

An Analysis of Student Learning Comparing Traditional, Interactive Television,
and Online Delivery Methods in Cross Sectional Anatomy
at Northcentral Technical College

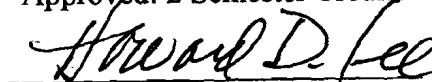
by

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ABSTRACT

Post-secondary enrollments are rising due to online learning. Today, most colleges and universities offer some form of online learning. While some will argue about its advantages and disadvantages, most would agree they are here to stay. Educational institutions are offering online learning to meet the scheduling demands of their students which create many questions. Is the online delivery method as effective for student learning when compared to traditional and interactive television methods?

Northcentral Technical College like other educational institutions across America is utilizing this new technology-online learning. Cross Sectional Anatomy was a course that went from a traditional and interactive delivery method to an online delivery method offering only. Research analyzing the effectiveness of student learning in this new delivery method had not

been done. Since the course is now only offered in an online method, it was critical to evaluate student learning (exam scores).

The results of the study indicated online students had statistically significantly lower test scores than traditional and ITV students. In regards to the gender of the students and the time of year the course was offered, there were no statistically significant differences. It was also concluded that students with higher grade point averages (GPA) had received higher test scores in the course. Interactive television students had statistically significant higher average ratings on course satisfaction than online and there were no significant differences between traditional and online.

Northcentral Technical College should continue to implement their online offerings due to the increasing demand from students, but ongoing research and evaluation needs to be done to ensure student learning is occurring. This study did show that online learning can be an effective tool in the field of instruction, but may not always be the delivery method with the highest individual exam scores.

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Chapter I: Introduction

Background of the Problem

During the 20th century, psychologists became interested in cognitive theory. This theory involved thinking, perception, memory, and problem solving. The invention of the computer sparked the interest of this theory because it was thought of as a replica for the human mind in terms of how it processes and retrieves information.

As different learning theories and behaviors were studied, different learning styles of the learner were also identified. "A learning style is a way a learner approaches learning. There were three different learning styles identified: visual, auditory, and kinesthetic" (Bogod, 1998, p. 2).

Visual learners learn through seeing. These learners need to see the teacher's body language and facial expressions to fully understand the content of the lesson. They tend to prefer sitting at the front of the classroom to avoid visual obstructions (e.g. people's heads). They may think in pictures and learn best from visual displays including: diagrams, illustrated text books, overhead transparencies, videos, flipcharts, and handouts. During a lecture or classroom discussion, visual learners often prefer to take detailed notes to absorb the information.

Auditory learners learn through listening. These learners learn best through verbal lectures, discussions, talking things through, and listening to what others have to say. Auditory learners interpret the underlying meanings of speech through listening to tone of voice, pitch, speed, and other nuances. Written information may have little meaning until it is heard. These learners often benefit from reading text aloud and using a tape recorder.

Kinesthetic learners learn through moving, doing, and thinking. Kinesthetic persons learn best through a hands-on approach, actively exploring the physical world around them. They may

find it hard to sit still for long periods and may become distracted by their need for activity and exploration (Bogod, 1998).

Most people demonstrate strong preferences for a given learning style. The ability to use or 'switch between' different styles is not one that comes easily or naturally to many people. "Simply, people who have a clear learning style preference, for whatever reason, will tend to learn more effectively if learning is oriented according to their preference" (Kolb, 2006, p. 5).

The understanding of learning theories and different learning styles help educators reach the learner. The formats in which the information exchange occurs are called delivery methods. For many years, the chosen delivery method in education for learning was the traditional classroom setting. A teacher communicated information to students who were located in the same room. This approach to learning was helpful for the visual, auditory, and kinesthetic learners if the instructor used a wide variety of learning activities. The learner could see the teacher, hear the teacher, and participate in hands-on experiments to learn the concepts. The traditional classroom was the most common delivery method used in the early days of education.

There have been many significant technological changes throughout the history of America such as the Industrial Revolution and the Space Age. A significant technologic change happened in American education about 150 years ago. American educators came to the conclusion that students in remote areas needed the same access to learning as their urban and suburban counterparts. People in remote areas could not participate in education using the traditional delivery method. "The delivery method of education needed to adjust itself since it was in the 'Information Age.' Education needs to use technology to offer its services to a wider range of diverse students" (Lanarkshire College, 2005, para. 7).

