use abstract conceptualization and active experiments. These learners learn best through interaction. Accommodators are learners who use concrete and active experiences. Accommodators learn best when taught using experiential learning, not lectures. Finally

Assimilators use abstract conceptualization and reflection. These learners learn best when taught using lectures.

This idea of multiple learning styles allows for the students who need multiple methods. Each student can be a mix of these styles and defining what type of learning style students are may help assist teachers when choosing a teaching method.

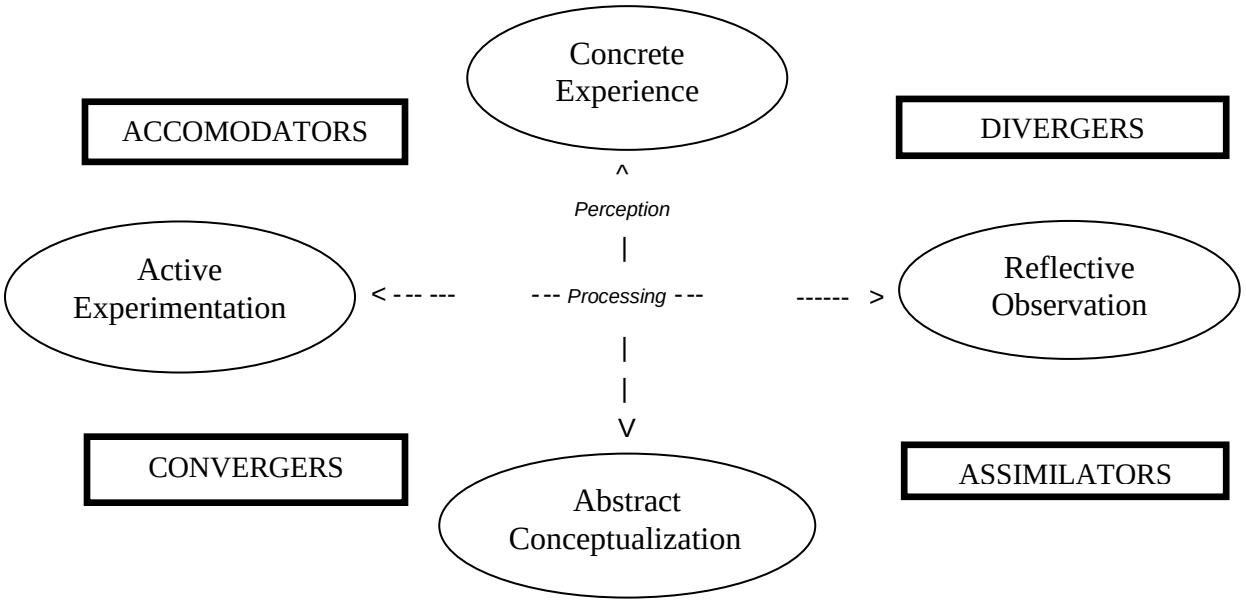

Figure 2.4 Kolb's Learning Style Diagram (Kolb, 1984).

Critical Thinking

Critical thinking can be traced to early philosophies of Plato and Aristotle (Burris & Garton, 2004). Critical thinking is also becoming more important in every educational situation. There is an emphasis for students to have the ability to understand and use information, not just possess (Richardson, 2003). Critical thinking can be thought of as a self-guided, self-disciplined thinking which attempts to reason at the highest level of quality in a fair-minded way (Elder, 2007). Critical thinking is a related to problem-based learning in that they both encourage

students to think outside of the box. Critical thinking allows students to create an explanation or reason for a situation based off of the knowledge they already know.

Research in agricultural education on critical thinking has been conducted (Myers & Dyer, 2004; Rudd, Baker, & Hoover, 2000; and Torres & Cano, 1995) but there has been little done to research the effects of specific teaching methodologies (Ricketts & Rudd, 2003).

Problem-Based Learning Approach

Dewey (1938) describes the ability to think critically as a way to find meaning in the world in which we live. Critical thinking and problem-based learning are said to go hand in hand (Sternberg and Baron, 1985). "Three-quarters of a century of educational literature suggests the main emphasis in schools has been teaching students facts, even though teachers and curriculum designers have attested to the importance of teaching students to think" (Cano, 1990). This statement shows that even though lecture based teaching is the go to method, it may not always be the best method for students.

Problem-based learning (PBL) began in the early 1970s at McMaster University in Canada. PBL has mostly been used in medical and professional school but has slowly been adapted for use in primary, secondary, and post-secondary educations (Barrows & Keelson, 1995). This method is thought of as a combination of cognitive and social constructivist theories, as developed by Piaget and Vygotsky (a Soviet psychology), respectively. Problem-based learning encourages a student to acquire knowledge about a certain content area and then develop thinking skills and strategies based around the content (Burris, Garton, & Terry, 2005). PBL was designed to help students construct a wide and flexible knowledge base; to develop effective problem-solving skills; aid in self-directed, lifelong learning skills; and to become

intrinsically motivated to learn (Barrows & Keelson, 1995). Studies (Vernon & Blake, 1993; Alleyne, et al., 2002; Leiux, 1996; and Dods, 1997) have explored the outcomes related to problem-based learning at virtually all levels of education (Burris, Garton, & Terry, 2005). Studies have shown that students exposed to PBL have shown growth in problem-solving skills (Ball & Knobloch, 2004; Hmelo, 1998).

