Determining the relationship among laboratory satisfaction, motivated learning strategies, and performance of distance animal anatomy and physiology students and comparing their performance to on-campus students

by

Celsey J. Crabtree

B.S., Kansas State University, 2015
M.S., Colorado State University, 2017

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

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Abstract

Distance courses are in high demand, post-secondary institutions are being encouraged to offer more. Some studies have found distance science classes to be as effective in content and student success, as on-campus courses. Distance courses often require greater self-motivation and study skills and as a result, the success of students in distance courses may be more variable than what would normally be found in on-campus courses. To assess the role of student preparation and learning characteristics in a distance version of a senior-level college anatomy and physiology course the Motivated Strategies for Learning Questionnaire (MSLQ) was used to examine the relationship between motivation, self-regulated learning, and academic achievement in an online animal anatomy and physiology laboratory section. The online laboratory section ran in conjunction with an online lecture course and enrollment in both was required. The online laboratory section was compared to an on-campus laboratory section. A pre- and post-test was administered to students to determine knowledge gained and compared distance and on-campus scores. Additionally, distance student satisfaction was measured using a self-reporting Likert Scale survey.

The Motivation section of the MSLQ is intended to assess value, expectancy, and affect as reported by students. The Learning Strategies section is intended to assess use of cognitive, metacognitive, and resource management strategies. Construct mean scores were correlated with end of lab grades. Data from each semester, Spring 2021 and Fall 2021, were analyzed separately. Distance students from both semesters reported self-efficacy, task value, and help-seeking strategies were correlated to their final laboratory grade. In contrast, on-campus students reported control of learning beliefs, and self-efficacy to be correlated with their final laboratory grades. There were variations between semesters in effectiveness of distance learning based on

improvement in pre-test versus post-test scores given at the beginning and ending of the semester, respectively. Both semesters of distance students improved their anatomy knowledge more than the on-campus students.

When compared to the distance students in Fall 2021, Spring 2021 distance students spent more hours completing laboratory assignments, worked more hours per week, and were enrolled in more credit hours. Both semesters of distance students were overall satisfied with their experiences but Fall 2021 students rated the course satisfaction higher, which indicated distance students can be highly satisfied with distance laboratory courses. The differences in demographics could partially explain the differences in satisfaction scores between the two semesters as students in the distance Fall 2021 course reported overall a higher satisfaction score. Additionally, both semesters of distance students gained more anatomy knowledge when compared to the on-campus students, indicating mode of delivery was just as effective. Furthermore, each group of students reported different constructs that influenced academic performance, but majority of students reported that self-efficacy influenced academic performance. Students in the fall distance and on-campus courses did have similar motivations and learning strategies, such as task value and self-efficacy which are two components of self-regulated learning, that positively predict student satisfaction which could explain their overall satisfaction with the course. Additionally, the higher correlations with the MSLQ constructs and final laboratory grade could explain the knowledge gained in the fall semester.

Instructors could use known motivations to improve learning in the classroom despite mode of delivery and educate students about self-reflection and self-regulation methods. Instructors could provide students opportunities to self-assess efforts. Lastly, Animal Science programs can offer distance specific science classes and instructors should be encouraged to

explore opportunities to expand their programs using at-home laboratory kits that give students hands-on experiences.

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Major Professor
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Chapter 1 - Introduction

The demand for distance education has increased dramatically over the last several years, and no longer simply a trend. Distance education is about making knowledge accessible for those who are unable or choose not to be in a traditional classroom. Educators must focus on the quality of the education provided, both in the classroom and online, and use the technology and innovations to motivate, inspire, and educate the students of the 21st century.

Distance education courses offer learners flexible and independent learning experiences (Anderson, Annand, & Wark, 2005). Distance learners can study and learn at any time and place they want but students are responsible for planning, managing, and assessing their learning processes (Moore & Kearsley, 2012). The fact that distance learning is more flexible, and learner-centered requires learners to be self-regulated and use their skills more frequently (Kuo, Walker, Schroder, & Belland, 2014). Previous literature supports the theory that self-regulated learners are more successful in distance learning settings (Kuo et al., 2014; Yukselturk & Bulut, 2007). Equally, studies have also shown that some distance learners have difficulties in managing their learning processes, and are subject to failure (Barnard-Brak, Lan, & Paton, 2010; Lehmann, Hähnlein, & Ifenthaler, 2014). Therefore, it is vital to establish the self-regulated learning skills that allow learners to regulate and manage their own learning processes. Determining these skills can assist professors and instructional designers in developing new strategies that can help them acquire skills crucial for a successful distance learning experience.

Overall, there is an increased demand by students for distance delivered learning opportunities. These opportunities have led to the development of online animal science anatomy and physiology labs with at-home dissection kits, 3D software programs and interactive videos.

Few studies have been conducted that measure the learning experience for students in distance delivered scientific laboratories. With the growing number of post-secondary educational institutions offering distance education laboratory classes, it is necessary to conduct research on the student learning experience in scientific laboratories including the impact on the knowledge gained and the effectiveness of online laboratories.

Need for the Study

Some distance animal science programs require students to complete an anatomy and physiology course as part of the major curriculum. Traditionally, students have learned these subjects through on-campus lecture and laboratories utilizing fresh and preserved specimens. There is a concern regarding effectiveness of replacing on-campus (face-to-face) laboratories with laboratories in a distance format. To evaluate Kansas State University's Animal Science distance programs, this study is to determine the effectiveness of a distance animal anatomy and physiology laboratory section simultaneously with an on-campus laboratory section.

Anatomy and Physiology at KSU is a 4-credit hour course that focuses on maintenance of homeostasis via the interaction of physiologic systems. The course includes both a lecture and a laboratory component, with the lecture mainly focused on physiological mechanisms and interaction of systems, and the lab focused primarily on anatomy and organization of the mammalian body. Anatomy and Physiology is designed primarily as an overview of basic anatomy and physiology, to meet the broad range of student background and interests in this required course. The same instructor has offered the on-campus version of this course since 1997, every semester to approximately 120 students.

A typical week of on-campus delivery consisted of two 1 hour and 45-minute lecture sessions and a two-hour laboratory session each week. A weekly lab exercise and quiz was determined to be essential to the mastery of the instructional objectives.

Distance Class Design

The growing demand for the online degree option in Animal Science production/management caused the development of an online section of the anatomy and physiology course, first offered in Fall 2019. The distance anatomy and physiology laboratory were designed to assimilate the on-campus laboratory course as close as possible. Students were required to order a take-home kit from Carolina Biological, a science education supply company. The take-home kits were established by the instructor and the company to meet class assignment needs. The take-home kit contained the following preserved specimens and activities; 14-inch cat, sheep heart/lungs, pig kidney, sheep brain, cow eyeball, and sensory activities.

The online laboratory section of this class was made to be as nearly identical as possible as the on-campus laboratory section. Online students were required to read the same lab manual chapter, watch nearly identical dissection videos, complete the assignment, and take a quiz to complete each laboratory module. Skeleton laboratory activities were done using pictures as animal skeletons were not available to send to distance students within the kits. The on-campus students utilized fresh heart/lungs, kidney, brain, and eyeballs compared to the distance students utilized preserved.

The instructor used Canvas to organize weekly modules. The first introductory module contained the laboratory syllabus, safety information, introductory video, link to order distance

kit, and each student was required to pass the safety quiz before moving to the next module. Following the first module, each module contained a checklist outlining the requirements for that module, lab manual chapter providing additional information about the activity, a dissection video modeling what is required of the students, assignment, and summary of information quiz.

Problem Statement

Overall, there is an increased demand by students for distance delivered learning opportunities. These opportunities have led to the development of online animal science anatomy and physiology labs with at-home dissection kits, 3D software programs and interactive videos. Few studies have been conducted that measure the learning experience for students in distance delivered scientific laboratories. With the growing number of post-secondary educational institutions offering distance education laboratory classes, it is necessary to conduct research on the student learning experience in scientific laboratories including the impact on the knowledge gained.

Purpose of the Study

The purpose of this study is to research a distance animal anatomy and physiology laboratory course and correlate the variables including student learning (student achievement, satisfaction, performance, self-regulated learning), to an on-campus animal anatomy and physiology laboratory course.

Research Objectives

1. Describe the demographics of students who choose to enroll in a distance delivered anatomy and physiology laboratory class.
2. Describe student satisfaction of a distance delivered anatomy and physiology laboratory class.
3. Compare student knowledge gain between distance and face-to-face laboratory instruction.

   a. H_O: There is no difference in mean knowledge gained scores between distance students and on-campus students. (H_O: $\mu_{di} = \mu_{ca}$)

4. Analyze the relationship between motivated strategies for learning and student's knowledge gained.

   a. H_O: Student motivated strategies for learning will not predict students' knowledge gained (H_O: $R^2=0$).

   b. H_O: There is no difference in motivated strategies for learning and students' knowledge gained between distance students and on-campus students. (H_O: $\mu_{di} = \mu_{ca}$)

Limitations

1. Sample population was limited to the students enrolled in online anatomy and physiology course over two semesters at Kansas State University.
2. The findings of the study should not be generalized beyond similar populations.

3. Research focused on one specific discipline, therefore may not be representation of other courses or disciplines.
4. Number of distance students observed was limited by completion of course.
5. Student response rate was limited by the students willing to participate in the study.
6. The differences between the populations of students between the two semesters cause the results to be ungeneralizable.

Chapter 2 - Review of Literature

This chapter reviews related to constructivist theory, adult education, self-regulated learning, quality of distance laboratory courses, distance course standards, Motivated Strategies for Learning, Bandura's self-efficacy, and differences seen between Spring and Fall semester courses.

Constructivist Theory

Constructivist conceptions of learning can be found in the work of Dewey (1929), Bruner (1961), Vygotsky (1962), and Piaget (1980). Constructivism is a concept that students learn by combining new information with previous knowledge. Therefore, the theory suggests that learners construct understanding and meaning from experiences.

There are two main aspects of constructivism (Glasersfeld, 1996). First, learning is a process of knowledge construction instead of absorption. Each learner must construct his or her knowledge, concepts cannot be transmitted from teacher to learner by means of words. Learning occurs only when the learners are actively involved in the construction and reorganization of concepts. Second, knowledge is highly related to the environment in which the learner experiences and constructs the knowledge. Therefore, constructivists emphasize cognitive experience in authentic activities.

Dewey (1916) indicated the main function of education was to improve the reasoning process and use problem-solving methods. Therefore, the methods of constructivism emphasize the development of learner's ability in solving real life problems. Knowledge is then built around the process of discovery (Dewey, 1916). Dewey suggested that the teacher is more of a guide rather than a leader.

Adult Education Theory

Adult learners have responsibilities and situations that can affect learning and performance in a course. Adult learners manage their classes around those responsibilities and other barriers traditional students may not have. Most adult learners are highly motivated and task-oriented (Merriam & Caffarella, 1999). According to Knowles (1973), "characteristics of adult learners are: (a) increasing self-directedness, (b) learners' experience is a rich resource for learning, (c) learning readiness is related to developmental tasks of social roles, (d) immediacy of application, and (e) problem-centeredness."

Adult learners focus on setting particular learning goals for themselves, locate appropriate resources to meet those goals, decide on which learning methods work best for them and can evaluate their own progress (Brookfield, 1995). These characteristics connect the adult learning theory and self-regulated learning theory.

Constructivism in Adult Learning in Distance Education

Constructivists like Dewey believed that students naturally learn and work collaboratively in their lives. Interactivity provides ways to encourage learners and students can reflect on content and the learning that occurred. Adults come to realize their learning, responses and the feedback that emerges. Therefore, the interactions among the teacher and students are very crucial to distance learning (Huang, 2002).

Constructivism allows students more freedom to select and organize their learning processes and the teacher's role changes into more of a facilitator (Westera, 1999). The teacher still needs to create a safe environment for the learners to express themselves and to ask questions. Furthermore, it should be the teacher's duty to monitor the quality of learning and

discussions (Westera, 1999). It is also necessary for the teacher to support, and provide guidelines for the student (Huang, 2002).

Constructivist theory emphasizes that learning should be genuine and be related to real life experiences (Huang, 2002). This would be ideal for adult learners as they want to be able to learn skills that will relate to their life or work experiences. Therefore, the learning environment for adults should use real-world examples to allow for students to gain meaningful and authentic knowledge. Teachers should take that into consideration when planning and designing curriculum (Huang, 2002).

Adult distance learners are highly autonomous, self-directed, motivated, and individually different (Brookfield, 1995). Online learning should involve higher-order thinking skills to judge the quality of information. Learners must learn how to manage, examine, critique, and convert information into knowledge (Huang, 2002). Additionally, instructors can develop curriculum that relate classroom work to life or work experiences, provide valuable feedback, and focus on being a facilitator.

Self-Regulated Learning

Self-regulated learning was identified in the 1980's, after an increased focus on self-regulation in academic settings (Dinsmore, Alexander, & Loughlin, 2008). Self-regulation refers to the process through which learners convert their mental abilities into task-related academic skills. The learner displays personal initiative, determination, and adaptive skills when pursuing learning. (Zimmerman & Schunk, 2001).

Self-regulated learning entails behavioral skills in self-managing as well as the knowledge and sense of personal agency to use this skill in relevant situations. Furthermore, self-regulation is the ability to adjust current efforts from feedback. Students may use behavioral-self

regulation which entails self-observing and adjusting or covert self-regulation which involves monitoring and adjusting cognitive and affective states (Pintrich, 2000).

Effective self-regulation can be distinguished by the quality and quantity of one's self-regulatory processes. There are three phases to the self-regulatory processes: forethought, performance, self-reflection. There are two categories with forethought: task analysis and self-motivational beliefs. Goal setting and strategic planning are crucial parts of the task analysis category. These skills are of little value if the learner cannot motivate themselves to use them. Therefore, self-efficacy, outcome expectations, intrinsic interest and goal orientation are crucial to self-motivational beliefs (Pintrich, 2000).

The second phase of the self-regulatory process is the performance phase. The two major components of the performance phase are: self-control and self-observation. Self-control processes, self-instruction, imagery, attention focusing, and task strategies, help learners focus on the task at hand, and their effort. Self-observation is the ability for the learner to track specific aspects of their own performance and the effects (Pintrich, 2000).

Lastly, self-reflection is the third phase of the self-regulatory process. Self-judgement and self-evaluation are the two categories that encompass self-reflection. Self-evaluation is when the learner compares themselves with the standard or goal. There are four types of criteria that people use to evaluate themselves: mastery, previous performance, normative, and collaborative. Self-reactions can be adaptive or defensive inferences. Adaptive reactions are potentially better forms of performance self-regulation. They allow learners to shift goals or choose more effective strategies to meet their goals. Defensive inferences serve primarily to protect the learner from dissatisfaction and can include helplessness, procrastination, apathy, and avoidance (Pintrich, 2000).

According to Zimmerman and Schunk (2001), self-regulated learning consists of three main components: cognition, metacognition, and motivation. Cognition includes skills necessary to memorize information, and then later remember that necessary information. Problem solving and critical thinking skills are also important within self-regulated learning. The metacognitive component contains knowledge about oneself as a learner, knowledge about strategies, and understanding why and when to use a particular strategy. Furthermore, demonstrating this knowledge is a way for learners to articulate what one is doing and why. Self-efficacy is crucial in self-regulated learning and is the individuals' judgements of their abilities to plan and carry out the necessary behaviors to achieve specific goals. Additionally, goal orientation is the degree to which a learner exhibits personal mastery over a task, and goal setting can contribute to performance (Zimmerman, 2001).

Self-regulated learning refers to one's ability to understand and control one's learning environment including the study environment. Self- regulation abilities include goal setting, self-monitoring, self-instruction, and self-reinforcement (Schraw, Crippen, & Hartley, 2006). Students who use their time more efficiently are more likely to learn and/or perform better than those who do not. Self-regulators manage their time because they are aware of deadlines and time to complete each assignment. Prioritize learning tasks, evaluating more difficult from easier tasks in terms of the time required to complete them.