Instructional and Learning Theories

Driscoll (1994) defines learning as "a persisting change in performance or performance potential that results from experience and interaction with the world" (Driscoll, 2003). She defines instruction as "…any deliberate arrangement of events to facilitate a learner's acquisition of some goal" (Driscoll, 2000). She states that instructional theories account for "a deliberate arrangement of learning conditions to promote the attainment of some intended goal," in this case the intended goal is achievement (Driscoll, p 332). Instructional theory suggests that creating an instructional system will promote learning. The idea of a lesson plan comes from the instructional learning theory (Dick, Carey, & Carey, 2005; Morrison, Ross, & Kemp, 2004; Smith & Ragan, 2005). As far as the learning theory, it comes from Gagne (1965). He believed there are five categories of learning. Verbal information, an example is previously learned materials. Intellectual skills which include: discriminations, concrete concepts, defined concepts, rules, and higher order rules. Cognitive strategies, an example is when a person employs their own personal way to guide learning, thinking, acting, and feeling. Attitudes, when a person chooses their actions based on how they feel internally. Finally, the last learning category is motor skills, which involves the actual execution of movements. These categories helped Driscoll come up with the following diagram, linking instructional and learning theories.

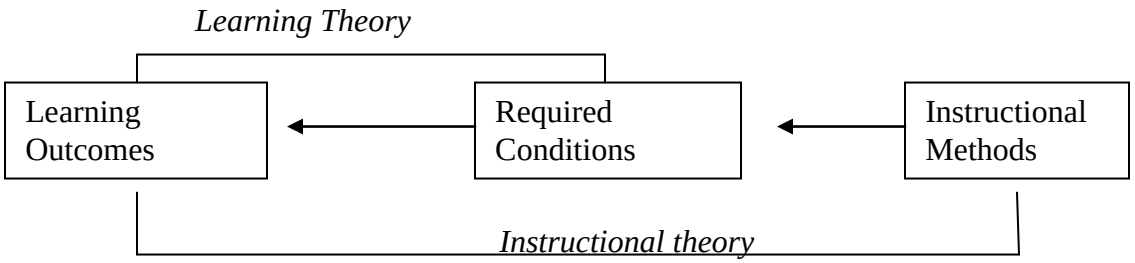

Figure 2.5. Relationship between Instructional Theory and Learning Theory (Driscoll, 1994)

Increasing Achievement Using Experiential Teaching

If there is a teaching method that will increase that probability, teachers should use the method or at least integrate it into their course(s). Borzak's (1981) field study found that active experimentations allow students to take an active role in their learning, therefore "owning" their knowledge. This ownership happened more with the experiments than with the knowledge learned in lecture classes. Another way to increase achievement is with problem-based teaching-another form of experiential teaching, where the student has to increase critical thinking, therefore increasing their knowledge on the subject matter (Ngeow & Kong, 2001). Having students come up with a solution to a problem will encourage them to think critically. There are many ways to solve many problems; allowing students to come up with the solutions on their own will encourage them to think "out of the box." With this increase in knowledge, it is assumed, there will be an increase in achievement. On the other hand, there have been studies (Burris, & Garton, 2004; Brown, 1998) showing that students instructed using the problem-based approach during lecture classes also increase knowledge, subsequently increases achievement (Sundblad, Sigrell, Knuttson, and Lindkvist, 2002).

Summary

This study focused on finding the most effective method of teaching to produce high rates of achievement in college-age students at the University of Georgia. The approaches and cycles discussed above were meant to show the framework of this study. The information in this chapter should provide information for how the hypotheses were obtained and how the results of this study will fit in with past research studies. Every student is different and there will never be one great way to teach but finding the most common ground would be a great breakthrough. Helping teachers use the best method would help the students and increase efficiency in teaching. If rates of achievement can be positively affected using a certain instructional method, teachers and students alike will benefit.

CHAPTER 3

METHODS AND PROCEDURES

Purpose and Objectives

The purpose of research was to increase the rate of achievement among animal science students at the University of Georgia. Objectives of the study were the following:

1. Determine the effects of the experiential teaching method on students' achievement in ADSC 3630;
2. Determine the effects of the lecture based teaching method of students' achievement in ADSC 3630;
3. Determine which of the teaching methods had an effect on students' achievement, positive or negative.
4. Determine if demographic characteristics have an effect on achievement for either teaching method.

The results of this study will assist current animal science professors in choosing the most effective instructional method, experiential teaching, lecture based teaching, or a mixture of both, to produce increased rates of achievement. This chapter will discuss the design of the research, the population studied, the instruments used to obtain the data, and explain the data collection process and analysis.

Research Design

The study was a comparison of the experiential teaching method and the lecture based teaching method as related to student achievement. A quasi-experimental, one group comparison

design was made using pre and post tests for ADSC 3630 at the University of Georgia's Animal Science department, along with basic demographics of the students. The experiential teaching method was hands-on laboratory style teaching where students participated in various activities with horses for approximately three hours per week. The lab section was conducting in various University of Georgia equine facilities, depending on the topic of the week. The students were in a classroom setting for approximately twenty minutes at the beginning of lab to discuss the topic of the day and address any concerns for the lab work. Lecture was strictly teacher lecturing using power point slides and other non-participatory means as reference.

The participants voluntarily enrolled in Dr. Kari Turner's ADSC 3630, Horse Production class for Fall Semester 2009 (N=21). The results may not be generalized beyond this population because it was a nonrandom sample. However, animal science majors are very similar from one institution to another; therefore, generalization with caution may contribute to the knowledge base of undergraduate, animal science, equine (horse) related students and professors beyond the University of Georgia's Animal Science department.

Population and Sample Selection

The target population for this study was all students enrolled in ADSC 3630, Horse Production and Management at the University of Georgia. Participants were enrolled in ADSC 3630 in the Fall semester of 2009. Participation in the study was voluntary but not random. All students agreed to participate.

Procedures

Data was collected by the researcher during the first and last ADSC 3630 class of the semester, with approximately fourteen weeks in between. Students were given an Informational Consent form (Appendix A) before being asked to fill in any documents. Approval from the Institutional Review Board (Appendix D) was sought and approved August 3, 2009.

After signing the consent form, participants completed a pre-test (Appendix C) and demographic survey (Appendix B). At the end of the semester, those who agreed to participate completed a post-test (Appendix C).

Data from the respondents (N=21) was entered into the Statistical Package for the Social Science Personal Computer version 18 (SPSS v. 18) where the identifiers were removed.

Instruments

An instrument designed to measure student achievement concerning knowledge of equine science and care was used as a pre-test and a post-test (Appendix C). This test was developed by the professor, Dr. Kari Turner, to make sure the questions were appropriate and effective in measuring knowledge. The students were asked to fill out a questionnaire, developed by the researcher to collect the demographic data of the participants (Appendix B).

Validity and Reliability

This study relied on the ability of the researcher and professor to develop a pre/posttest effective in measuring change in knowledge because there was no pilot test done prior to the study. Having a pretest also safeguarded the threat of prior knowledge from affecting the

outcome of the study. Since only one class was tested over the course of one semester, there was an increase in both content and face validity. The class only being at the University of Georgia decreased the ability to generalize findings. The researcher and professor taught ninety percent of all classes to reduce the effects of different teachers. The researcher scored all tests to eliminate the threat of scorer variability.

There was single selected group under observation, with a careful measurement being done before applying the experimental treatment and then measuring after. This design had a lot of internal validity because the influence of external threats to outcomes being measured has been minimized. It had no external validity and very little generalizability because there was no comparison group and no random assignment.

Data Collection

The data included scores on pre and post achievement tests (total score = 15), and demographic information collected from a questionnaire. The researcher and professor administered each test, and the researcher only scored each test and administered the questionnaire.

Data Analysis

A quasi-experimental, one-group comparison design was utilized. The data was analyzed using the Statistical Package for the Social Science Personal Computer version 18 (SPSS v. 18). Frequencies, means, standard deviations, Pearson's r correlations, and paired samples t-tests were the statistics used for reporting. Multiple statistical tests were used to incorporate any correlations with demographic data.

Pre and post test summated scores were created and growth scores (comparing post and pre scores) were created to determine the amount of change in students between pre and post measurements. This was done to answer objectives one, two, and three.

Participant demographic information, including whether they owned a horse, participated in extracurricular activities, had taken previous courses, and self-reported prior knowledge, was used to compare scored based on previous experiences of participants. This was done to answer objective four.

Summary

Chapter three explained the methods and procedures conducted in this study regarding rate of achievement based on teaching method. Threats to validity and reliability were discussed. The methods and procedures employed were outlined. The instruments used were described, as well as the data collection and analysis procedure. Chapter four will provide a detailed report of the data and a discussion of the results.

CHAPTER 4

RESULTS

Chapter one introduced the problem and Chapter two explained the related literature and theoretical framework related to this study. Chapter three explained in detail the methods and procedures, and in this chapter the results will be presented. Each of the objectives will be discussed and the hypotheses will be confirmed or discredited.

Objective 1: Determine the effects of the experiential teaching method on students' achievement in ADSC 3630.

After using a paired samples t-test to analyze the lab data, evidence exists to suggest the experiential portion was statistically significant (p=.000) (Table 1), indicating that students in the experiential lab scored significantly higher on the test following exposure to the lab. The mean of the lab pre test score was (*M*=2.05, *SD*=1.28) and the lab post test score was (*M*=4.81, *SD*=1.47) (Table 2).

Table 4.1
Experiential (Lab) Pre and Post Score

	t	df	Sig. (2-tailed)
Pre/PostLabScore	-6.679	20	.000

Table 4.2
Experiential (Lab) Pre and Post Scores Separately

	Mean	Standard Deviation
LabPreScore	2.0476	1.28360
LabPostScore	4.8095	1.47034

After performing a frequency test on the data, the results showed an increase in rate of achievement (percent improvement) when the experiential teaching method was used. This

increase was determined by analyzing the pre and post test scores for the items related to the lab portion of ADSC 3630. The table below (Table 3) shows what the frequency of correct and incorrect answers were, followed by the percentage of these answers (N=21).

Table 4.3
Experiential (Lab Section) Only Questions: f/%. (N=21)

Item: Lab Question	Pre-Test Incorrect (f/%)	Pre-Test Correct (f/%)	Post-Test Incorrect (f/%)	Post-Test Correct (f/%)
1 (Actual #3)	14/66.7	7/33.3	9/42.9	12/57.1
2 (Actual #6)	20/95.2	1/4.8	10/47.6	11/52.4
3 (Actual #7)	19/90.5	2/9.5	2/9.5	19/90.5
4 (Actual #8)	11/52.4	10/47.6	8/38.1	13/61.9
5 (Actual #11)	15/71.4	6/28.6	2/9.5	19/90.5
6 (Actual #12)	20/95.2	1/4.8	19/90.5	2/9.5
7 (Actual #13)	8/38.1	13/61.9	8/38.1	13/61.9
8 (Actual #15)	18/85.7	3/14.3	9/42.9	12/57.1

Note: f=frequency, %=percentage, (Actual #) =the item number on the original document.

Objective 2: Determine the effects of the lecture based teaching method of students' achievement in ADSC 3630.

After using a paired samples t-test to analyze the lecture data, evidence exists to suggest the lecture based portion was statistically significant (.000) (Table 4), indicating that students scored significantly higher on the test following exposure to the lecture. The mean of the lecture pre test score was (M=1.67, SD=1.11) and the lecture post test score was (M=5.67, SD=1.15) (Table 5).