Successful online students may need higher levels of self-regulation and discipline (Xu & Jaggers, 2014). However, not all online students will have strong self-regulatory learning skills and may need additional support or help. Some researchers have suggested that an online course is not typically designed to help students develop these skills. To incorporate the teaching of self-

directed learning skills into courses would require the institution to support both online and face-to-face instructors in developing materials, assignments, and other pedagogical processes that cultivate self-directed learning skills within the context of each instructor's specific discipline (Weimer, 2002). Such a systematic skill-building strategy would require substantial new investments in faculty professional development and support. Furthermore, it may be more difficult to create effective online material that requires a high degree of hands-on demonstrations and practice (Xu & Jaggars, 2014).

Self-regulation may also play a role in student satisfaction. Task value and self-efficacy, which are two components in the motivation construct of self-regulated learning, positively predicted students' overall satisfaction with an online course in the U.S. Navy (Artino, 2007). Additionally, task value was the strongest individual predictor of satisfaction, perceived learning, and choice behaviors. Students that believed the course was worthwhile and stimulating were highly satisfied. Furthermore, self-efficacy was an important singular predictor of satisfaction and perceived learning (Artino, 2007).

Rehearsal, elaboration, meta-cognitive self-regulation, time management, and study environment were determined to have significant positive correlations with the level of satisfaction in Puzziferro's (2008) study with community college students enrolled in liberal arts online courses. In addition, rehearsal, elaboration, metacognitive self-regulation, and time and study environment were significantly positively correlated with levels of satisfaction (Puzziferro, 2008).

Self-regulated learning refers to the motivational orientations and learning strategies that students employ to attain desired goals (Zimmerman 1989), and self-efficacy measures are task

and domain specific. Self-efficacy refers to one's convictions about her/his ability to perform a given task at a designated level and is the personal aspect for why that person engages in a task (Bandura 1997). Generally, learners who have high confidence in their ability to perform certain academic tasks tend to use more cognitive and metacognitive strategies and show higher task-persistence than those who have lower confidence levels. Pintrich and de Groot (1990) found that academic self-efficacy beliefs were positively related to intrinsic value and cognitive and self-regulatory strategy use. In addition, strong self-efficacy beliefs were negatively correlated with test anxiety. Additionally, Peterson (2011) investigated high school students taking online courses from various subjects and found that subject specific self-efficacy for learning and performance predicted a students' willingness to take online classes in the future. Comfort and confidence with the subject matter is related to positive experience in an online course.

Bandura has identified four sources of self-efficacy: mastery experiences, physiological and emotional arousal, vicarious experiences, and verbal persuasion (Bandura, 1997). Mastery experiences are the most powerful source of efficacy, as successes raise efficacy beliefs. van Dinther (2011) agreed and stated, "enactive mastery experiences are stated as the most powerful source of creating a strong sense of efficacy", (p.104). In almost every study reviewed stressed the relevance of providing students with practical experiences, such as students performing a task while applying knowledge and skills in different situations (van Dinther, 2011). Additionally, the authenticity level of the experience, structure of the situation, and supervision of the students, complexity of the task, and the students' skill developmental level is very relevant to the mastery experience (van Dinther, 2011). Additionally, level of arousal or excitement affects efficacy (Bandura, 1997). In vicarious experiences, the more closely students identify with the model, the greater impact on efficacy. Verbal persuasion is specific performance feedback and may not

alone create increases in self-efficacy, but it can lead the individual to make more of an effort, attempt new strategies, or simply try harder (Bandura, 1986).

Gaskill, (2002) stated "self-efficacy beliefs and self-regulated learning strategies are interdependent; both require the presence of specific cognitive capacities, including the ability to set goals, self-monitor, reflect, and make judgments", (p.194). Both self-regulated learning and self-efficacy judgments require a similar series of cognitive and metacognitive processes, including self-observation, self-judgment, and self-reaction. Motivationally, students take responsibility for successes and failures, are interested in the task, and have high self-efficacy. Behaviorally, they seek out help, and create their own optimal learning environments (Gaskill, 2002). Lastly, a student's level of self-efficacy can predict cognitive strategies and self-regulation, which in turn can predict academic achievement (Zimmerman, 1995).

History of Distance Education

The first forms of distance education were correspondence education by postal mail. The Boston Gazette started offering weekly lessons in shorthand on March 20, 1728. A teacher by the name of Caleb Phillips offered weekly lessons to students in rural areas who wished to learn shorthand (Bower & Hardy, 2004). But it has been argued that this was not formal correspondence education because there is no record of two-way communication (Verduin & Clark, 1991).

Seven years later, Isaac Pitman adapted Phillips' system and instructed students to use shorthand to transcribe Bible selections and then return the transcriptions to Pitman (Bower & Hardy, 2004). However, it was over one hundred years later before there was an established institution of higher education offering distance learning; a Swedish university offering an

opportunity to study *Composition through the medium of Post* (Holmberg, 2002). As the idea became more popular, forms of distance education started to develop all over the world.

In Germany, it was thought that organized distance education came to existence in the year 1856 when Frenchman Charles Toussaint and the German Gustav Langenscheidt formed a school in Berlin for language teaching by correspondence (Noffsinger, 1926). In Japan, a form of distance education was first applied in 1882 but wasn't published in an advertisement until 1898 (Hisano, 1989). In 1886, H.S. Hermod of Sweden, began teaching English by correspondence. By 1898, he founded Hermod's, which would become one of the world's largest and most influential distance teaching organizations (Gadden, 1973).

Meanwhile in the United States, Anna Ticknor created the *Society to Encourage Studies at Home* in 1873; a society to provide educational opportunities for women that could be done at home and at their own pace (Ticknor, 1891). The program provided correspondence instruction to 10,000 members over a 24-year period and was all volunteer-based. Printed materials were sent through the mail and was the primary way of communication. Women's desire for an education greatly impacted correspondence study in the eighteenth and nineteenth century. Ticknor ran the society until her death in 1897 (Ticknor, 1891).

Distance education efforts continued in the U.S. and began to grow in popularity. Programs were developed at the major universities such as Illinois Wesleyan College in 1874, Chautauqua College of Liberal Arts, and Correspondence University of Ithaca in 1883 (Harting & Erthal, 2005). The Chautauqua College granted academic degrees to students who successfully completed classes at the summer institute in-person and by correspondence during the academic year. In comparison to the Chautauqua College program, The Illinois Wesleyan College offered bachelor's, master's, and doctoral degrees to individuals who could not attend regular college.

Between 1881 and 1890, a total of 750 students were enrolled; and by 1900, nearly 500 students were seeking degrees. However, it was terminated in 1906 because the university failed to meet a high standard of excellence (Watkins, 1991).

Soon after the Chautauqua College of Liberal Arts was founded in 1883, The Moody Bible Institute, was established in 1886. The institute formed a correspondence department in 1901 that continues today (Simonson, 2011). The Moody Bible Institute was a two-year college that had large number of enrollments and developed a worldwide reach. Correspondence study/distance education has had a significant impact on religious education (Simonson, 2011). As distance education efforts continued to increase, methods were additionally improved in extension programs at universities.

In 1885, the University of Wisconsin started working towards a university extension program (Watkins, 1991). The university established "short courses" to extend education to all people. However, faculty did not see the value in the movement until Thomas Chamberlain president of the university in 1887 began to encourage the formation of institutes that could allow learning to be extended to students outside of the university. By 1891, with the support of Chamberlain, a series of mechanics institutes were developed which then led to the extension department. Between 1906 and 1916, the Correspondence Study Department at the university registered 24,555 students (Watkins, 1991). Other universities continued to develop their own successful correspondence programs.

William Rainey Harper helped develop the correspondence courses at the University of Chicago in 1892, becoming the first traditional educational institution in the U.S. to do so. The university had five different divisions and three of the five were new to American universities. Among the five divisions, 350 courses were offered by 125 instructors and more than 3,000

students enrolled in the courses (Watkins, 1991). As universities began to develop distance education programs, several impactful events were happening in the U.S.

In between the World Wars (1918-1946), 202 colleges, universities and school boards were granted radio broadcasting licenses (Engel, 1936). In 1919, University of Wisconsin professors began an amateur wireless station later known as WHA, the first federally licensed radio station dedicated to educational broadcasting (Engel, 1936).

By 1922, Pennsylvania State College began broadcasting courses over the radio. Soon after, in 1925, the State University of Iowa began offering course credit for five radio broadcast courses: commerce, sociology, education, English and political science (Miller, 2014). By the end of the 1920s, 176 educational institutions had broadcast licenses **(**Kentor, 2015). Radio broadcasting was inexpensive and immediate, the content could be adapted quickly, and it could reach a very large number of people. However, the Great Depression in 1929 had an enormous impact on educational institutions and educational radio broadcasting. By that time, of the 176 radio stations at educational institutions, only 35 had survived **(**Gibson, 1961).

As popularity increased in different methods of distance education, conferences were held to host leaders in this movement. The first International Conference on Correspondence Education held its first meeting in 1938 in Canada. Delayed because of World War II, the University of Nebraska hosted the second International Conference on Correspondence Education (ICCE) in 1948 (Wright,1991). The conference included some of the most important individuals in correspondence study- Knute Broady, Gayle Childs, Fred Wilhelms, J.S. Noffsinger, T.W. Thordarson, Neil Garvey, Rex Haight, William Young, and Earl Platt. Over 56 of the 100 delegates were women, showing the importance of women during this movement. The

conference was able to revive the international correspondence education movement and established U.S. correspondence educators as the leaders of the movement (Wright, 1991).

Continuing the span of distance education, the development of educational television followed by the mid 20th century. In the early 1930s, experimental television teaching programs were produced at the University of Iowa, Purdue University, Iowa State, and Kansas State College (Simonson, 2011). In the beginning, educational television programs were an experiment and continued to evolve. However, there were still many barriers effecting the use of educational television programs. In 1948, the Federal Communications Commission (FCC) put a freeze on granting new licenses after several issues came up after the rush of license applications. Because of this, it wasn't until the 1952 that television channels were reserved specifically for educational purposes (Simonson, 2011). By 1968 one could obtain an accredited high school diploma via distance education from the University of Nebraska-Lincoln's Independent Study High School. In 1976, the first "virtual college" with no physical campus was in operation. This virtual college, called Coastline Community College, offered a wide variety of telecourses (Miller, 2014).

The PENNARAMA Network was founded in 1977 at Penn State to make educational programming available to cable TV subscribers throughout the state of Pennsylvania. The Department of Independent Learning at Penn State was responsible for programming the educational cable TV channel and producing or purchasing the rights to air the video materials. Courses were offered statewide over the PENNARAMA network. Students then had access and could view the video portion of their Penn State Independent Learning course on the network cable channel. PENNARAMA continued into the 1990s (Penn State Archives, 1977-1991).

Throughout the 1980s, educational television programs continued to develop. In 1981 the Western Behavioral Sciences Institute's School of Management and Strategic Studies started their first online program. In 1982, the Computer Assisted Learning Center in New Hampshire functioned as an offline adult education facility. By 1985, Nova Southeastern University was offering accredited graduate degrees through online courses (Miller, 2014). Due to the increase in interest, the Mind Extension University (MEU), founded in 1987, assembled a consortium of higher education institutions to make telecourses and high-quality educational programming using cable and satellite delivery. In fall 1991, 18 institutions including University of California Extension, Oklahoma and Oklahoma State, Penn State, and Washington State used MEU to deliver video course material for independent study courses (Wright, 1991). At the same time, the use of computers as a medium for delivering education was being implemented.

The World Wide Web, increased possibilities for distance learning experiences. With the introduction of high-speed broadband transmission, distance learning over the Internet became the next instructional frontier (Carlson & Carnevale, 2001). The potential for interactive, virtual classrooms was limited only by the budget, institutional vision, and course management software. The University of Phoenix became the first to offer online education programs using the internet in 1991 (Carlson & Carnevale, 2001). However, the growth of online education in traditional nonprofit institutions did not start until the year 1998 (Arenson, 1998). In October of 1998, New York University (NYU), already operating one of the largest continuing education schools in the country, was the first large nonprofit university to create a for-profit online education subsidiary, NYU Online (Arenson, 1998-2).

By the 2000s, online courses were defined as at least 80 percent content online (Allen & Seaman, 2008). Face-to-face instruction consists of the courses in which up to 29 percent of the

content is delivered online. Blended (sometimes called hybrid) instruction is defined as 30-80 percent of the course content is delivered in the online format (Allen & Seaman, 2008). Universities can offer online learning in a variety of ways to meet students' needs.

New course delivery programs were developed to help universities provide online education. Blackboard Inc., founded in 1997, standardized a platform for course management and delivery increasing online education opportunities. Soon after in 2000, CourseNotes.com launched at University of Texas at Austin. Web Course Tools (WebCT) was developed in 2003 and quickly became popular among more than 1,300 institutions (Miller, 2014).

In the academic year 2000-2001, 56 percent of all two- and four-year degree granting institutions offered distance education courses (NCES, 2003). Total enrollment in distance education courses for two- and four-year institutions combined was 3,077,000 students; two-year institutions had 1,472,000 enrollments, public four-year had 945,000 enrollments, and private four-year institutions had 589,000 enrollments. In 2000–2001, 90 percent of public 2-year and 89 percent of public 4-year institutions offered distance education courses. Among institutions offering distance education courses, the majority (90 percent) reported that they offered Internet courses using asynchronous computer-based instruction (NCES, 2003).

Online enrollments for postsecondary institutions continued to grow and by fall semester of 2007, over 3.9 million students were taking at least one online course; an increase of 12.9 percent from fall 2006 (Allen & Seaman, 2008). Majority of growth was seen at the universities that were actively engaged in online education as they were adding new courses and programs. Furthermore, the universities that invested in their online programs and had become established early on, were seeing the largest growth in number of enrollments. (Allen & Seaman, 2008) In

the fall of 2012, 20.6 million students enrolled in higher education, 6.7 million were enrolled in an online course. (Allen & Seaman, 2013).

In fall 2018, total undergraduate enrollment in degree-granting postsecondary institutions was 16.6 million students, an increase of 26 percent from 2000 (NCES, 2020). Total undergraduate enrollment increased by 37 percent (from 13.2 million to 18.1 million students) between 2000 and 2010 but decreased by 8 percent (from 18.1 million to 16.6 million students) between 2010 and 2018. Total undergraduate enrollment is projected to increase by 2 percent (from 16.6 million to 17.0 million students) between 2018 and 2029 (NCES, 2020). As the demand for distance education increases, it is imperative to better understand distance education and the students enrolled.

Distance Education

Garrison and Shale (1987), suggested that distance education consists of three important criteria (p.11):

1. Distance education implies that the majority of educational communication between (among) teacher and student(s) occurs noncontiguously.

2. Distance education must involve two-way communication between (among) teacher and student(s) for the purpose of facilitating and supporting the educational process.

3. Distance education uses technology to mediate the necessary two-way communication.

In addition to Garrison and Shale, Moore and Kearsley (1996) defined distance education: "planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special

methods of communication by electronic and other technology" (Moore & Kearsley, 1996, p.2). Moore and Kearsley's description is one of the most common definitions of distance education used. Since the development of distance education, leaders in field have been conducting research to answer many questions.

Michael Moore of Penn State founded the American Journal of Distance Education in 1987 and had a very large impact on the independent studies in this field (Wright, 1991). Gale Childs was a large support for the journal and had major contributions in the field. Before 1987, majority of scholarly journals publishing material of interest were international, such as Teaching at a Distance (United Kingdom), Distance Education (Australia), and Research in Distance Education (Canada) (Wright, 1991).