Table 4.4
Lecture Pre and Post Score

	t	df	Sig. (2-tailed)
Pre/PostLectureScore	-12.087	20	.000

Table 4.5
Lecture Pre and Post Score Separately

	Mean	Standard Deviation
LecturePreScore	1.6667	1.11056
LecturePostScore	5.6667	1.15470

After performing a frequency test on the lecture section, the results showed an increase in rate of achievement (percent improvement) for the lecture based section. This increase was determined by analyzing the pre and post-test scores for the items related to the lab portion of ADSC 3630. The table below (Table 6) shows what the frequency of correct and incorrect answers were, followed by the percentage of these answers (N=21).

Table 4.6
Lecture based Only Questions: f/%. (N=21)

Item: Lecture Question	*Pre-Test Incorrect (f/%)*	*Pre-Test Correct (f/%)*	*Post-Test Incorrect (f/%)*	*Post-Test Correct (f/%)*
1	11/52.4	10/47.6	1/4.8	20/95.2
2	19/90.5	2/9.5	5/23.8	16/76.2
3 (Actual #4)	15/71.4	6/28.6	4/19	17/81
4 (Actual #5)	10/47.6	11/52.4	1/4.8	20/90.5
5 (Actual #9)	18/85.7	3/14.3	2/9.5	19/90.5
6 (Actual #10)	21/100	0/0	14/66.7	7/33.3
7 (Actual #15)	18/85.7	3/14.3	1/4.8	20/95.2

Note: f=frequency, %=percentage, (Actual #) =the item number on the original document.

Objective 3: Determine which of the teaching methods had an effect on students' achievement, positive or negative.

After using a paired sample t-test to analyze the data, evidence exists to suggest that the lecture based part of the study showed more of an increase in achievement than the lab based experience. When using the paired sample t-test, the overall growth was determined as well as the difference in post test scores. The lab growth showed a mean of (M=2.76, SD=1.89) and lecture growth (M=4.00, SD=1.52) (Table 7). The p-value (.011) shows evidence to suggest that the overall growth of the class is statistically significant (Table 8). The post scores showed, (M=4.81, SD=1.47) for the lab section and (M=5.67, SD=1.15) for the lecture section (Table 9). The p-value (.030) shows evidence to suggest that the post test scores are statistically significant (Table 10).

Table 4.7
Overall Growth for Lab and Lecture Sections

	Mean	Standard Deviation
LabGrowth	2.7619	1.89486
LectureGrowth	4.0000	1.51658

Table 4.8
Overall Growth for Lab and Lecture Sections

	t	df	Sig. (2-tailed)
Lab/LectureGrowth	-2.805	20	.011

Table 4.9
Post test score for Lab and Lecture Sections

	Mean	Standard Deviation
LabPostScore	4.8095	1.47034
LecturePostScore	5.6667	1.15470

Table 4.10
Overall Score for Lab and Lecture Sections

	t	df	Sig. (2-tailed)
Lab/LecturePostScore	-2.335	20	.030

Objective 4: Determine if demographic characteristics have an effect on achievement for either teaching method.

The first part of objective 4 is analyzing data related to horse ownership. Evidence exists to suggest that horse ownership plays a role in the rate of achievement for the experiential (lab) teaching part of the study. For the participants who reported owning horses, the lab pre test mean was (M=2.70, SD=1.34) and the lab post test mean was (M=4.50, SD=1.43) (Table 11). This shows an approximate rate of achievement of 1.8 points out of a possible 8. The lecture pre test mean was (M=1.70, SD=1.42) and the lecture post test mean was (M=5.60, SD=1.26) (Table 11). This shows an approximate rate of achievement of 3.9 points out of a possible 7. The p-value for the lab pre and post scores was .014 (Table 12) and the p-value for the lecture pre and post scores was .000 (Table 12). Both are statistically significant.

Table 4.11
Pre and Post Scores for Lab and Lecture Sections for Horse Owners

	Mean	Standard Deviation
LabPreScore	2.7000	1.33749
LabPostScore	4.5000	1.43372
LecturePreScore	1.7000	1.41814
LecturePostScore	5.6000	1.26491

Table 4.12
Results for the paired samples t-test

	t	df	Sig. (2-tailed)
LabPre/PostScore	-3.038	9	.014
LecturePre/PostScore	-7.134	9	.000

For non-horse owners, there was also evidence to suggest that not owning a horse plays a role in rate of achievement. It is more uniform between the lab portion and the lecture portion. The lab pre test mean was (*M*=1.45, *SD*=.934) and the lab post test mean was (*M*=5.09, *SD*=1.51) (Table 13). The lecture pre test mean was (*M*=1.64, *SD*=.81) and the lecture post test mean was (*M*=5.72, *SD*=1.10) (Table 13). The p-values for both sections were .000 (Table 14).

Table 4.13
Pre and Post Score for Lab and Lecture Sections for non-horse owners

	Mean	Standard Deviation
LabPreScore	1.4545	.93420
LabPostScore	5.0909	1.51357
LecturePreScore	1.6364	.80904
LecturePostScore	5.7273	1.10371

Table 4.14
Results for the paired samples t-test

	t	df	Sig. (2-tailed)
LabPre/PostScore	-8.032	10	.000
LecturePre/PostScore	-9.867	10	.000

The second section of objective 4 is whether or not the participants had taken previous horse related classes. When a participant marked yes to having participated in a previous class that pertained to horses, it means that they have taken a class, at the University of Georgia, that's main emphasis was horses. Examples of these classes include, but are not limited to, Pleasure Horse Management, Equine (horse) Nutrition, Equine Physiology, etc. For the six participants

who reported no previous horse classes, there was a large increase in rate of achievement for the lecture section. The lecture pre test mean was (*M*=.833, *SD*=.41) and the lecture post test mean was (*M*=5.83, *SD*=.75) (Table 15). This shows a 5 point increase in the rate of achievement, out of a possible 7. The lab pre test mean was (*M*=1.67, *SD*=1.63) and the lab post test mean was (*M*=4.17, *SD*=1.83) (Table 15). This shows an increase but not as much as the lecture portion. The p-value for the lecture portion was .000 (Table 16), suggesting a statistically significant increase at the alpha=0.05 level.