Charles Wedemeyer was another individual who played a major role in the advancement of the state of scholarly research in the field. Wedemeyer and Gale Childs made major contributions in the transformation of correspondence study into a profession. Both played major roles in the advancement of distance education research. They were recognized as leaders of the movement throughout the 1950s, 1960s, and 1970s (Wright, 1991). Wedemeyer and Childs provided leadership to their own university's correspondence programs and offered direction for growth in this method of teaching and learning. Wedmeyer and Child's publications, books, and films on correspondence study have provided teachers and students with an irreplaceable source of design, teaching, and learning (Wright, 1991). Advancements have been made in distance education due to major leaders in the field and distance education continues to grow dramatically.

Because of the growth in the amounts of distance education in our higher educational institutions in recent years, other researchers have been examining students learning experiences,

effectiveness of instructional methods, and strengths and limitations during delivery of distance education. Additionally, it's important to understand why students choose to enroll in distance courses over traditional.

Many nontraditional students have other responsibilities besides school such as children, full-time jobs, financial resources and more (Choy, 2002). Online course delivery provides an opportunity to enroll in an educational program they previously may not had access to. However, developing and delivering online courses require effort from the faculty and students, communication, appropriate assessment, and technology to allow for the delivery (Choy, 2002).

According to Choy (2002), the "traditional" undergraduate is "characterized as one who earns a high school diploma, enrolls full time immediately after finishing high school, depends on parents for financial support, and either does not work during the school year or works part time," (p. 6). Traditional students typically do not have the outside stresses and can direct majority of their energy toward school. Furthermore, traditional, or non-traditional, student satisfaction is critical to academic achievement in a distance education course. Even more so, satisfaction is associated with program and technology quality, effectiveness of the instruction, timeliness of feedback, and the use of instructional strategies that aid the students in understanding the course content (Debourgh, 1999).

Distance Education Laboratory Courses

Most traditional science classes include a laboratory portion that plays a role in understanding lecture material. Ottander and Grelsson (2006) found that science educators and teachers agree that laboratory work is crucial to the understanding of biology and science courses. Lab work helps students learn science through attainment of conceptual and theoretical knowledge. Furthermore, students gain analytical and critical thinking skills, and lab work can

create a greater interest in science. All teachers noted that the informal discussions among students and teachers during lab work were important to associate the knowledge gained (Ottander & Grelson, 2006).

In education, laboratory activities have numerous purposes. Mainly, laboratory work provides students with the conceptual and theoretical knowledge necessary to fully understand scientific concepts and understand the nature of science. Additionally, students engaging in laboratory activities apply procedures used by scientists in the field (Dikmenli, 2009). Therefore, when transitioning a traditional on-campus lecture to a distance course, the laboratory component should not be ignored as the demand for distance courses increases (Ottander & Grelson, 2006).

However, many, but perhaps not a majority, of science faculty remain skeptical about the effective delivery of science course content in a distance format. A study conducted in 2012 comparing distance and on-campus first semester biology, chemistry, and physics classes found that distance science students were not as successful as were the on-campus students (Colorado Department of Higher Education, 2012).

Others have found contradicting data. Kerr, Rynearson, and Kerr (2004) conducted two studies to investigate the effectiveness of teaching distance science labs to secondary students. The results from study one indicated there were no significant differences in achievement for the traditional on-campus versus distance students on the pretest nor the posttests, and there were no significant differences in achievement gain scores for the traditional on-campus versus the distance students. Therefore, students who completed the on-campus, hands-on labs performed as well as students who completed the virtual labs (Kerr et al., 2004). The result of study two indicated the instructor characteristics and student characteristics that were examined, did not

have systematic effects on the results of study one, lending validity to the findings of the first study (Kerr et al., 2004). Even with the increased evidence supporting the effectiveness of distance learning, in science and other disciplines, there is still a concern for hands-on learning. In addition to natural science courses, anatomy laboratory courses can be difficult to adapt to distance format, but some have found success.

McClure and Cook (2012) compared student exam scores between a traditional on-campus anatomy course and a distance anatomy course with the same learning objectives. Exam scores of the distance students were significantly higher than exam scores of the on-campus students. Garrison (2003) conducted a study to determine alternative methods of instruction in a human gross anatomy course. The first group of students completed a traditional on-campus cadaver course. The second group completed a self-study, computerized non-cadaver anatomy course working completely independently. And lastly, the third group attended weekly lectures and completed a self-study, computerized non-cadaver laboratory course. There was no significant difference in anatomy course class means, study times, performance through the remainder of the curriculum and performance on the state board licensure examination. The researchers suggested the computerized self-study technique could be a viable option instead of traditional cadaver laboratory and instruction in human gross anatomy courses (Garrison, 2003).

Stucky-Mickell (2007) found students preferred on-campus labs over virtual labs. The researchers investigated student perceptions of virtual biology laboratories and found that students perceived on-campus labs as more effective than virtual labs. It was found that nearly 87% perceived that the on-campus labs enhanced their understanding of the course content. Furthermore, students stated they preferred the interaction with other students and instructors in

the on-campus format. But students did indicate that the virtual labs were useful to their learning experiences (Stuckey-Mickell, 2007).

Scheckler (2003) stated the biggest disadvantage of a virtual lab is the lack of reality in the laboratory. Virtual laboratories do not have the same experience as a traditional on-campus laboratory. For example, in a biology lab, students handle specimens, live organisms, and use different lab technologies. Furthermore, in a traditional lab, there is a sense of unknown; what will happen during the experiment and conversing with other students about observations and conclusions. Peer-learning is a crucial part of the learning experience in laboratories. Additionally, Scheckler (2003) designated another disadvantage of virtual labs as the lack of direct supervision and contact with an experienced teacher. The teacher has designed how the experiment will go, can answer questions and lead students to different findings. He stated only self-motivated and mature students do well in courses with no class meetings and structure from the teacher.

The main reason students chose to take distance classes was that they had other commitments that made taking classes very difficult. Some of these commitments included childcare issues, shift work, long hours at work, and traveling for work. Other reasons students chose distance classes included limited number of classes offered in the traditional classroom, students thought distane classes would be easier, and the comfort of not having to participate in a face-to-face classroom setting (Hannay & Newvine, 2006).

Online courses allow non-traditional students the opportunity to enroll in an educational program that in the past, may have not been an option. Many nontraditional students have other responsibilities besides school such as children, full-time jobs, financial resources, and more.

However, developing and delivering online courses require effort from the faculty and students, communication, appropriate assessment, and technology to allow for the delivery (Choy, 2002).

Distance Education Standards

Many educators and educational institutions have increased their examination of distance education standards. Standards are created to develop and maintain the quality of content, and improved standards are the result of the effort to solve any problems (Marshall, 2004). Standards represent rigid guidance of distance education implementation regarding the quality of instructional content and need. Universal standards reduce the difference between the learning experiences in varying educational systems. These differences can be minimized to create a higher quality program while reducing the time and money required in developing and maintaining distance education resources (Dobbs, 2000).

With increasing attention on distance education, the six U.S. accrediting bodies have completed a set of recommendations that evaluate and develop distance education programs in America (McDonald, 2002). Regional commissions have defined their distance education standards through a series of guidelines, recommendations, and sets of commitments. Most regional commissions emphasize standards that are broad and flexible to learn and adapt to the unforeseeable conditions and expectations. Each regional institution also has different online learning experiences, needs, instructional traditions, and values and principles (Council of Regional Accrediting Commissions, 2000).

Higher education organizations have developed guidelines for distance education. Guidelines represent integral comments on what is thought best learning practice. The guidelines are intended to provide online learning institutions with a whole source to guide their distance education plans and instructional experiences. The guidelines play a role as the self-assessment

framework for distance education programs. Standards, guidelines, and benchmarks are the criteria to evaluate the program (Seok, 2007). The Guidelines for the Evaluation of Distance Education (On-line Learning) have been developed by the Council of Regional Accrediting Commissions (C-RAC) to assist institutions in planning distance education and to provide an assessment framework for institutions already involved in distance education and for evaluation teams (HLC, 2009).

The Guidelines comprise nine hallmarks of quality for distance education:

1. Online learning is appropriate to the institution's mission and purposes.

2. The institution's plans for developing, sustaining and, if appropriate, expanding online learning offerings are integrated into its regular planning and evaluation processes.

3. Online learning is incorporated into the institution's systems of governance and academic oversight.

4. Curricula for the institution's online learning offerings are coherent, cohesive, and comparable in academic rigor to programs offered in traditional instructional formats.

5. The institution evaluates the effectiveness of its online learning offerings, including the extent to which the online learning goals are achieved, and uses the results of its evaluations to enhance the attainment of the goals.

6. Faculty responsible for delivering the online learning curricula and evaluating the students' success in achieving the online learning goals are appropriately qualified and effectively supported.

7. The institution provides effective student and academic services to support students enrolled online learning offerings.

8. The institution provides sufficient resources to support and, if appropriate, expand its online learning offerings.

9. The institution assures the integrity of its online learning offerings.

Theoretical Framework

Dunkin and Biddle's model (1974) suggested that the study of teaching and learning involves four categories of variables: presage, context, process, and product. The presage variable has been modified to fit this distance education course. Presage variables include teacher experiences that influenced teacher properties. Teacher variables can include the teacher's values, attitudes, behaviors, and preparation that influence the online design and delivery/instruction of the course.

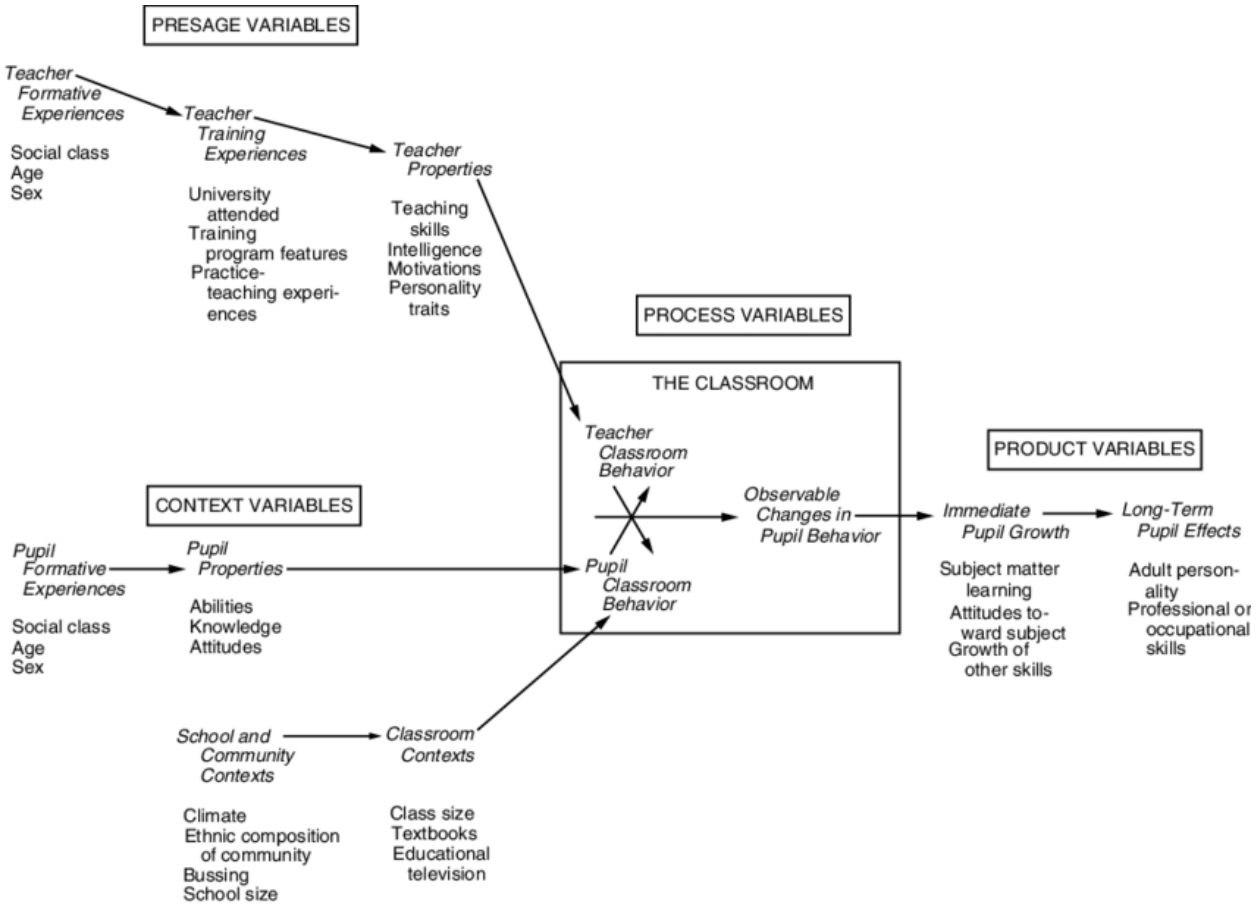


Figure 1. A model for the study of classroom teaching (Dunkin & Biddle, 1974).

The two types of contexts variables include foundational student experiences, and the students' environment. The student experience can be studied to predict student satisfaction and

attitude. The second type of context variable are the characteristics of the online environment. Interactions between the student and the environment encompass the activities completed by the students, online instruction, and interactions between teachers and students.

The process variable is the interactions between the teacher and the student. The interaction of the teacher and student classroom behaviors yield observable changes in the students learning. Changes in student learning that result from the interaction of the student with online activities, the teachers, and the online delivery, impact the final category of variables, product variables. The product variable is described as the desired outcomes of the teaching/learning process. The product variables for this study include subject matter learning, student attitude and satisfaction.

Dunkin's and Biddle's (1974) model for teaching and learning served as a constructive lens in this study, but we must recognize that a new lens had to be used to encompass a 21st century educational environment.

Chapter 3 - Methodology

Research Design

The design of this study was descriptive-correlational. A convenience sample of (28) online undergraduate students at Kansas State University were recruited to participate in the study. In this study, student satisfaction and the relationship between motivated strategies for learning and knowledge gained in distance animal science anatomy and physiology laboratory were compared to on-campus animal science anatomy and physiology laboratory. Students enrolled in the distance animal science anatomy and physiology laboratory course comprised the experimental group. The comparison group consisted of students enrolled in the on-campus animal science anatomy and physiology laboratory course. Descriptive correlational research is used to describe variables and the relationships that occur naturally between and among them. The descriptive design was utilized to describe student demographics, student satisfaction, knowledge gained, and perceived educational value of the hands-on laboratory kits. Correlational design was used to determine if there was a significant relationship between motivated strategies for learning and knowledge gained.

Variables of Interest

Overall course satisfaction is related to overall ratings of the instructor and instruction, regardless of course format. Satisfaction in distance-education courses is related to the performance of the instructor--just as for traditional face-to-face classes. Students acclimated to the instructional delivery and once adapted to the mode, it was the quality and effectiveness of the instructor and the instruction, not the technology that was associated with satisfaction (Debourgh, 1999). Student satisfaction was measured using an 11 question Likert scale

questionnaire and was self-reported. Also collected on the questionnaire were student demographics.

The knowledge gained in both the on-campus and distance courses can be determined and compared using a pre-test and post-test. The comparison of the knowledge gained scores can support the effectiveness of a distance hands-on laboratory. A pre-test was given to on-campus and distance students at the beginning of each semester, and the post-test was given to all students at the conclusion of the course. The pre-test and post-test questions were anatomy identification questions. The pre-test questions were selected randomly from learning objectives from each week, the post-test questions were the same as the pre-test.