Table 4.15
Pre and Post Scores for Lab and Lecture Sections for no previous class

	Mean	Standard Deviation
LabPreScore	1.6667	1.63299
LabPostScore	4.1667	1.83485
LecturePreScore	.8333	.40825
LecturePostScore	5.8333	.75277

Table 4.16
Results for the paired samples t-test

	t	df	Sig. (2-tailed)
LabPre/PostScore	-2.366	5	.064
LecturePre/PostScore	-13.693	5	.000

The fifteen participants who reported having taken previous classes showed increased rate of achievement that were almost equal. The lab pre test mean was (*M*=2.20, *SD*=1.15) and the lab post test mean was (*M*=5.07, *SD*=1.28) (Table 17). The lecture pre test mean was (*M*=2.00, *SD*=1.13) and the lecture post test mean was (*M*=5.60, *SD*=1.29) (Table 17). Both sections showed p-values of .000 (Table 18).

Table 4.17
Pre and Post scores for Lab and Lecture Sections for classes previously taken

	Mean	Standard Deviation
LabPreScore	2.2000	1.14642
LabPostScore	5.0667	1.27988
LecturePreScore	2.0000	1.13389

LecturePostScore	5.6000	1.29835

Table 4.18
Results for the paired samples t-test

	t	df	Sig. (2-tailed)
LabPre/PostScore	-6.763	14	.000
LecturePre/PostScore	-9.000	14	.000

The third section for objective 4 is whether or not the participants participated in horse related activities outside of class. The horse related activities item describes participants that take part in extracurricular activities, some associated with the University and some not. These activities include, but are not limited to, competitive riding, trail riding, working at a horse farm, working at a veterinary clinic, etc.

The students who did not participate in extracurricular activities showed an increase in achievement in both lab and lecture sections. The lab pre test mean was (M=1.33, SD=1.00) and the lab post test mean was (M=4.89, SD=1.17) (Table 19). The lecture pre test mean was (M=1.22, SD=.44) and the lecture post test mean was (M=5.44, SD=1.33) (Table 19). Both sections had a p-value that was statistically significant (.000) (Table 20).

Table 4.19
Pre and Post Scores for Lab and Lecture Sections for no extracurricular activities

	Mean	Standard Deviation
LabPreScore	1.3333	1.00000
LabPostScore	4.8889	1.16667
LecturePreScore	1.2222	.44096
LecturePostScore	5.4444	1.33333

Table 4.20
Results for the paired samples t-test

	t	df	Sig. (2-tailed)
LabPre/PostScore	-7.491	8	.000
LecturePre/PostScore	-9.731	8	.000

The students who did participate in extracurricular activities also showed an increase in rate of achievement. The lab pre test mean was (*M*=2.58, *SD*=1.24) and the lab post test mean was (*M*=4.75, *SD*=1.71) (Table 21). The lecture pre test mean was (*M*=2.00, *SD*=1.35) and the lecture post test mean was (*M*=5.83, *SD*=1.02) (Table 21). The lecture section had a p-value of .000 (Table 22).

Table 4.21
Pre and Post Scores for Lab and Lecture Sections for extracurricular activities

	Mean	Standard Deviation
LabPreScore	2.5833	1.24011
LabPostScore	4.7500	1.71226
LecturePreScore	2.0000	1.34840
LecturePostScore	5.8333	1.02986

Table 4.22
Results for the paired samples t-test

	t	df	Sig. (2-tailed)
LabPre/PostScore	-3.684	11	.004
LecturePre/PostScore	-7.826	11	.000

The final section for objective 4 is self-reported prior horse knowledge; this was the researcher's way to measure self-efficacy. Participants had to choose from this list: none, below average, average, above average. The table below (Table 23) shows the number of participants who chose each option.

Table 4.23
Frequency of Self-Reported Knowledge Items

	Frequency	Percent	Valid Percent	Cumulative Percent
None	1	4.8	4.8	4.8
Below Average	3	14.3	14.3	19.0
Average	7	33.3	33.3	52.4
Above Average	10	47.6	47.6	100.0

Data for the "none" category was unable to be analyzed as there was only one respondent. This participant did, however, have a large increase in rate of achievement, lab growth was five points out of eight and lecture growth was four points out of seven.

The participants who answered "below average" had more of an increase in the lecture section than the lab section. The lab pre test mean was (*M*=1.33, *SD*=.57) and the lab post test mean was (*M*=4.33, *SD*=1.53) (Table 24). The lecture pre test mean was (*M*=1.67, *SD*=1.15) and the lecture post test mean was (*M*=6.33, *SD*=1.15) (Table 24). P-values were statistically significant, lab p-value was .035 and lecture p-value was .020 (Table 25).