The Motivated Strategies for Learning Questionnaire (MSLQ), developed by Pintrich (1991), is a widely used self-report instrument designed to assess college students' motivational orientations and their use of different learning strategies. This 81-item instrument, 7-point Likert scale (1 = not at all true of me and 7 = very true of me) consists of six motivation scales (31 items measuring value, expectancy, and affective component) and nine learning strategies (50 items measuring cognitive and metacognitive strategies, and resource management strategies). The questionnaire was divided into two sections, motivations and learning strategies. The motivations section was administered at the beginning of the semester, and the learning strategies section was administered at the end, to reduce questionnaire exhaustion.

Population

The target population for this study was students enrolled in Kansas State University distance animal science course during spring semester 2021 and fall semester 2021 (N=28). The variables of interest were tested only in the laboratory section, not lecture. The comparison group consisted of students enrolled in the Anatomy and Physiology animal science anatomy laboratory

on-campus during the Spring semester 2021 and Fall semester 2021. On-campus students learning gains were compared to distance students. Students voluntarily participated in the study and were asked to sign consent forms before participating (see Appendix). Students who declined were dropped from the study. The lab instructor was the same for both the on-campus and distance courses both semesters.

Instrumentation

For the purposes of this study three data collection instruments were used: a knowledge pre- and post-test, satisfaction questionnaire, and the Motivated Strategies for Learning Questionnaire. The pretest instrument was developed from subject matter items selected from the final exam. The pre-test instrument was a total of 30 anatomy identification questions randomly chosen from subject categories taught through the semester. The comprehensive post-test was administered at the conclusion of both courses. The post-test consisted of the same 30 questions from the pre-test.

A questionnaire was used to measure learner satisfaction and collect demographic data from the distance students. The instrument used for learner satisfaction, employed a seven-item Likert-type response scale ranging from strongly agree to strongly disagree. The questionnaire was provided at the conclusion of the class in only the distance laboratory section, not the on-campus students.

The Motivated Strategies for Learning Questionnaire (MSLQ), developed by Pintrich (1991), is a widely used self-report instrument designed to assess college students' motivational orientations and their use of different learning strategies. This 81-item instrument, 7-point Likert scale consists of six motivation scales and nine learning strategies. The instrument has been widely used in measuring critical thinking in learning, motivation for conceptual change, self-

efficacy, beliefs about knowledge, intrinsic and extrinsic motivation, integrated metacognitive instruction, adolescent help-seeking in math classes, and goal orientation. It has been found that most components of the MSLQ are correlated with multiple aspects of motivation and learning strategies (Pintrich, 1991).

The MSLQ provides a scale for student motivations and learning strategies. The motivation scale of the MSLQ consists of value components. Questions 1, 16, 22, and 24 purports to measure the student's *intrinsic goal orientation*. *Intrinsic goal orientation* is the student's perception of the reasons why they are engaging in a learning task. Questions 7, 11, 13, and 30 purports to measure student's *extrinsic goal orientation. Extrinsic goal orientation* is the degree to which the student perceives themselves to be participating in a task for seasons such as grades rewards, performance, evaluation by others. Questions 4, 10, 17, 23, 26, and 27 purports to measure the *value of the task. Task value* refers to the student's evaluation of how the interesting, important, and useful the task is to them. Questions 2, 9, 18, and 25 purports to measure the *control of learning beliefs and* refers to the students' beliefs that their efforts to learn will result in positive outcomes. Questions 5, 6, 12, 15, 20, 21, 29, and 31 purports to measure *self-efficacy for learning and performance*. The scale consists of two aspects of expectancy: *expectancy for success* and *self-efficacy*. *Expectancy for success* refers to performance expectations and relates specifically to task performance. *Self-efficacy* is self-appraisal of one's ability to master a task. Questions 3, 8, 14, 19, and 29 purports to measure *test anxiety*. *Test anxiety* has been found to be negatively related to expectancies as well as academic performance (Pintrich, 1991).

The learning strategies scales is the second component of the MSLQ and provides cognitive and metacognitive strategies. Questions 39, 46, 59, and 72 purports to measure

r*ehearsal*. Basic *rehearsal* strategies involve reciting or naming items from a list to be learned. Questions 53, 62, 64, 67, 69, and 81 purports to measure *elaboration. Elaboration* strategies help students store information into long-term memory by building internal connections between items to be learned. Questions 32, 42, 49, and 63 purports to measure *organization. Organization* strategies help the learner select appropriate information and construct connections among the information to be learned. Questions 38, 47, 51, 6, and 71 purports to measure *critical thinking. Critical thinking* refers to the degree to which students report applying previous knowledge to new situations to solve problems, reach decisions, or make critical evaluations with respect to standards of excellence. Questions 33, 36, 41, 46, 54, 55, 56, 57, 61, 76, 78, and 79 purports to measure *metacognitive self-regulation. Metacognition* refers to the awareness, knowledge, and control of cognition. There are three general processes that make up metacognitive self-regulatory activities: *planning, monitoring, and regulating*.

The MSLQ also provides resource management strategies. Questions 35, 43, 52, 65, 70, 73, 7, and 80 provide *time and study environment* data. Students must be able to manage and regulate their time and their study environments. *Time management* involves scheduling, planning, and managing one's study time. Questions 37, 48, 60, and 74 provide data for *effort regulation.* Self-regulation also includes students' ability to control their effort and attention in the face of distractions and uninteresting tasks. *Effort regulation* is self-management, and reflects a commitment to completing one's study goals, even where there are difficulties or distractions. Questions 34, 45, and 50 provide data regarding *peer learning* as collaborating with one's peers has been found to have positive effects on achievements. Questions 40, 58, 68, and 75 provide data in regard to students *seeking help*. Students must learn to manage the support of others. This includes both peers and instructors.

Validity and Reliability

Validity- Satisfaction Survey

For an instrument to be relevant to the study the instrument should be valid, which is an assessment of the instrument's accuracy. The instrument was presented to a panel of experts to establish content and face validity. The panel of experts consisted of an Anatomy and Physiology Professor in Animal Science and faculty in Agricultural Education. Suggestions from the panel led to the addition, removal, and revision of questions. To establish concurrent validity, the survey questions were developed using *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method* (Dillman, 2014).

Validity- Knowledge Pre- and Post-test

Internal validity only indicates that you have evidence to suggest that a program or study had some effect on the observations and results. By using a pretest, and comparison group, this design controls for all internal threats to validity exception selection. Students in the distance course were a convenience sample. In this study, the content validity of the instruments was determined by obtaining content verification from one animal science anatomy professor.

Validity and Reliability- MSLQ

The Motivated Strategies for Learning Questionnaire (MSLQ), developed by Pintrich (1991), is a widely used self-report instrument designed to assess college students' motivational orientations and their use of different learning strategies. The motivation scale was originally divided into three broad areas: (1) value, (2) expectancy, and (3) affect. The Learning Strategies scale was all divided into three broad areas: (1) cognitive, (2) metacognitive, (3) resource management strategies. Cronbach's α (alpha) for the three subscales of motivation range from

0.73 to 0.80. Cronbach's α (alpha) for the three subscales of learning strategies range from 0.71 to 0.88. The reliability of MSLQ instrument is consistent with the original Pintrich's study.

Reliability- Satisfaction Survey

A pilot test, consisting of online students (n=10) who were not included in the research sample, was used to measure the reliability of the instrument. Test-retest reliability has a disadvantage caused by memory effects. To reduce memory effects, the time between the first test and retest was a semester. The internal consistency reliability (Cronbach's alpha) of this test was found to be ($\alpha = .84$).

Reliability- Knowledge Pre- and Post-test

Cronbach's alpha test was used to determine the internal consistency of the pre- and post-test. Data were collected from a pilot test that was run with distance students in Fall 2020. The internal consistency reliability (Cronbach's alpha) of this test was found to be ($\alpha = .72$).

Data Collection

The satisfaction survey was distributed to students in the distance course during the last two weeks of the semester via Qualtrics. Fourteen demographic questions were answered at the first part of this questionnaire to gather basic background information concerning students' gender, age, academic major, academic classification, number of hours worked per week, computer knowledge, previous knowledge of the subject, whether they have taken an online course before, and why they were taking the course. A reminder was sent to students two days before the conclusion of the course.

Both the on-campus and distance students received a pretest to determine their existing level of competency on course material. The pre- and post-test were administered as an activity

in the class. The online students completed it virtually while the on-campus students viewed specimens and completed the pre-test virtually, and the post-test using paper and pencil.

Data were collected using both sections of the MSLQ. The motivation section was administered at the beginning of the semester using Qualtrics Survey forms. Qualtrics is an online platform used to collect data. Students answered the 31 questions on the motivation section of the MSLQ. This section took no longer than 30 minutes to answer. The learning strategy section was administered at the end of the semester. These 50 questions took no longer than 30 minutes to answer. Both portions of the MSLQ were administered online using Qualtrics. Students answered the questionnaire on a voluntary basis, although extra credit was offered as a motivation.

Data Analysis

Data were collected from the first objective in all scales of measurement. Objective one was, describe the demographic characteristics (sex, age, financial assistance, degree option, online degree percentage, work, children, computer knowledge, previous enrollment) of students. Data representing nominal form were analyzed using modes, frequencies, and percentages. Interval and ratio data were analyzed using means, medians, and modes as measures of central tendency. Standard deviation and range were calculated as measures of variability.

Data to describe student's satisfaction toward the distance laboratory, objective two, were collected using Likert-type questionnaire and is an ordinal measurement scale. Data representing nominal form were analyzed using modes, frequencies, and percentages.

Data from objective three were collected using pre- and post-test scores from the students. Interval data were analyzed using means, medians, and modes as measures of central tendency. Paired t-test was used for comparing pre- and post-test scores. A comparison of the

relationship between knowledge gained was conducted using Pearson's product moment correlation coefficients. The Pearson's products moment correlation coefficient measures the strength of the linear association between the two variables.

Data to analyze student's motivated strategies for learning, objective four, were collected using summated rating scale questions. The summative scales were constructed by taking designated survey questions and combining answers that are correlated with each other to form a single variable that is the sum of scores on each individual item. The summated scores were treated as interval data. Bivariate correlations were calculated for the MSLQ scales and laboratory final grades for distance and on-campus students.

Institutional Review Board

Federal regulations and Kansas State University policy required approval of all research studies that involve human subjects before investigators can begin their research. The Kansas State University Office of Research and the Institutional Review Board (IRB) conduct this review to protect the rights and welfare of human subjects involved in biomedical and behavioral research. In compliance with the aforementioned policy, this study received proper review and was granted permission to proceed. The IRB assigned reference number 9844.1 to this study to assess student satisfaction, and the relationship between motivated strategies for learning and student's knowledge gained.

Chapter 4 - Findings

Findings are summarized by order of objective. Due to observed differences, each semester is reported separately.

Research Objective One

Describe the demographic characteristics of students who choose to enroll in a distance delivered anatomy and physiology laboratory class.

Spring 2021

The students (n=17) in the Spring 2021 distance anatomy and physiology laboratory were 76.5% (13) female and 17.6% (3) male and 5.9% (1) preferred not to answer (see Table 4.1). Animal Sciences and Industry Production and Management was the major and degree option for 14 (82.4%) and three (17.6%) were seeking other degree options. Among the distance students enrolled, eight (47.1%) students had previously enrolled in at least one online laboratory and six (35.3%) had previously enrolled in an anatomy and physiology course. When asked about computer knowledge, three (17.6%) distance students rated their computer knowledge as expert level, 13 (76.5%) students rated their computer knowledge as intermediate level, and 1 (5.9%) as novice. During the distance laboratory, three (17.6%) students spent more than 4 hours per week completing laboratory assignments, four (23.5%) students spent 3-3.9 hours, nine (52.9%) students spent 2-2.9 hours, and one (5.9%) student spent less than 2 hours completing assignments.

Table 4.1
Personal and Academic Demographic Data of Responding Distance Students During Spring 2021 (n=17)

Variable		*f*	%
Gender			
	Male	3	17.6
	Female	13	76.5
	Prefer Not to Answer	1	5.9
Degree Major			
	Product Management	14	82.4
	Other Degree Option	3	17.6
Previously Enrolled in Online Lab			
	Yes	8	47.1
	No	9	52.9
Previously Enrolled in A&P Course			
	Yes	6	35.5
	No	11	64.5
Computer Knowledge Level			
	Expert	3	17.6
	Intermediate	13	76.5
	Novice	1	5.9
Hours Spent Completing Assignments			
	>4 Hours	3	17.6
	3-3.9 Hours	4	23.5
	2-2.9 hours	9	52.9
	<2 Hours	1	5.9

Students in the distance Spring 2021 course worked on average 34.53 (SD=14.96) hours per week while an average of 11.29 (SD=3.62) credit hours (see Table 4.2). The mean age for students in the distance course was 25. Additionally, students reported completing 52.76 (SD=30.81) credit hours online before taking this course.

Table 4.2
Personal and Academic Demographic Data Averages of Responding Distance Students During Spring 2021 (n=17)

Variable	M	SD
Age	25	6.18
Hours Worked Per Week	34.53	14.96
Credit Hours Per Semester	11.29	3.62
Online Credit Hours Completed	52.76	30.81

Fall 2021

Students in the Fall 2021 distance animal science anatomy and physiology laboratory were 81.8% (9) female and 18.2% (2) male (see Table 4.3). Majority of students were in the Animal Science Production and Management degree and option, six (54.5%), and three (17.6%) students were Animal Science Pre-Veterinary degree and option, and two (18.2%) were seeking other degree options. Among the students enrolled, six (54.6%) students had previously completed at least one online laboratory and three (27.3%) had previously enrolled in an anatomy and physiology course. When asked about computer knowledge, one (9.1%) distance student rated their computer knowledge as expert level, 9 (81.8%) students rated their computer knowledge as intermediate level, and 1 (9.1%) as novice. During the distance laboratory, three (27.3%) students spent 3-3.9 hours per week completing laboratory assignments, two (18.2%) students spent 2-2.9 hours, and six (54.5%) student spent less than 2 hours completing assignments (see Table 4.3)

Table 4.3
Personal and Academic Demographic Data of Responding Distance Students During Fall 2021 (n=11)

Variable		*f*	%
Gender			
	Male	2	18.2
	Female	9	81.8
	Prefer Not to Answer	-	-
Age			
	Average	26	
Degree Major			
	Product Management	6	54.5
	Pre-Vet	3	17.6
	Other Degree Options	2	18.2
Previously Enrolled in Online Lab			
	Yes	6	54.6
	No	5	45.4
Previously Enrolled in A&P Course			
	Yes	3	27.3
	No	8	72.7
Computer Knowledge Level			
	Expert	1	9.1
	Intermediate	9	81.8
	Novice	1	9.1
Hours Spent Completing Assignments			
	>4 Hours	-	-
	3-3.9 Hours	3	27.3
	2-2.9 hours	2	18.2
	<2 Hours	6	54.4

Students in the distance Fall 2021 course worked on average 30.18 (SD=15.77) hours per week while taking approximately 10.00 (SD=5.42) credit hours (see Table 4.4). The mean age for students in the distance course was 26. Additionally, students reported completing 33.36 (SD=24.39) credit hours online before taking this course.

Table 4.3
Personal and Academic Demographic Data Averages of Responding Distance Students During Fall 2021 (n=11)

Variable	M	SD
Age	26	8.13
Hours Worked Per Week	30.18	15.77
Credit Hours Per Semester	10.00	5.42
Online Credit Hours Completed	33.36	24.39

Research Objective Two

Describe student's satisfaction of a distance delivered anatomy and physiology laboratory class.

Spring 2021

When asked about course satisfaction, 70.6% (12) of respondents indicated high level of satisfaction (see Table 4.5) about "How well did the instructor answer student questions", 11.8% (2) indicated moderate level of satisfaction, and 17.6% were neutral (3). In regard to expectations, 64.7% (10) of respondents indicated high level of satisfaction about "How well did the laboratory course correspond to your expectations", 17.6% (3) indicated moderate level of satisfaction, 11.8% (2) disagreed, and 5.9% (1) were neutral. Overall, 53.1% (9) of respondents indicated high level of satisfaction about "Overall how would you rate your satisfaction of this online laboratory", 17.6% (3) indicated a moderate level of satisfaction, 23.5% (4) disagreed, and 5.9% (1) were neutral. When asked about increasing interest, 58.8% (10) of respondents indicated high level of satisfaction about "What level of impact if any did this class have on your interest", 17.6% (3) indicated moderate level of satisfaction, 17.7% disagreed (3), and 5.9% (1) were neutral.

Table 4.4
Perceived Satisfaction of Responding Distance Students During Spring 2021 (n=17)

	Extremely poor		Moderately poor		Slightly poor		Neither well nor poor		Slightly well		Mod well		Extremely well	
Question	f	%	f	%	f	%	f	%	f	%	f	%	f	%
How well did the instructor answer the students' questions?	-	-	-	-	-	-	3	17.6	2	11.8	2	11.8	10	58.8
What level of impact, if any, did this class have on your interest level of anatomy?	1	5.9	1	5.9	1	5.9	1	5.9	3	17.6	5	29.4	5	29.4
How well did the laboratory course correspond to your expectations?	-	-	1	5.9	1	5.9	1	5.9	3	17.6	6	35.3	5	29.4
Overall, how would you rate your satisfaction of this online laboratory?	-	-	1	5.9	3	17.6	1	5.9	3	17.6	6	35.5	3	17.6

Student satisfaction regarding the lab materials, 53% (9) of respondents indicated high level of satisfaction about “How useful were the laboratory materials”, 11.8% (2) disagreed and 35.3% (6) were moderately satisfied (see Table 4.6).

Table 4.5 Perceived Satisfaction of Lab Materials of Responding Distance Students Spring 2021 (n=17)

	Slightly useless		Neither useful no useless		Slight useful		Moderately useful		Extremely useful	
Question	f	%	f	%	f	%	f	%	f	%
How useful were the laboratory materials (lab manuals, videos, etc.)?	2	11.8	-	-	6	35.3	2	11.8	7	41.2

When asked about the technology used, 64.7% (11) of respondents indicated a high level of satisfaction about "How easy it was to use the technology", 5.9% (1) were moderately satisfied, 11.8% (2) disagreed and 17.6% (3) were neutral (see Table 4.7).

Table 4.6 Perceived Satisfaction of Technology of Responding Distance Students Spring 2021 (n=17)

	Slightly hard		Neither easy nor hard		Slightly easy		Moderately easy		Extremely easy	
Question	f	%	f	%	f	%	f	%	f	%
How easy was it to use the technology needed for this laboratory?	2	11.8	3	17.6	1	5.9	5	29.4	6	35.3

In response to being asked about instructor satisfaction, 76.5% (13) of respondents were highly satisfied about "How clearly did the instructor explain the laboratory material?", 5.9% (1) stated material was slightly clear, 11.8% (2) slightly unclear, and 5.9% (1) was neutral (see Table 4.8).

Table 4.7
Perceived Satisfaction of Instructor of Responding Distance Students Spring 2021 (n=17)

	Slightly unclear		Neither clear nor unclear		Slight clear		Moderately clear		Extremely clear	
Question	f	%	f	%	f	%	f	%	f	%
How clearly did the instructor explain the laboratory material?	2	11.8	1	5.9	1	5.9	7	41.2	6	35.3

When asked about lab assignments, 70.6% of respondents indicated high level of satisfaction about "How helpful or unhelpful were the assignments", 29.4% indicated a slight level of satisfaction (see Table 4.9).

Table 4.8
Perceived Satisfaction of Assignments of Responding Distance Students During Spring 2021 (n=17)

	Neither helpful nor unhelpful		Slightly helpful		Moderately helpful		Extremely helpful	
Question	f	%	f	%	f	%	f	%
How helpful or unhelpful were the assignments in your understanding of the material?	-	-	5	29.4	7	41.2	5	29.4

Majority of respondents, 82.3% (14), indicated high level of satisfaction about "Were the tasks that you were asked to complete in each laboratory assignment appropriate for this class?", 11.8% (2) indicate a slight level of satisfaction, and 5.9% (1) was neutral (see Table 4.10).

Table 4.9
Perceived Satisfaction of Tasks of Responding Distance Students Spring 2021 (n=17)

	Neither appropriate nor inappropriate		Slight appropriate		Moderately appropriate		Extremely appropriate	
Question	f	%	f	%	f	%	f	%
Were the tasks that you were asked to complete in each laboratory assignment appropriate for this class?	1	5.9	2	11.8	3	17.6	11	64.7

Fall 2021

All the respondents (100%) from the Fall 2021 distance course indicated high level of satisfaction about "How well did the instructor answer student questions" (see Table 4.11). When asked about interest, 81.9% (9) of respondents indicated high level of satisfaction about "What level of impact of any did this class have on your interest", 9.1% (1) was moderately satisfied, and 9.1% (1) was neutral. When asked about expectations, 100% of respondents indicated high level of satisfaction about "How well did the laboratory course correspond to your

expectations". Overall, (9) 81.4% of respondents indicated high level of satisfaction about "Overall how would you rate your satisfaction of this online laboratory", 18.2% (2) indicated a moderate level of satisfaction.

Table 4.10
Perceived Satisfaction of Responding Distance Students During Fall 2021 (n=11)

	Neither well nor poor		Slightly well		Moderately well		Extremely well	
Question	f	%	f	%	f	%	f	%
How well did the instructor answer the students' questions?	-	-	-	-	3	27.3	8	72.7
What level of impact, if any, did this class have on your interest level of anatomy?	1	9.1	1	9.1	4	36.4	5	45.5
How well did the laboratory course correspond to your expectations?	-	-	-	-	6	54.5	5	45.5
Overall, how would you rate your satisfaction of this online laboratory?	-	-	2	18.2	4	36.4	5	45.5

When asked about the laboratory materials, 81.9% of respondents indicated high level of satisfaction about "How useful were the laboratory materials", 18.2% reported laboratory materials being slightly useful (see Table 4.12).

Table 411
Perceived Satisfaction of Laboratory Materials of Responding Distance Students During Fall 2021 (n=11)

	Slightly useful		Moderately useful		Extremely useful	
Question	f	%	f	%	f	%
How useful were the laboratory materials (lab manuals, videos, etc.)?	2	18.2	5	45.5	4	36.4

Regarding the technology used in lab, 81.9% (9) of respondents indicated a high level of satisfaction about "How easy it was to use the technology", 9.1% (1) were neutral, and 9.1% (1) indicated the technology was slightly hard to use.

Table 4.12
Perceived Satisfaction of Technology of Responding Distance Students During Fall 2021 (n=11)

	Slightly hard		Neither easy nor hard		Slightly easy		Moderately easy		Extremely easy	
Question	f	%	f	%	f	%	f	%	f	%
How easy was it to use the technology needed for this laboratory?	1	9.1	1	9.1	-	-	5	45.5	4	36.4

All the respondents (100%) in the course indicated high level of satisfaction about "How clearly did the instructor explain laboratory material" (see Table 4.14).

Table 4.13
Perceived Satisfaction of Instructor of Responding Distance Students During Fall 2021 (n=11)

	Moderately clear		Extremely clear	
Question	f	%	f	%
How clearly did the instructor explain the laboratory material?	7	63.6	4	36.4

When asked about lab assignments, 91% (10) of respondents indicated a high level of satisfaction about "How helpful or unhelpful were the assignments", 9.1% (1) reported lab assignments were slightly helpful (see Table 4.15).

Table 4.14
Perceived Satisfaction of Lab Assignments of Responding Distance Students Fall 2021 (n=11)

	Slightly helpful		Moderately helpful		Extremely helpful	
Question	f	%	f	%	f	%
How helpful or unhelpful were the assignments in your understanding of the material?	1	9.1	5	45.5	5	45.5

When asked about the tasks in each assignment, 100% of respondents indicated a high level of satisfaction about "Were the tasks that you were asked to complete in each laboratory assignment appropriate for this class?" (see Table 4.16).

Table 4.15
Perceived Satisfaction of Tasks of Responding Distance Students Fall 2021 (n=11)

	Moderately appropriate		Extremely appropriate	
Question	f	%	f	%
Were the tasks that you were asked to complete in each laboratory assignment appropriate for this class?	5	45.5	6	54.5

Research Objective Three

Compare student knowledge gain between distance and face-to-face laboratory instruction.

Spring 2021

Students enrolled in both the distance Spring 2021 and on-campus Spring 2021 laboratory course took a pre- and post-test (see Table 4.17). Students enrolled in the distance Spring 2021 laboratory course had a mean score of 6.59 (SD=4.97) on the pre-test. Students had a mean score of 23.95 (SD=5.33) on the post-test. Students averaged a 17.82 (SD=6.58) point increase in their scores on the exam. Students enrolled in the on-campus Spring 2021 laboratory course had a mean score of 11.70 (SD=5.64) on the pre-test. Students had a mean score of 24.18 (SD=5.48) on the post-test. Students averaged 13.18 (SD=6.58) point increase in their scores on the exam. There was a significant difference in the pre-test scores between the distance students and on-campus students; t(df)= (-3.89), p= (.01). There was a significant different in the post-test scores between the distance students and on-campus students; t(df)= (-.18). There was a

significant difference in the changes in scores between the distance students and on-campus students; t(df)= (3.09).

Table 4.16
Pre-Test Post-Test Comparison Spring 2021 Distance and On-Campus Students

	Mean	Standard Deviation	*t*	*p*	Cohen's D
Pre-Test Scores			-3.89	.01*	5.52
On-Campus students	11.70	5.64			
Distance Students	6.59	4.97			
Post-Test Scores			-0.18	.01*	5.45
On-Campus Students	24.18	5.48			
Distance Students	23.95	5.33			
Changes in Scores			3.09	.01*	6.31
On-Campus Students	13.28	6.24			
Distance Students	17.82	6.58			

Note. *= p<.05

Fall 2021

Students enrolled in the distance Fall 2021 and on-campus Fall 2021 laboratory courses findings from the pre- and post-test are represented in Table 4.18. Students enrolled in the distance Fall 2021 laboratory course had a mean score of 8.18 (SD=3.84) on the pre-test. Students had a mean score of 26.18 (SD=3.84) on the post-test. Students averaged a 18.00 (SD=4.69) point increase in their scores on the exam. Students enrolled in the on-campus Fall 2021 laboratory course had a mean score of 12.14 (SD=5.46) on the pre-test. Students had a mean score of 24.38 (SD=6.28) on the post-test. Students averaged a 12.52 (SD=5.96) point increase in their scores on the exam. There was a significant difference in the pre-test scores between the distance students and on-campus students; t(df)= (-2.28). The post-test scores

between the distance students and on-campus students were not significantly different; t(df)= (.911). There was a significant difference in the change scores between the distance students and on-campus students; t(df)= (2.86).

Table 4.17
Pre-Test Post-Test Comparison Fall 2021 Distance and On-Campus Students

	Mean	Standard Deviation	*t*	*p*	Cohen's D
Pre-Test Scores			-2.28	.027*	5.22
On-Campus students	12.14	5.46			
Distance Students	8.18	3.84			
Post-Test Scores			0.91	.366	5.94
On-Campus Students	24.38	6.28			
Distance Students	26.18	3.84			
Changes in Scores			2.86	.006*	5.76
On-Campus Students	12.52	5.96			
Distance Students	18.00	4.69			

Note. *= p< .05

Research Objective Four

Analyze the relationship between motivated strategies for learning and student's knowledge gained.

The fourth research question pertained to the relationship between motivational strategies and the knowledge gained. The findings for each motivational scale component are presented as follows:

Intrinsic Goal Orientation

Intrinsic goal orientation is the degree to which the students perceived themselves to be participating in the academic task for reasons of challenge, curiosity, and mastery. Table 4.19 displays results from the distance Spring 2021 course and indicated no interaction between academic performance and intrinsic goal orientation (r = 0.05) for the sample. Additionally, intrinsic goal orientation was highly correlated with task value (r=.75), self-efficacy (r=.71) and a substantial association with organization (r=.67), help seeking r=.57). extrinsic goal orientation (r=.58), and control of learning beliefs (r=.54). For on-campus Spring 2021 students no interaction was found between intrinsic goal orientation and academic performance (r=-0.05). Additionally, intrinsic goal orientation is substantially associated with task value (r=.58), control of learning beliefs (r=54), and self-efficacy (r=.69).

Table 4.18
Correlations (r) between Intrinsic Goal Orientation and Final Grade and other MSLQ Constructs

		Motivational Orientations					Cognitive-Metacognitive					Resource Mgmt.			
Semester	Final Lab Grade	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	.05	.58	.75	.54	.71	.34	.43	.06	.67	.34	.51	.44	.41	.52	.57
Distance Fa (N=10)	.23	.11	.71	.31	.38	-.45	.45	.58	.42	.08	.55	.49	.40	.13	.61
On-Campus Sp (N=82)	-.05	.10	.58	.54	.69	-.12	.02	-.01	.05	.27	-.19	.08	.11	.15	-.10
On-Campus Fa (N=47)	.32	.29	.82	.42	.75	.23	.01	.04	.06	.30	-.11	.01	-.16	.15	.06

For distance Fall 2021 students, a low interaction between intrinsic goal orientation and academic performance (r=0.23) was found. Intrinsic goal orientation was highly correlated with task value (r=.71), and substantially associated with elaboration (r=.58), metacognition self-

regulation (r=.55), and moderately associated with rehearsal (r=.45), organization (r=.42), time & study (r=.49), effort regulation (r=.40), and negative moderately associated with test anxiety (r=-.45). For on-campus Fall 2021 course, a moderate interaction between academic performance and intrinsic goal orientation was found (r=0.32) (see Table 4.19). Additionally, intrinsic goal orientation was highly correlated with task value (r=.82), self-efficacy (r=.75), and moderately associated with control of learning beliefs (r=.42) and critical thinking (r=.30).

Extrinsic Goal Orientation

Extrinsic goal orientation is the level to which the students were concerned with issues which were not directly related to participating in the task, such as, grades, rewards, and comparing performance with others. Table 4.20 displays the results from the distance Spring 2021, it was found that extrinsic goal orientation had a low negative relationship with level of performance (r = -0.25). However, extrinsic goal orientation had a very strong association with metacognition self-regulation (r=.73) and a substantial correlation with intrinsic goal orientation (r=.58), rehearsal (r=.69), critical thinking (r=.60), time and study management (r=.64), effort regulation (r=.59), peer learning (r=.53), and help seeking (r=.58). Extrinsic goal orientation was also moderately associated with self-efficacy (r=.34), elaboration (r=.46), and organization (r=.34). During the on-campus Spring 2021 course there was no interaction between academic performance and extrinsic goal orientation (r=-0.01) found. However, extrinsic goal orientation was moderately associated with test anxiety (r=0.38).

Table 4.19
Correlations (r) between Extrinsic Motivation and Final Grade and other MSLQ Constructs

		Motivational Orientations					Cognitive-Metacognitive					Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	-.25	.58	.23	.22	.34	.19	.69	.46	.34	.60	.73	.64	.59	.53	.58
Distance Fa (N=10)	-.06	.11	.47	.24	.52	.06	.13	-.12	.39	.20	-.03	.12	-.02	-.50	-.18
On-Campus Sp (N=82)	-.01	.10	.14	.25	.20	.38	.08	.17	-.04	.10	.21	.19	.06	.07	.10
On-Campus Fa (N=47)	.34	.29	.35	.31	.28	.43	.25	.19	.12	.18	.14	.15	-.03	-.01	.03

Table 4.20 displays the results from the distance Fall 2021 course and had no interaction between extrinsic goal orientation and academic performance (r=-0.06). Extrinsic goal orientation was substantially associated with self-efficacy (r=.52), and moderately associated with task value (r=.47), and organization (r=.39). From the on-campus Fall 2021 course moderate interaction with extrinsic goal orientation and academic performance (r=0.34) was found. Extrinsic goal orientation was moderately associated with task value (r=.35), control of learning beliefs (r=.31), and test anxiety (r=.43).