Table 4.24
Pre and Post Test Scores for Lab and Lecture Sections for Below Average

	Mean	Standard Deviation
LabPreScore	1.3333	.57735
LabPostScore	4.3333	1.52753
LecturePreScore	1.6667	1.15470
LecturePostScore	6.3333	1.15470

Table 4.25
Results for the paired samples t-test

	t	df	Sig. (2-tailed)
LabPre/PostScore	-5.196	2	.035
LecturePre/PostScore	-7.000	2	.020

The participants who answered "average" had an almost even increase in rate of achievement. The lab pre test mean was (*M*=1.57, *SD*=1.27) and the lab post test mean was (*M*=5.57, *SD*=1.39) (Table 26). The lecture pre test mean was (*M*=1.28, *SD*=.95) and the lecture post test score was (*M*=5.57, *SD*=1.27) (Table 26). P-values were statistically significant, lab p-value was .001 and lecture p-value was .000 (Table 27).

Table 4.26
Pre and Post Scores for Lab and Lecture Sections for Average

	Mean	Standard Deviation
LabPreScore	1.5714	1.27242
LabPostScore	5.5714	1.39728
LecturePreScore	1.2857	.95119
LecturePostScore	5.5714	1.27242

Table 4.27
Results for the paired samples t-test

	t	df	Sig. (2-tailed)
LabPre/PostScore	-6.481	6	.001
LecturePre/PostScore	-7.579	6	.000

Participants who answered "above average" showed a larger increase in rate of achievement for the lecture section. The lab pre test mean was (M=2.80, SD=1.03) and the lab post test mean was (M=4.40, SD=1.51) (Table 28). The lecture pre test mean was (M=1.90, SD=1.28) and the lecture post test mean was (M=5.50, SD=1.17) (Table 28). P-values were statistically significant, lab p-value was .013 and lecture p-value was .000 (Table 29).

Table 4.28
Pre and Post Score for Lab and Lecture Sections for Above Average

	Mean	Standard Deviation
LabPreScore	2.8000	1.03280
LabPostScore	4.4000	1.50555
LecturePreScore	1.9000	1.28668
LecturePostScore	5.5000	1.17851

Table 4.29
Results for the paired samples t-test

	t	df	Sig (2-tailed)
LabPre/PostScore	-3.073	9	.013
LecturePre/PostScore	-6.647	9	.000

points. Critical thinking is a large component of any classroom, including it in lecture may increase achievement by making students think on their own while learning through lecture (Richardson, 2003). Understanding what is being taught instead of just possessing the knowledge will increase achievement with any teaching method.

Summary of Objective 3

Objective 3: Determine which of the teaching methods had an effect on students' achievement, positive or negative.

The results of this objective showed that while both teaching methods increased rate of achievement, the lecture based method had more of an increase. There ultimately was more than a 1 point difference in lecture to lab. The frequencies, t-statistics, p-values, and means all showed that the lecture based method increased rate of achievement more than the experiential teaching method. Through all tests, the overall lecture growth was more than the lab growth. All results were statistically significant and evidence exists to suggest that both teaching methods increase rate of achievement but the lecture based method shows a greater increase. There have been mixed results from previous studies as to which method actually produces better results. Newsome, Wardlow, and Johnson suggest that the decision should be made by the teacher and may change from class to class and school to school. Different types of students need different methodologies. Finding the best method for the student population is most important (New, Wardlow, and Johnson, 2005).

methods but the lecture based method had an approximate 1 point increase over the experiential method.

Section four pertained to self-reported prior horse knowledge. There were four options to choose from: none, below average, average, and above average. There was one participant who chose "none", this participant had an increase in both sections but data could not be correlated due to lack of sample size. Three participants chose "below average" and these participants showed statistically significant results in both sections, with the lecture section having slightly larger increase. Seven participants chose "average" and these participants also showed statistically significant results in both sections, with almost identical increase. Finally, ten participants chose "above average" and these participants showed statistically significant results for both sections. There was a slightly greater increase in the lecture section.

Incorporating the theories of Dewey, Piaget, Lewin, and Kolb may produce positive outcomes. This study did not have a reflection component like the ones depicted in the theories, including once, especially with the different demographic characteristics may produce different results (Kolb, 1984).

Recommendations for Objective 1

Future research should increase the sample size and the longevity of the study. There should also be a control group used to establish a baseline for knowledge prior to instruction. Having the lab setting more controlled may increase the rate of achievement. There are many reasons why the lab showed less of an increase in achievement but one reason may be a "distracter factor." When students are outside and with live animals there are many more things to look at and pay attention than just the instructor. Taking this into consideration, having a very

structured lab setting may have a positive effect on the increased rate of achievement. The teacher may choose to break students of comparable ability into smaller groups to lower the risk of distractions or having student with more prior knowledge lead a discussion for a smaller group. The teacher may also want to spend more time away from the live animals and distractions by having an indoor classroom to meet in before and after to go over expectations and reflect on what they should have learned. Having a study to show different types of lab settings, some more controlled than others, would be ideal. There are many ways that this study could branch off.

Recommendations for Objective 2

Future research for this objective also should increase sample size and longevity of the study. There should also be a control group used to establish a baseline for knowledge prior to instruction. Having two separate classes and tests would also account for some variance. Having different types of lecture may cause different results. Such as, having multiple instructors or guest speakers, having a more varied sample (ethnicity, SES, etc), and lecture setting may have an effect. Also, when giving pre tests, the teacher can never be completely positive that he/she will cover everything that was tested. With this in mind, the instruments used to test the rates of achievement could be more structured in the future (i.e. making sure that everything tested was covered with same emphasis on each item).

Recommendations for Objective 3

For future research, as was said above, increasing sample size and longevity may produce different results. The results in every objective were statistically significant with small standard deviations. This leads one to believe that a larger sample size will just solidify more what was

found in this study. There are many reasons why the lecture based method may have influenced a larger increase in rate of achievement but there was also no control group. In future studies, separating groups more and having a more diverse sample may produce different results.