Task Value

Task value is how the students evaluated the course material in terms of interest, importance, and utility. Table 4.21 displays the results from the distance Spring 2021 course which indicated a substantial level of interaction between task value and academic performance (r=0.69). Furthermore, task value had a strong correlation with intrinsic goal orientation (r=.75), control of learning beliefs (r=.73), self-efficacy (r=.73), and organization (r=.74),

and moderately associated with help seeking (r=.47). For the on-campus Spring 2021 students and had no interaction between academic performance and task value (r=0.02) was found. Task value was substantially associated with intrinsic goal orientation (r=.59), self-efficacy (r=.60), and moderately correlated with control of learning beliefs (r=.46).

Table 4.20
Correlations (r) between Task Value and Final Grade and other MSLQ Constructs

		Motivational Orientations					Cognitive-Metacognitive					Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	.69	.75	.23	.73	.73	.21	.07	-.19	.74	.13	.10	.06	.07	.12	.47
Distance Fa (N=10)	.17	.71	.47	.27	.56	-.45	.21	.13	.55	-.07	.25	.14	.16	-.25	.34
On-Campus Sp (N=82)	.02	.59	.14	.46	.60	.06	.07	-.01	.07	.23	-.08	.05	.11	-.05	-.08
On-Campus Fa (N=47)	.35	.82	.35	.52	.60	.21	.02	.07	.12	.32	-.11	.09	-.12	.19	.06

Table 4.21 displays the results from the distance Fall 2021 course and indicated low relationship between academic performance and task value (r=0.17). Task value was substantially associated self-efficacy (r=.56), and organization (r=.55), and moderately associated with help seeking (r=.34). In the on-campus Fall 2021 course indicated a moderate interaction was present between academic performance and task value (r=0.34). Task value was very strongly associated with intrinsic goal orientation (r=.82), substantially associated with control of learning beliefs (r=.52), and self-efficacy (r=.60) and moderately associated with extrinsic goal orientation (r=.35), and critical thinking (r=.32).

Control Of Learning Beliefs

Control of learning beliefs was used to measure the level to which students believed that their efforts to study made a difference in their learning. Table 4.22 displays the results from the distance Spring 2021 course and indicated that this scale did not interact with the distance Spring 2021 students' academic performance (r =0.01). Additionally, control of learning beliefs was strongly associated with task value (r=.73), organization (r=.71), and substantially correlated with intrinsic goal orientation (r=.54), self-efficacy (r=.64), and moderately associated with test anxiety (r=.40), critical thinking (r=.42), effort regulation (r=.32), help seeking (r=.42). During the on-campus Spring 2021 course a low interaction between academic performance and control of learning beliefs (r=0.15) was found. Control of learning beliefs was substantially associated with self-efficacy (r=.60), and intrinsic goal orientation (r=.54), and moderately associated with task value (r=.46), and critical thinking (r=.33).

Table 4.22
Correlations (r) between Control Learning and Final Grade and other MSLQ Constructs

		Motivational Orientations					Cognitive-Metacognitive					Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	.01	.54	.22	.73	.64	.40	.18	.07	.71	.42	.29	.29	.32	.02	.42
Distance Fa (N=10)	-.26	.31	.24	.27	-.04	.12	.63	.28	.74	.23	.60	.48	.61	.05	-.06
On-Campus Sp (N=82)	.15	.54	.25	.46	.60	-.01	.11	.15	.09	.33	.09	.14	.12	.04	-.14
On-Campus Fa (N=47)	.25	.42	.31	.52	.45	.26	.04	.03	-.14	.31	-.09	-.06	-.06	.13	.10

Table 4.22 displays the results from the distance Fall 2021 course control of learning beliefs and indicated negative low interaction with academic performance (r=-0.26). Control of learning beliefs was strongly associated with organization (r=.74), and substantially associated

with rehearsal (r=.63), effort regulation (r=.61), and metacognition self-regulation (r=.60) and moderately associated with intrinsic goal orientation (r=.31), and time & study (r=.48). For the on-campus Fall 2021 course a low interaction between academic performance and control of learning beliefs (r=0.25) was found. Control of learning beliefs was moderately associated with self-efficacy (r=.45), intrinsic goal orientation (r=.42), and task value (r=.52).

Self-efficacy

Self-efficacy measured the students' ability to master tasks and confidence that they possessed the skills to perform the tasks. Table 4.23 displays the results from the distance Spring 2021 course and indicated that self-efficacy lowly interacted with their academic performance (r =0.11). Self-efficacy was additionally strongly associated with intrinsic goal orientation (r=.71), task value (r=.73), substantially associated with control of learning beliefs (r=.64), organization (r=.64), and help seeking (r=.60), and moderately associated with extrinsic goal orientation (r=.34), rehearsal (r=.34), critical thinking (r=.43), and effort regulation (r=.38). For the on-campus Spring 2021 course a low interaction between self-efficacy and academic performance (r=0.17) was found. Self-efficacy was substantially associated with intrinsic goal orientation (r=.69), task value (r=.60), control of learning beliefs (r=.60), and moderately associated with critically thinking (r=.36).

Table 4.21
Correlations (r) between Self-Efficacy and Final Grade and other MSLQ Constructs

		Motivational Orientations					Cognitive-Metacognitive					Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	.11	.71	.34	.73	.64	.27	.34	-.11	.64	.43	.26	.38	.10	.16	.60
Distance Fa (N=10)	.64	.38	.52	.56	-.04	-.11	.12	-.28	.46	.33	.01	.18	-.07	-.32	.36
On-Campus Sp (N=82)	.17	.69	.20	.60	.60	-.20	-.02	-.06	.03	.36	-.08	.09	.06	.06	-.03
On-Campus Fa (N=47)	.40	.75	.28	.60	.45	.16	.16	.18	.09	.49	.07	.18	.10	.24	.19

Table 4.23 displays the results from the distance Fall 2021 course self-efficacy and indicated substantial interaction with academic performance (r=0.64). Self-efficacy was substantially associated with extrinsic goal orientation (r=.52), task value (r=.56), and moderately associated with critical thinking (r=.33), organization (r=.46), intrinsic goal orientation (r=.38), and help seeking (r=.36). For on-campus Fall 2021 course a low interaction with academic performance and self-efficacy (r=0.40) was found. Self-efficacy was strongly associated with intrinsic goal orientation (r=.75), and substantially associated with task value (r=.60), and moderately associated with critical thinking (r=.49), and control of learning beliefs (r=.45).

Test Anxiety

Test anxiety has been found to be negatively related to expectancies as well as academic performance (Pintrich, 1991). Table 4.24 displays the results from the distance Spring 2021 course which indicated no interaction with academic performance (r=0.06). Test anxiety was strongly associated with organization (r=.72), and help seeking (r=.78), substantially

associated with rehearsal (r=.56), time and study management (r=.57), elaboration (r=.69), and metacognition self-regulation (r=.63), and moderately associated with critical thinking (r=.49), control of learning beliefs (r=.40). For the on-campus Spring 2021 a low relationship between test anxiety and academic performance (r=0.01) was found. Test anxiety was moderately associated with extrinsic goal orientation (r=.38).

Table 4.22
Correlations (r) between Test Anxiety and Final Grade and other MSLQ Constructs

		Motivational Orientations					Cognitive-Metacognitive					Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	.06	.34	.19	.21	.40	.27	.56	.69	.72	.49	.63	.57	.53	.57	.78
Distance Fa (N=10)	-.41	-.45	.06	-.45	.12	-.11	.08	-.10	-.13	.36	-.01	.04	-.14	.40	-.39
On-Campus Sp (N=82)	.01	-.12	.38	.06	-.01	-.20	.10	.06	-.19	-.23	-.01	-.10	-.02	-.06	-.06
On-Campus Fa (N=47)	.13	.23	.43	.21	.26	.16	.13	.09	-.02	.15	.04	.19	-.06	.07	.11

Table 4.24 displays the results from the distance Fall 2021 course test anxiety and indicated negatively moderate interaction with academic performance (r=-0.41). Text anxiety was negatively moderately associated intrinsic goal orientation (r=-.45), task value (r=-.45), help seeking (r=-.39), and positively moderately associated with critical thinking (r=.36), and peer learning (r=.40). For the on-campus Fall 2021 course a low interaction between test anxiety and academic performance (r=0.13) was found. Test anxiety additionally was moderately associated with extrinsic goal orientation (r=.43).

Rehearsal

Rehearsal measured strategies that involved reciting or naming items from a list to be learned. Table 4.25 displays the results from the distance Spring 2021 course rehearsal and indicated a negatively low relation between critical thinking and academic performance (r=-0.16). However, rehearsal was strongly associated with elaboration (r=.75), critical thinking (r=.88), metacognition self-regulation (r=.90), time and study management (r=.77), effort regulation (r=.77), and help seeking (r=.70), and substantially associated with peer learning (r=.54), test anxiety (r=.56), and moderately associated with organization (r=.44). For the on-campus Spring 2021 course a negative low interaction between rehearsal and academic performance (r=-.12) was found. Rehearsal was substantially associated with effort regulation (r=.54), and moderately associated with elaboration (r=.45), and time and study management (r=.48), critical thinking (r=.30), and metacognition self-regulation (r=.38).

Table 4.23
Correlations (r) between Rehearsal and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive				Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	-.16	.43	.69	.07	.18	.34	.56	.75	.44	.88	.90	.77	.77	.54	.70
Distance Fa (N=10)	-.15	.45	.13	.21	.63	.12	.08	.71	.35	.56	.90	.92	.88	.13	.48
On-Campus Sp (N=82)	-.12	.02	.08	.07	.11	-.02	.10	.45	.24	.30	.38	.48	.54	.25	.12
On-Campus Fa (N=47)	-.04	.01	.25	.02	.04	.16	.13	.54	.38	.69	.63	.56	.62	.51	.36

Table 4.25 displays the results from the distance Fall 2021 course rehearsal and indicated negatively low interaction with academic performance (r=-0.15). However, rehearsal was strongly correlated with elaboration (r=.71), metacognition self-regulation (r=.90), time and

study management (r=.92), and effort regulation (r=.88), and substantially associated with control of learning beliefs (r=.63), and critical thinking (r=56), and moderately associated with organization (r=.35), and help seeking (r=.48). For the on-campus Fall 2021 course no interaction between rehearsal and academic performance (r=-0.04) was found. Rehearsal was substantially associated with elaboration (r=.54), critical thinking (r=.69), metacognition self-regulation (r=.63), time and study management (r=.56), effort regulation (r=.62), and peer learning (r=.51), and moderately associated with organization (r=.38), and help seeking (r=.36).

Elaboration

Elaboration measured the strategies used by students to help store information into long-term memory by building internal connections between items to be learned. Table 4.26 displays the results from the distance Spring 2021 course elaboration and indicated negative low interaction with academic performance (r=-0.12). Elaboration was strongly associated with critical thinking (r=.74), metacognition self-regulation (r=.80), and substantially associated with time and study management (r=.62), effort regulation (r=.69), peer learning (r=.62), and help seeking (r=.55), and moderately associated with extrinsic goal orientation (r=.46). For the on-campus Spring 2021 course a negative low interaction between elaboration and academic performance (r=-0.24) was found. Elaboration was substantially associated with metacognition self-regulation (r=.53), and moderately associated with critical thinking (r=.39), time and study management (r=.36), and effort regulation (r=.32).

Table 4.24
Correlations (r) between Elaboration and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive				Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	-.12	.06	.46	-.19	.07	-.11	.69	.75	.28	.74	.80	.62	.69	.62	.55
Distance Fa (N=10)	-.42	.58	-.12	.13	.28	-.28	-.10	.71	-.08	.15	.80	.67	.60	.27	.40
On-Campus Sp (N=82)	-.24	-.01	.18	-.01	.15	-.06	.06	.45	.11	.39	.53	.36	.32	.27	.22
On-Campus Fa (N=47)	-.04	.04	.19	.07	.03	.18	.09	.54	.45	.50	.74	.64	.42	.52	.48

Table 4.26 displays the results from the distance Fall 2021 course elaboration and indicated negatively moderate interaction with academic performance (r=-0.42). Elaboration was strongly associated with metacognition self-regulation (r=.80), and rehearsal (r=.71), and substantially associated with intrinsic goal orientation (r=.58), time and study management (r=.67), and effort regulation (r=.60), and moderately associated with help seeking (r=.40). For the on-campus Fall 2021 course no interaction between elaboration and academic performance (r=-0.04) was found. Elaboration was strongly associated with metacognition self-regulation (r=.74), substantially associated with critical thinking (r=.50), time and study management (r=.64), peer learning (r=.52), and rehearsal (r=.54) and moderately associated with effort regulation (r=.42), and organization (r=.45), and help seeking (r=.48).

Organization

Organization measured the strategies that help the learner select appropriate information and construct connections among the information to be learned. Table 4.27 displays the results

from the distance Spring 2021 course organization and indicated organization was negative lowly related to academic performance of the students (r=-0.13). Organization was strongly associated with help seeking (r=.74), control of learning beliefs (r=.71), test anxiety (r=.72), and help seeking (r=.74), and substantially associated with intrinsic goal orientation (r=.67), self-efficacy (r=.64), effort regulation (r=.53), and moderately associated with critical thinking (r=.41), metacognition self-regulation (r=.46), and time and study management (r=.49). For the on-campus Spring 2021 course a negatively low interaction between organization and academic performance (r=-0.19) was found. Organization was substantially associated with time and study management (r=.63), and moderately associated with metacognition self-regulation (r=.39) and effort regulation (r=.36).

Table 4.25
Correlations (r) between Organization and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive				Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	-.13	.67	.34	.74	.71	.64	.72	.44	.28	.41	.46	.49	.53	.33	.74
Distance Fa (N=10)	.19	.42	.39	.55	.74	.46	-.13	.35	-.08	.36	.27	.17	.23	-.12	.15
On-Campus Sp (N=82)	-.19	.05	-.04	.07	.09	.03	-.19	.24	.11	.19	.39	.63	.36	.16	.11
On-Campus Fa (N=47)	-.05	.06	.12	.12	-.14	.09	-.02	.38	.45	.33	.53	.60	.45	.33	.41

Table 4.27 displays the results from the distance Fall 2021 course organization and indicated low interaction with academic performance (r=0.19). Organization was strongly associated with control of learning beliefs (r=.74), and substantially associated with task value

(r=.55), moderately associated with intrinsic goal orientation (r=.42), extrinsic goal orientation (r=.39), self-efficacy (r=.46), rehearsal (r=.35), and critical thinking (r=.36). For the on-campus Fall 2021 course no interaction between organization and academic performance (r=-0.05) was found. Organization was substantially associated with rehearsal metacognition self-regulation (r=.53), and time and study management (r=.60), and moderately associated with rehearsal (r=.38), elaboration (r=.45), critical thinking (r=.33), peer learning (r=.33), effort regulation (r=.45), and help seeking (r=.41).