Recommendations for Objective 4

Collecting demographic data has to always account for truthfulness. If there was a way to ensure that all of the data collected was truthful, it would protect reliability a bit more. Having a larger sample size and a more diverse population would also increase the generalizability of the study. Finding participants from various backgrounds, ethnicities, degrees, and majors would help also.

For the section about horse ownership, if there was a way to separate horse owners from non-horse owners, the study may produce interesting results. In the case of this study, owning a horse proved to be somewhat detrimental to achievement in the lab portion. Maybe students who own horses believe that they know everything there is to know about the lab portion and decide not to pay attention. Maybe the students who do not own horses think they need to listen and learn extra hard so they can "catch up" with the students who own horses. The lab setting may be too "boring" for the students who own horses and they need to be challenged more. There are many reasons why horse ownership can effect which teaching method works best, finding out as many of those reasons as possible will help educators teach more efficiently.

For the section about having taken previous horse related classes, there are many reasons why the results differed between students who had and students who had not taken classes prior to ADSC 3630. The students who have taken previous horse classes may have been more comfortable with the vocabulary and the fact that they are around live animals. The students

who had not taken classes about horses prior to ADSC 3630 may not have even known what some of the words were on the pre test. Separating students who have and have not taken previous classes (like prerequisites) may increase the educators' ability to reach each student more efficiently. Being able to give special attention to students who are not sure about the material and being able to challenge those who are comfortable may make a huge difference in rate of achievement.

For the section about participation in extracurricular activities, participants who did participate in extracurricular horse activities will obviously be more comfortable around horses. Any extra knowledge that can be brought into the classroom will give certain students an advantage. Like with the other two sections, separating the more horse related students from the less horse related students might provide the ability to challenge each group differently. The students who know more about horses need to be challenged more and those who do not, will be challenged but not to the same degree. Performing studies like this may provide even more answers for teaching methods.

Finally, the section about self-reported prior knowledge leads to a lot of ideas in future research. A future study may ask students to report their prior knowledge and then separate them accordingly. Giving each group a different pre and post test may yield much different results. The more knowledge they report, the "harder" the tests are and so on. Also, asking more questions about how they are reporting their prior knowledge may lead to other ideas.

Summary

Hypothesis one was negated, there was a difference in the outcome based on teaching method. Hypothesis two was also negated because the lecture based method showed a higher

rate of achievement overall. All in all, the future studies should have larger, more diverse sample populations. Future studies should also go to multiple universities, fields, and majors. The longer these studies can be performed, the more validity there will be in the rate of achievement. There are many possible studies that can help educators come to agreement on an efficient ways to increase rate of achievement for students. Something also worth noting is that there were eight lab related questions and seven lecture related questions on the pre and post test. Re-analyzing the data and deleting one question from the lab questions may yield different results as far as the significance, means, and frequencies. Going back and checking for questions missed frequently and confirming that everything on the tests was covered in class is a necessity also. Using different instruments to test for achievement may also help. A future study could combine problem-based learning, critical thinking, and reflection to see if different results are found. Combining as many proven teaching methods as possible may give teachers more resources to pull from if they see one thing is not working for a class. There are many future studies to be done but also a few different ways this exact study could be redone to yield more results.

student attitudes in a technical writing in an agricommunication course. *Journal of Agricultural Education.* 39 (4), 65-75.

Dewey, J. (1938/1997). *Experience and Education*. New York: Simon and Schuster.

Dick, W., Carey, L., & Carey, J. O. (2005). *The systematic design of instruction* (6th Ed.). New York: Allyn and Bacon.

Dods, R. F. (1997). An action research study of the effectiveness of problem-based learning promoting the acquisition and retention of knowledge. *Journal for the Education of the Gifted*, 20(4), 423-437.

Doyle, W. & Carter, K. (Eds.) (1987). Choosing the mean of instruction: A research perspective. *Educational Horizons.* New York: Longman.

Driscoll, M. P. (1994, 2000). *Psychology of Learning for Instruction.* Bostong: Allyn and Bacon.

Duch, Barbara (2008). *Problem Based Learning*. University of Delaware. http://www.udel.edu/pbl/

Elder, Linda (2007). A brief conceptualization of critical thinking. Defining Critical Thinking. http://www.criticalthinking.org/page.cfm?CategoryID=51

Ewing, J. C. & Whittington, M. S. (2006). Examining teaching techniques used in college of agriculture classes. *American Association for Agricultural Education.*

Ewing, J. C. & Whittington, M. S. (2007). Teaching techniques used by professors in a college of agriculture and their relationship to cognitive levels of discourse. *2007 AAAE Research Conference*. Vol. 34. 181-196.

Freire, P (1970). *Pedagogy of the oppressed.* (Myra Bergman Tramos, Trans.). New York: Seabury Press.

Gagne, R. M. (1977). The conditions of learning. New York: Holt, Rinehart, and Winston.

Goodenough, Florence L. (1950). Edward Lee Thorndike: 1874-1949. *The American Journal of Psychology*. 63, 291-301.

Hancock, L. and Wingert, P. (1996). Why do schools flunk biology? *Newsweek,* 27(8), 58-59.

Hmelo, C. E. (1998). Problem-based learning: Effects on the early acquisition of cognitive skill in medicine. *The Journal of the Learning Sciences,* 7(2), 173-208).

Hendricks, B. (1994). *Improving evaluation in experiential education.* ERIC Clearinghouse on Rural Education and Small Schools. Charleston, WV. (Eric Document Reproduction Service No. ED376998)

Johnson, D. M., Wardlow, G. W., & Franklin, T. (1997). Hands on activities versus worksheets in reinforcing physical science principles: effects on student achievement and attitude. *Journal of Agricultural Education*, 38(3), 9-17.