Critical Thinking

Critical thinking measured the degree to which students report applying previous knowledge to new situations to solve problems, reach decisions, or make critical evaluations with respect to standards of excellence. Table 4.28 displays the results from the distance Spring 2021 course critical thinking and indicated a negatively low relation with academic performance (r=-0.16). Critical thinking was strongly associated with rehearsal (r=.88), and metacognition self-regulation (r=.80), and elaboration (r=.74), and substantially associated with extrinsic goal orientation (r=.60), time and study management (r=.67), effort regulation (r=.66), and help seeking (r=.52), and moderately associated with intrinsic goal orientation (r=.34), control of leraning beliefs (r=.42), self-efficacy (r=.43), test anxiety (r=.29), and peer learning (r=.41). For the on-campus Spring 2021 course a negative low interaction between critical thinking and academic performance (r=-0.12) was found. Critical thinking was moderately associated with control of learning beliefs (r=.33), self-efficacy (r=.36), rehearsal (r=.30), elaboration (r=.39), metacognition self-regulation (r=.31), time and study management (r=.43), and peer learning (r=.38).

Table 4.26
Correlations (r) between Critical Thinking and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive				Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	-.16	.34	.60	.13	.42	.43	.49	.88	.74	.41	.80	.67	.66	.41	.52
Distance Fa (N=10)	.20	.08	.20	-.07	.23	.33	.36	.56	.15	.36	.27	.48	.33	.38	.52
On-Campus Sp (N=82)	-.12	.27	.10	.23	.33	.36	-.23	.30	.39	.19	.31	.43	.13	.38	.24
On-Campus Fa (N=47)	.26	.30	.18	.32	.31	.49	.15	.69	.50	.33	.53	.57	.60	.61	.48

Table 4.28 displays the results from the distance Fall 2021 course critical thinking and indicated a low interaction with academic performance (r=0.20). Critical thinking was substantially associated with rehearsal (r=.56), and help seeking (r=.52), and moderately associated with self-efficacy (r=.33), test anxiety (r=.36), organization (r=.36), time and study management (r=.48), effort regulation (r=.33), and peer learning (r=.38). For the on-campus Fall 2021 course a low interaction between critical thinking and academic performance (r=0.26) was found. Critical thinking was substantially associated with rehearsal (r=.69), elaboration (r=.50), metacognition self-regulation (r=.53), time and study management (r=.57), effort regulation (r=.60), peer learning (r=.61), and moderately associated with help seeking (r=.48).

Metacognition Self-Regulation

Metacognition refers to the awareness, knowledge, and control of cognition. This scale measured the three general processes that make up metacognitive self-regulatory activities: planning, monitoring, and regulating. Table 4.29 displays the results from the distance Spring 2021 course indicated a negatively low relation between critical thinking and academic

performance (r=-0.22). Metacognition self-regulation was strongly correlated with extrinsic goal orientation (r=.73), rehearsal (r=.90), elaboration (r=.80), critical thinking (r=.80), time and study management (r=.88), effort regulation (r=.80), peer learning (r=.714), and help seeking (r=.77) and substantially associated with intrinsic goal orientation (r=.51), and test anxiety (r=.63). For the on-campus Spring 2021 course a negative low interaction between metacognition self-regulation and academic performance (r=-0.13) was found. Metacognition self-regulation was substantially associated with elaboration (r=.53), and time and study management (r=.55) and moderately associated with organization (r=.39), and effort regulation (r=.37).

Table 4.27
Correlations (r) between Metacognition Self-Regulation and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive				Resource Mgmt.			
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Time & Study	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	-.22	.51	.73	.10	.29	.26	.63	.90	.80	.46	.80	.88	.80	.71	.77
Distance Fa (N=10)	-.30	.55	-.03	.25	.60	.01	-.01	.90	.80	.27	.23	.81	.77	.04	.34
On-Campus Sp (N=82)	-.13	-.19	.21	-.08	.09	-.08	-.01	.38	.53	.39	.31	.55	.37	.28	.28
On-Campus Fa (N=47)	-.04	-.11	.14	-.11	-.09	.07	.04	.63	.74	.53	.53	.66	.63	.59	.56

Table 4.29 represents the results from the distance Fall 2021 course and indicated negatively moderate interaction between metacognition self-regulation and academic performance (r=-0.30) was found. However, metacognition self-regulation was strongly correlated with rehearsal (r=.90), elaboration (r=.80), time and study management (r=.81), and

effort regulation (r=.77), substantially associated with intrinsic goal orientation (r=.55), control of learning beliefs (r=.60), and moderately associated with help seeking (r=.34). For the on-campus Fall 2021 course no interaction between metacognition self-regulation and academic performance (r=-0.04) was found. Metacognition self-regulation was strongly associated with elaboration (r=.74), and substantially associated with rehearsal (r=.63), organization (r=.53), critical thinking (r=.53), time and study management (r=.66), effort regulation (r=.63), peer learning (r=.59), and help seeking (r=.56).

Time And Study Environment

The time and study environment scale measured the level at which students must be able to manage and regulate their time and their study environment. Table 4.30 displays the results from the distance Spring 2021 course and indicated that time and study environment as utilized by the sample is negatively related to the students' academic performance (r =-0.38). Time and study management was strongly correlated with rehearsal (r=.77), effort regulation (r=.72), and metacognition self-regulation (r=.88), and help seeking (r=.70), and substantially associated with extrinsic goal orientation (r=.64), test anxiety (r=.57), elaboration (r=.62), critical thinking (r=.67), and peer learning (r=.61), and moderately associated with intrinsic goal orientation (r=.44), self-efficacy (r=.38), and organization (r=.49). For the on-campus Spring 2021 course a negative low interaction between time and study environment and academic performance (r=-0.10) was found. Time and study management was substantially associated with organization (r=.63), metacognition self-regulation (r=.55), effort regulation (r=.58), and moderately associated with elaboration (r=.36), critical thinking (r=.43), peer learning (r=.39), and help seeking (r=33).

Table 4.28
Correlations (r) between Time and Study Environment and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive					Resource Mgmt.		
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Effort Regulation	Peer Learning	Help Seeking
Distance Sp (N=14)	-.38	.44	.64	.06	.29	.38	.57	.77	.62	.49	.67	.88	.72	.61	.70
Distance Fa (N=10)	.05	.49	.12	.14	.48	.18	.04	.92	.67	.17	.48	.81	.87	.17	.53
On-Campus Sp (N=82)	-.10	.08	.19	.05	.14	.09	-.10	.48	.36	.63	.43	.55	.58	.39	.33
On-Campus Fa (N=47)	-.03	.01	.15	.09	-.06	.18	.19	.56	.64	.60	.57	.66	.70	.51	.67

Table 4.30 displays the results from the distance Fall 2021 course time and study environment indicated no interaction with academic performance (r=0.05). Time and study management was strongly associated with rehearsal (r=.92), metacognition self-regulation (r=.81), and effort regulation (r=.87), and substantially associated with elaboration (r=.67), and help seeking (r=.53), and moderately associated with intrinsic goal orientation (r=.49), control of learning beliefs (r=.48), and critical thinking (r=.48). For the on-campus Fall 2021 course no interaction between time and study environment and academic performance (r=-0.03) was found. Time and study management was strongly associated with effort regulation (r=.70), and substantially associated with rehearsal (r=.56), elaboration (r=.64), organization (r=.60), critical thinking (r=.57), and metacognition self-regulation (r=.66), and peer learning (r=.51), and help seeking (r=.67).

Effort Regulation

This scale measured the level of students' effort and commitment to completing their study goals, even in the presence of difficulties or distractions. Table 4.31 displays the results from the distance Spring 2021 course and indicated that effort regulation was negatively moderately related to the academic performance of students (r = -0.38). Effort regulation was strongly associated with rehearsal (r=.77), metacognition self-regulation (r=.80), and time and study (r=.72), and substantially associated with extrinsic goal orientation (r=.59), test anxiety (r=.53), elaboration (r=.69), organization (r=.53), critical thinking (r=.66), and help seeking (r=.65), and moderately associated with control of learning beliefs (r=.32), and peer learning (r=.44). For the on-campus Spring 2021 course no interaction between effort regulation and academic performance (r=-0.01) was found. Effort regulation was substantially associated with rehearsal (r=.54), time & study (r=.58), and moderately associated with elaboration (r=.32), organization (r=.36), metacognition self-regulation (r=.37), and peer learning (r=.35).

Table 4.29
Correlations (r) between Effort Regulation and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive					Resource Mgmt.		
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Peer Learning	Help Seeking
Distance Sp (N=14)	-.38	.41	.59	.07	.32	.10	.53	.77	.69	.53	.66	.80	.72	.42	.65
Distance Fa (N=10)	-.03	.37	-.02	.16	.61	-.07	-.14	.88	.60	.23	.33	.77	.87	.13	.48
On-Campus Sp (N=82)	-.01	.11	.06	.11	.12	.06	-.02	.54	.32	.36	.13	.37	.58	.35	.21
On-Campus Fa (N=47)	-.02	-.16	-.03	-.11	-.06	.10	-.06	.62	.42	.45	.60	.63	.70	.53	.57

Table 4.31 displays the results from the distance Fall 2021 course effort regulation and indicated no interaction with academic performance (r=-0.03). Effort regulation was strongly associated with rehearsal (r=.88), metacognition self-regulation (r=.77), and time & study (r=.87), and substantially associated with control of learning beliefs (r=.61), elaboration (r=.60), moderately associated with intrinsic goal orientation (r=.37), critical thinking (r=.33), and peer learning (r=.48). For the on-campus Fall 2021 course no interaction between effort regulation and academic performance (r=-0.02) was found. Effort regulation was strongly associated with time & study (r=.70), and substantially associated with rehearsal (r=.62), critical thinking (r=.60), metacognition self-regulation (r=.63), peer learning (r=.53), and help seeking (r=.57).

Peer Learning

The level of collaboration with peers to assist a learner to clarify materials and reach insights on coursework that was not attained in the classroom. Table 4.32 displays the results from the distance Spring 2021 course indicated that peer learning was not related to the academic performance of the students (r = -0.05). Peer learning was strongly associated with metacognition self-regulation (r=.71), substantially associated with intrinsic goal orientation (r=.52), extrinsic goal orientation (r=.53), test anxiety (r=.57), rehearsal (r=.54), elaboration (r=.62), time & study (r=.61), and moderately associated with organization (r=.33), critical thinking (r=.41), effort regulation (r=.42), and help seeking (r=.48). For the on-campus Spring 2021 course a negative low interaction between peer learning and academic performance (r=-0.22) was found Peer learning was moderately associated with critical thinking (r=.38), time & study (r=.39), and effort regulation (r=.35).

Table 4.30
Correlations (r) between Peer Learning and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive					Resource Mgmt.		
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Help Seeking
Distance Sp (N=14)	-.05	.52	.53	.12	.02	.16	.57	.54	.62	.33	.41	.71	.61	.42	.48
Distance Fa (N=10)	-.03	.13	-.50	-.25	.05	-.32	.40	.13	.27	-.12	.38	.04	.17	.13	.36
On-Campus Sp (N=82)	-.22	.15	.07	-.05	.04	.06	-.06	.25	.27	.16	.38	.28	.39	.35	.29
On-Campus Fa (N=47)	.14	.15	-.01	.19	.12	.24	.07	.51	.52	.33	.61	.59	.51	.54	.56

Table 4.32 displays the results from the distance Fall 2021 course peer learning and indicated no interaction with academic performance (r=-0.03). Peer learning was negatively substantial relation with extrinsic goal orientation (r=-0.50), and moderately associated with test anxiety (r=.40), critical thinking (r=.38), and help seeking (r=.36). For the on-campus Fall 2021 students a low interaction between peer learning and academic performance (r=0.14) was found. Peer learning was substantially associated with rehearsal (r=.51), elaboration (r=.52), critical thinking (r=.61), metacognition self-regulation (r=.59), time & study (r=.51), effort regulation (r=.54), and help seeking (r=.56).

Help Seeking

Research has indicated that peer help, peer tutoring, and instructor assistance facilitate student achievement (Pintrich, 1991). Table 4.33 displays the results indicated that students' participants in this study did not fully utilize these resources. The scale was negatively related to the students' academic performance, and the lowly associated to academic performance (r =-0.18). Help seeking was strongly associated with test anxiety (r=.78), organization (r=.74),

metacognition self-regulation (r=.77), time & study (r=.70)), and substantially associated with intrinsic goal orientation (r=.57), extrinsic goal orientation (r=.58), self-efficacy (r=.59), rehearsal (r=.69), elaboration (r=.55), critical thinking (r=.52), and effort regulation (r=.65), and moderately associated with task value (r=.47), and peer learning (r=.48). For the on-campus Spring 2021 students a negative low interaction between help seeking and academic performance (r=-0.21) was found. Help seeking is moderately associated with time & study (r=.33).

Table 4.31
Correlations (r) between Help Seeking and Final Grade and other MSLQ Constructs

		Motivational Orientations						Cognitive-Metacognitive					Resource Manage		
Semester	Final Lab Grade	Intrinsic	Extrinsic	Task Value	Control Learning	Self-Efficacy	Test Anxiety	Rehearsal	Elaboration	Organization	Critical Thinking	Meta Self-Regulation	Time & Study	Effort Regulation	Peer Learning
Distance Sp (N=14)	-.18	.57	.58	.47	.42	.59	.78	.69	.55	.74	.52	.77	.70	.65	.48
Distance Fa (N=10)	.54	.61	-.18	.34	-.06	.36	-.39	.48	.40	.15	.52	.34	.53	.48	.36
On-Campus Sp (N=82)	-.21	-.10	.10	-.08	-.14	-.03	-.06	.12	.22	.11	.14	.28	.33	.21	.29
On-Campus Fa (N=47)	.10	.06	.03	.06	.10	.19	.11	.36	.48	.41	.48	.56	.67	.57	.56

Table 4.33 displays the results from the distance Fall 2021 course help seeking and indicated substantial interaction with academic performance (r=0.54). Help seeking was substantially associated with intrinsic goal orientation (r=.61), critical thinking (r=.52), and time & study (r=.53), and moderately associated with task value (r=.34), self-efficacy (r=.36), rehearsal (r=.48), elaboration (r=.40), metacognition self-regulation (r=.34), effort regulation (r=.48), and peer learning (r=.36). For the on-campus Fall 2021 students a low interaction

between help seeking and academic performance (r=0.10) was found. Help seeking was substantially associated with metacognition self-regulation (r=.56), time & study (r=.67), effort regulation (r=.57), and peer learning (r=.56), and moderately associated with rehearsal (r=.36), elaboration (r=.48), organization (r=.41), and critical thinking (r=.48).

Chapter 5 - Conclusions and Recommendations

Conclusions: Research Objective One

The majority of students enrolled in this online laboratory section were female with an intermediate level of computer knowledge. The average age was older than a traditional college-aged student. The students were likely to be an animal science major that also worked outside of the classroom and had to balance managing coursework with outside commitments which indicated a level of self-discipline existed. The time spent completing laboratory assignments varied between the two semesters of students. Students in the Spring 2021 distance course on average worked more hours, while taking more credit hours during the semester.

Implications: Research Objective One

Research indicated many students have the background necessary to be successful in a distance science course and supports existing literature for non-traditional student success in distance courses. The research will contribute to the body of knowledge that explains the type of student enrolling in the distance modality.

Conclusions: Research Objective Two

Students in both semesters of the distance course were overall satisfied with the interactions with the laboratory instructor, laboratory materials and technology, laboratory assignments, level of impact the course had on interest. However, the Fall 2021 students were approximately 20-30% more pleased with the instructor, the assignments were more helpful to their learning, reported the course highly corresponded to their expectations, and majority were

highly satisfied with the distance course, and 30% more students would recommend this online laboratory to another student compared to Spring 2021 students.

Both semesters of distance students were overall satisfied with their experiences but Fall 2021 students rated their course satisfaction higher, which indicated distance students can be highly satisfied with distance laboratory courses. Though the courses were taught the same and the instructor was the same, distance students in the Fall 2021 semester indicated there were differences between the two samples. Differences in demographics such as credit hours being taken and number of hours worked per week, could partially explain the differences in satisfaction scores between the two semesters.

Previously, the distance course was capped at a fairly low number of students, therefore Spring 2021 had a greater number of students due to opening to the class to a larger number of students. Before Fall 2021, the decision was made to offer the course in both spring and fall semester, but a lesser number of students. Having fewer students in the Fall 2021 course, allowed more time for each student, which could explain the greater satisfaction for the Fall 2021 students. There were no other recognizable changes made to the course, so it was unclear why this change was present. An observation was that the Fall 2021 class was more engaged and interacted with the instructor more readily.

Implications: Research Objective Two

The conclusions of this study related to student satisfaction support findings in other research as Stucky-Mickell (2007), that reported students perceived on-hands laboratories enhanced understanding of the course content. Additionally, this research expands the knowledge base related to student satisfaction in distance science laboratories.

Conclusions: Research Objective Three

Anatomy knowledge gained in the distance courses was similar in both fall and spring semesters. Both distance semesters indicated increased learning over on campus learning. However, the fall semester revealed an even greater increased anatomy knowledge over on campus learning than the spring semester. This finding indicated distance students in this study were able to learn more anatomy knowledge than the on-campus students. This study shows students were able to gain anatomy knowledge within different modes of delivery. Potentially the distance format gave students more time to learn the material as they completed assignments, access to material at times that worked around other commitments, and the opportunity to study at their own pace. Additionally, taking a course from the comfort of their own home could reduce test anxiety.

Implications: Research Objective Three

This study corroborates the findings of McClure and Cook (2012), which compared student exam scores between a traditional on-campus anatomy course and a distance anatomy course and found exam scores of the distance students were higher than exam scores of the on-campus students. The findings of this contribute to the knowledge that students in a distance modality can gain more knowledge than their counterparts in on-campus format. The perception that distance instruction is less effective appears to be false.

Conclusions: Research Objective Four

Students in fall coursework may have different motivations and learning strategies than students enrolling in spring coursework. Students in fall distance and on campus courses had similar motivations and learning strategies while students in spring distance and on campus courses also tended to be similar with each other but not necessarily consistent with fall. One possible explanation is that students taking a high-level anatomy course in fall are motivated to acquire prerequisite knowledge for graduate or veterinarian programs while the students that completed the course in the spring are meeting graduation requirements. This variance in motivation may also influence their enrollment and choice of modality.

Students in the Fall and Spring distance and on-campus courses indicated self-efficacy has a positive relation with academic performance. A student's level of self-efficacy can predict cognitive strategies and self-regulation, which in turn can predict academic achievement (Zimmerman, 1995), and explain the success of the distance and on-campus students. Students that exhibit more motivation strategies and multiple learning tactics tend to exhibit more learning in higher level science coursework. Students in Fall distance and on-campus courses revealed additional factors correlating to academic performance: intrinsic and extrinsic goal orientation, task value, organization, critical thinking, seeking help, control of learning beliefs, and peer learning. Fall students reported a higher correlation with task value and self-efficacy to final laboratory grade and are two components in the motivation construct of self-regulated learning, positively predicted students' overall satisfaction with a distance course (Artino, 2007). This finding could contribute to the explanation of the student satisfaction previously found in objective two. Additionally, the higher correlation and these constructs and final laboratory grade could explain the knowledge gained in the fall semester and higher final grades.

Implications: Research Objective Four

These findings are in line with Zimmerman (1995), stating student's level of self-efficacy can predict cognitive strategies and self-regulation, which in turn can predict academic achievement. Additionally, this study shows students with higher self-efficacy tend to use more cognitive and metacognitive strategies than those who have lower confidence levels which is in agreeance with Pintrich and de Groot (1990).

Recommendations

1. One of the main premises of this research was that a key factor in predicting online student performance and success is students' ability to monitor, regulate, and manage resources to facilitate their own learning. Instructors can use this known motivation to improve learning in their courses despite the mode of delivery.

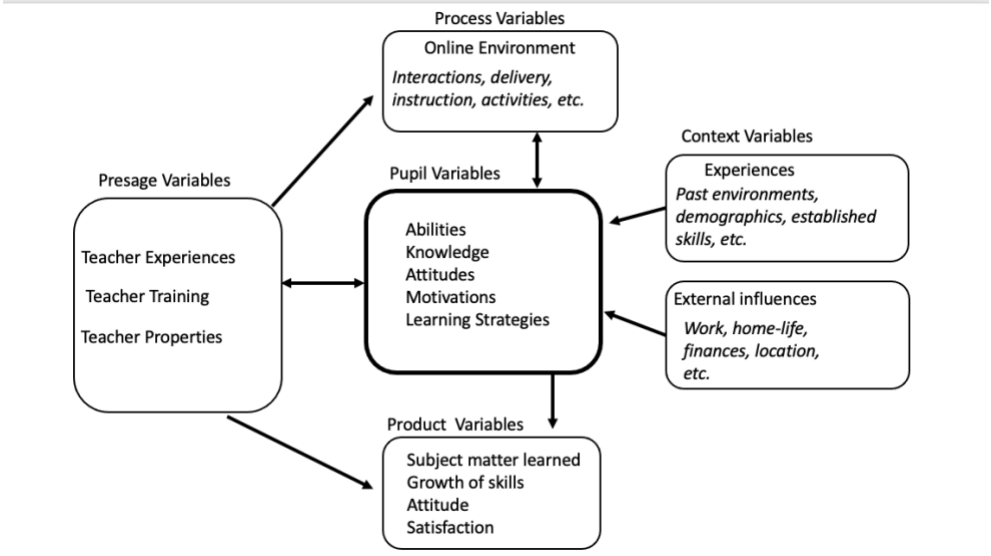
2. Instructors could also educate students in time management techniques and coach them on self-reflection and self-regulation of effort. Instructors could devise strategies to help students set goals that focus on mastery and encourage the use of self-regulatory strategies for persisting through difficult and challenging assignments.

3. Instructors could provide students structured opportunities to self-assess to focus their efforts on relevant skills and knowledge, which allows students to see what they should be putting effort into rather than what they individually believe effort looks like in college.

4. Animal Science programs can offer distance specific science classes and instructors should be encouraged to explore opportunities to expand their programs using at-home laboratory kits that give students hands-on experiences.

5. Students can use their understanding of their own motivations and learning strategies to embrace distance education classes as a quality way to learn.

We propose that Dunkin's and Biddle's (1974) should be modernized to encompass a 21st century educational distance education environment. The adapted model puts the pupil variables in the center, showing how the remaining variables influence the student. Presage variables heavily influence the process, pupil variables, and product variables but more emphasis needs to be on how the pupil variables interact with the other variables to produce the product variables. Additionally, external influences such as work, home-life, finances, etc., need to be factored into context variables as they can sway student variables.



Recommendations for Further Research

1. This study should be replicated, based on the limited generalizability of the sample. With each additional replication, a better understanding of the impact of distance hands-on learning on students.

2. Further research to continue studying the relationships between academic performance and motivational beliefs and learning strategies through longitudinal research within the college years, identifying possible changes as students continue within their major or across different related majors.

3. Additional research should be conducted to better understand student majors, time of graduation, and post-graduate goals and how this relates to motivations and learning strategies.

4. Research to explore the impact of the different barriers distance students experienced during their semester of distance learning and how this influences their motivations and learning strategies.

5. Research on demographics and knowledge gained could help verify if the finding of the study can generalize across other student populations.

6. Research to explore the age and maturity level of non-traditional distance students to distance students who are otherwise on campus and younger, not working full time, are less mature.

7. Research to explore the differences in students that enroll in spring and fall semesters of upper-level science courses.

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Appendix A -

Appendix A.1 Consent Form
Evaluation of Animal Science Anatomy and Physiology Online Laboratory Course

The teachers of Anatomy and Physiology in the Animal Science department are completing research to understand the impact of their online laboratory course. Since you enrolled in the online Anatomy and Physiology course, we would like to know how you were impacted by this course. The results of the study will help us understand the effectiveness of an online laboratory course.

The interview should take about 30 to 45 minutes to complete. Your response will be kept confidential and your participation in this survey is voluntary. All data collected from this survey will be combined and reported with other participants data and not by individuals. Your data will not be stored with your personal information and only the two lead researchers will have access to the raw data. It is possible that your data, without your personal information, could be stored and used for future research studies or by future research without asking for further consent. If you would prefer not to answer a particular question, simply tell the researcher and we will continue to the next question.

There are no perceived risks from your participation in the interview.

If you have any questions about this project, please feel free to ask the researcher now or contact

Celsey Beneda at celseyb@ksu.edu. For additional information regarding human participation in research, contact the Kansas State University, Office of Research Compliance at (785) 532-3224.

Do you give your personal consent for your information to be used for the completion of this study?

☐ Yes

☐ No

Signature_____

Appendix A.2 Consent Form

Evaluation of Animal Science Anatomy and Physiology Online Laboratory Course

The teachers of Anatomy and Physiology in the Animal Science department are completing research to understand the impact of their online laboratory course. Since you enrolled in the online Anatomy and Physiology course, we would like to know how you were impacted by this course. The results of the study will help us understand the effectiveness of an online laboratory course.

You will be asked complete a pre- and post-test over the course information, a satisfaction survey and an interview. Your responses will be kept confidential and your participation is voluntary. All data collected from this survey will be combined and reported with other participants data and not by individuals. Your data will not be stored with your personal information and only the two lead researchers will have access to the raw data. It is possible that your data, without your personal information, could be stored and used for future research studies or by future research without asking for further consent. We also ask for permission to your student data. If you would prefer for your data to not be used, mark no on this consent form.

There are no perceived risks from your participation in the interview.

If you have any questions about this project, please feel free to ask the researcher now or contact Celsey Beneda at celseyb@ksu.edu. For additional information regarding human participation in research, contact the Kansas State University, Office of Research Compliance at (785) 532-3224.

Do you give your personal consent for your data to be used for the completion of this study?

☐ Yes

☐ No

Signature_____

Appendix B -

Appendix B.1 Semi-Structured Open-Ended Interview Questions

1. What were the most valuable aspects of this course?
2. What was the main reason (s) you chose to take this online anatomy and physiology lab class?
    a. Would you enroll in another online lab class?
3. What was your favorite aspect of the course? Least favorite?
4. How would you describe your overall experience of learning in this online lab course?
5. What are the advantages and disadvantages of an online laboratory class?
6. Were there any external barriers that you faced that effected your performance in this course?
    a. Anything the instructor could have done to help more?
7. Would the quality of learning be the same if you took this lab in a traditional face to face environment? What is different?
8. Were the laboratory manuals helpful? Were the videos?
9. How would you describe the quality of the preserved specimens? Bigger rabbits?
    a. Would you be willing to pay more to get bigger rabbits?
    b. Any suggestions for next semester dissection kits?
10. Did you like how the modules were setup on Canvas?
    a. No due dates? Would you prefer due dates?
11. What would you have changed about this course?
12. Do you have constructive suggestions for improving the course?
13. Is there anything you would like to add before this interview is done?

Appendix C

Appendix C.1 Online Laboratory Satisfaction Survey

Survey Instructions: As a student taking an online course this semester, your responses to the following questions will help us improve our course design and our instruction. This survey is given to assess your satisfaction with the online learning environment. This survey will be asking questions based on the LABORATORY PORTION ONLY.

Q1 What is your gender?

_____

Q2 What is your age?

_____

Q3 Do you receive financial aid?

- ○ Yes (if so, what type?) (1)

_____

- ○ No (2)
- ○ Prefer not to answer (3)

Q4 What is your degree option?

- ○ Animal Products (4)
- ○ Products Management (5)
- ○ Pre-Vet (6)
- ○ Other (7) _____

Q5 What percentage of your degree from KSU in online?

(1 2 3 4 5 6 7 8 9 1

0 0 0 0 0 0 0 0 0 00

% ()

Q6 How many credit hours have you completed to date online?

_____

Q7 How many online hours are you enrolled in this semester?

_____

Q8 How many total online credits are from KSU?

_____

Q9 What is your level of computer knowledge?

- ○ Expert (1)
- ○ Intermediate (2)
- ○ Novice (3)
- ○ Other (4) _____

Q10 How many hours do you work per week?

((1 1 2 3 3 4 4 5 6

2 8 4 0 6 2 8 4 0

Hours per week ()	

Q11 How many children do you have?

_____

Q12 How many total hours per week did you spend completing laboratory assignments?

- ○ >4 (1)
- ○ 3-3.9 hours (2)
- ○ 2-2.9 hours (3)
- ○ <2 hours (4)

Q13 How many previous online laboratories have you enrolled in?

_____

Q14 How many anatomy and physiology courses have you enrolled in before this semester? (Human & animal)

_____

End of Block: Demographics

Start of Block: Student Satisfaction

Q15 How useful were the laboratory materials (lab manual, videos, etc.)?

- ○ Extremely useful (1)
- ○ Moderately useful (2)
- ○ Slightly useful (3)
- ○ Neither useful nor useless (4)
- ○ Slightly useless (5)
- ○ Moderately useless (6)
- ○ Extremely useless (7)

Q16 How easy was it to use the technology needed for this laboratory?

- ○ Extremely easy (1)
- ○ Moderately easy (2)
- ○ Slightly easy (3)
- ○ Neither easy nor hard (4)
- ○ Slightly hard (5)
- ○ Moderately hard (6)
- ○ Extremely hard (7)

Q17 How clearly did the instructor explain the laboratory material?

- ○ Extremely clearly (1)
- ○ Moderately clearly (2)
- ○ Slightly clearly (3)
- ○ Neither clear nor unclear (4)
- ○ Slightly unclearly (5)
- ○ Moderately unclearly (6)
- ○ Extremely unclearly (7)

Q18 How well did the instructor answer the students' questions?

- ○ Extremely well (1)
- ○ Moderately well (2)
- ○ Slightly well (3)
- ○ Neither well nor poorly (4)
- ○ Slightly poorly (5)
- ○ Moderately poorly (6)
- ○ Extremely poorly (7)

Q19 How helpful or unhelpful were the assignments in your understanding of the material?

- ○ Extremely helpful (1)
- ○ Moderately helpful (2)
- ○ Slightly helpful (3)
- ○ Neither helpful nor unhelpful (4)
- ○ Slightly unhelpful (5)
- ○ Moderately unhelpful (6)
- ○ Extremely unhelpful (7)

Q20 Would you recommend this course with an online laboratory to another student?

- ○ Yes (1)
- ○ Maybe (2)
- ○ No (3)

Q21 Would you take another online laboratory if offered in the same format?

- ○ Yes (1)
- ○ Maybe (2)
- ○ No (3)

Q22 Were the tasks that you were asked to complete in each laboratory assignment appropriate for this class?

- ○ Extremely appropriate (1)
- ○ Moderately appropriate (2)
- ○ Slightly appropriate (3)
- ○ Neither appropriate nor inappropriate (4)
- ○ Slightly inappropriate (5)
- ○ Moderately inappropriate (6)
- ○ Extremely inappropriate (7)

Q23 What level of impact, if any, did this class have on your interest level of anatomy?

- ○ Extremely well (1)
- ○ Moderately well (2)
- ○ Slightly well (3)
- ○ Neither well nor poor (4)
- ○ Slight poor (5)
- ○ Moderately poor (6)
- ○ Extremely poor (7)

Q24 How well did the laboratory course correspond to your expectations?

- ○ Extremely well (1)
- ○ Moderately well (2)
- ○ Slightly well (3)
- ○ Neither well nor poor (4)
- ○ Slightly poor (5)
- ○ Moderately poor (6)
- ○ Extremely poor (7)

Q25 Overall, how would you rate your satisfaction of this online laboratory?

- ○ Excellent (1)
- ○ Very well (2)
- ○ Moderately well (3)
- ○ Neutral (4)
- ○ Fairly (5)
- ○ Poorly (6)
- ○ Very Poorly (7)

End of Block: Student Satisfaction