Kantor, Harvey, & Tyack David B., eds. (1982). *Work, Youth, and Schooling: Historical Perspectives on Vocationalism in American Education.* Stanford, Calif.: Stanford University Press.

Kelly, Tamara (2009). *P i a g e t ô s E x p e r i e.n t i a l L e a r n i n g P r o c e* effective.leadershipdevelopment.edu.au

Kliebard, H.M. (1995). *The struggle for the American curriculum.* New York: Routledge.

Kolb, D. A. (1984). *Experiential Learning: Experience as the source of learning and development*. New Jersey: Prentice Hall.

Kolb, D. A, & Lewis, L. H. (1986). Facilitating experiential learning: Observations and reflections. *New Directions for Continuing Education,* 30, 99-107.

Kraft, R. J. (1986). Towards a theory of experiential learning. In R. Kraft and M. Sakofs (eds.), *the theory of experiential education* (7-38). Boulder, CO: Association of Experiential Education.

Leiux, E. M. (1996). A comparative study of learning in lecture vs. problem-based format. *Newsletter of the Center for Teaching Effectiveness,* Spring.

Lipman, M. (1991). Thinking in Education. Cambridge, UK: Cambridge University Press.

Mackeracher, D., (2004). *Making Sense of Adult Learning*. Boston: Twayne Publishers

Mayer, R. E. (2002). Rote versus meaningful learning. *Theory into Practice,* 41(4), 226-232.

Myers, B. E., & Dyer, J. E. (2004). The influence of student learning style on critical thinking skill. *Proceedings of the Thirty-first Annual National Agricultural Education Research Meeting, 31,* 379-390.

Mezirow, J. (1994). Understanding transformation theory. *Adult Education Quarterly,* 44(4), 222-244. (Eric Document Reproduction Service No. EJ487444)

Morrison, G., Ross, S., & Kemp, J. (2004). *Designing effective instruction.* (4th Ed.). Indianapolis, IN: Wiley & Sons.

National Research Council. (1988). *Understanding agriculture: New directions for education.* Washington: national Academy Press.

Newmann, F. (1992) *Student Engagement and Achievement in American Secondary Schools*. Teachers College Press. pp. 2–3.

Newsome, L. A., Wardlow, G. W., & Johnson, D. M. (2005). Effects of lecture versus experiential teaching method on cognitive achievement, retention, and attitude among high school agriscience students. *National AAAE Research Conference,* 146-156.

Ngeow, K. and Kong, Y. (2001). *Learning to learn: Preparing teachers and students for problem-based learning.* ERIC Digest. (Eric Document Reproduction Service No. ED457524)

Piaget, J. (1970). Piaget's Theory. In P. Mussen (Series Ed.), *Handbook of child psychology, 1*(3), 703-732.

Prentice Hall. (n.d.) *Smith Hughes act of 1917.* Retrieved August 20, 2009, from http://cwx.prenhall.com/bookbind/pubbooks/dye4/medialib/docs.smith917.htm

Richardson, V. (2003). Constructivist pedagogy. *Teachers College Record.* 105(9), 1623-1640.

Ricketts, J. C., & Rudd, R. (2003). Growing the seeds of change: The effectiveness of teaching for critical thinking in the context of plant biotechnology. *Proceedings of the thirtieth Annual National Agricultural Education Research Meeting,* 30, 105-116.

Roberts, T. G., & Dyer, J. E. (2004). Characteristics of effective agriculture teachers. *Journal of Agricultural Education, 45*(4), 82-95.

Rudd, R., Baker, M, & Hoover, T. (2000). Undergraduate agriculture student learning styles and critical thinking abilities: Is there a relationship? *Journal of Agricultural Education 41*(3), 2-12.

Shields, R. W., Aaron, D., & Wall, S. (2001). What is Kolb's model of experiential education, and where does it come from? *Adult Education Q&As*, University of Toronto.

Smith, L., Wardlow, G. W. & Johnson, D. M. (2001). A problem-oriented approach to teaching agriscience compared with lecture and study questions: effects on achievement and attitude of high school students. 28th Annual National Agricultural Education Research Conference, Dec. 12, 2001. p 554-563.

Smith, P., & Ragan, T. (2005). *Instructional design*. (3rd Ed.). San Francisco, CA: Jossey-Bass.

Socioeconomic status. (n.d.). The American Heritage® New Dictionary of Cultural Literacy, Third Edition. Retrieved March 30, 2010, from Dictionary.com website: http://dictionary.reference.com/browse/socioeconomic status

Sternberg, R. J., & Baron, J. B. (1985, October). A statewide approach to measuring critical thinking skill. *Educational Leadership,* 40-41.

Sundblad, G, Sigrell, B., Knuttson, L, and Lindkvist, C. (2002). Students evaluation of a learning method: A comparison between problem-based learning and more traditional methods in specialist university training programme in psychotherapy. *Medical Teacher*, 24(3) 268-271.

Torres, R. M. & Cano, J. (1995). Critical thinking as influenced by learning style. *Journal of Agricultural Education, 36*(4), 55-62.

Vernon, D. T. & Blake, R. L. (1992). Does problem-based learning work? A meta-analysis of evaluative research. *Academic Medicine,* 68(7), 550-563.

Wassermann, Selma (1994). *Introduction to Case Method Teaching: A Guide to the Galaxy*. New York: Teachers College Press.

Wolf, K. J & Miller, L. E. (2009). Agricultural education perceived teach self-efficacy: a descriptive study of beginning agricultural education teachers. *American Association for Agricultural Education Research Conference.* May 20-22, 2009. Louisville, Kentucky. 571-586.

Wulff-Risner, L. & Stewart, B. (1997). Using experiential learning to teach evaluation skills. *Journal of Agricultural Education*, 38(3), 43-50.