Interactive television was one such technology considered by more and more institutions as a way to reach students in remote areas (Cronje, 1996).

Advantages of interactive television include:

- Instantaneousness, which means that a geographically dispersed population can be reached immediately, irrespective of location.
- Simultaneousness, which allows information to be given to all remote areas at the same time, regardless of their distance from the source.
- Unfiltered information transfer, which means that all receivers get the same message.
- Accessibility, which rests on the ability, particularly of satellite technology, to reach anywhere within its footprint, irrespective of distances or geographic obstacles.
- Affordability, which has to do with economies of scale - the larger the target population, the smaller the unit cost (Cronje, 1996, para. 18).

Using Canfield's Learning Styles Inventory, Gee (1990) found that independent learners were the most successful learning-type of students in interactive television courses. Ehrhard (2000), however, found there were no significant differences among learning styles when based on Kolb's learning styles.

"Post-secondary enrollments are rising, and it is clear the growth is online. Each year brings new college enrollment records in the USA, with nearly 18 million enrolled in post-secondary education by the end of this decade" (Waits & Lewis, 2003, p. 1). "Today, most colleges and universities offer some form of distance education" (Jones, 2005, p. 1). "One in five institutions offers at least one completely distance-based degree and/or certification program and two-thirds offer at least some distance-based courses" (Waits & Lewis, 2003, p. 1). "Web-based

technologies are the medium of choice for most universities as they move their offerings off campus and online” (Bronack, Riedl, & Tashner, 2006, p. 1).

The availability of having the Internet along with its functions made the idea of online learning a reality. “While some will argue about the utility of online courses, most would agree that they are here to stay. The demand for services from students or the perceived cost effectiveness of online courses has made them a mainstay in academia” (Edmonds, 2006, p. 1).

Advantages of online learning include:

- Offers a tremendous opportunity to learn without the limitations of time or location. Students have the flexibility to learn anytime, anywhere.
- Contrary to popular opinion, distance education learning can be more personal and interactive than traditional classroom courses. Students who are uncomfortable asking questions in class can communicate more comfortably with faculty.
- Students often have the opportunity to learn accordingly to their preferred learning styles.
- Students become more self-directed and responsible for their own learning.

(Cincinnati State, 2008, para. 1).

Visual learners process text-based information in an online delivery method differently than auditory and kinesthetic learners. They prefer graphics to help them learn. Auditory learners like to talk to people and this can be done by utilizing a brainstorming method. Unfortunately, people believe that if you just insert sound files or video clips you have changed the curriculum to be suitable for auditory learners. Kinesthetic learners like to use their hands so they prefer to click the mouse and move things around (Summers, 2000).

“It is less clearly understood how online courses compare to the traditional classroom-based sections” (Edmonds, 2006, p. 1). “Is technology-assisted, distance teaching as effective as

traditional face-to-face” (Willis, 1994, p. 1)? Are students learning as well in these different delivery formats? Is this a concern in educational institutions across the country?

The Wisconsin Technical College Student Focus Group researched issues of concern at the technical colleges in 1995. One of the most important issues identified included scheduling problems and course availability (Nelson, 2005), which aligned with the idea that American educators want to offer education to all students using a variety of delivery methods.

The demand of offering learning options through the use of different delivery methods was a critical issue that needed to be addressed for technical colleges to continue to be the first choice when considering education (M. Rhodes, personal communication, October 30, 2006). Different delivery options included ways of taking courses at times and locations which went beyond the traditional classroom such as using different delivery methods such as interactive television or online.

“There are many reasons why people find typical daytime traditional classes inconvenient: shift work, employment/home commitments, being housebound, living too far away from college and timetable conflicts” (Lanarkshire College, 2005, para.1).

Etech College of Wisconsin is one example of collaborative learning that does not take place in the traditional classroom format. It provides learners with access to education using online options (Etech, 2008). Etech states that the five essential ingredients for success in using different delivery methods are: a well-defined vision, a sound strategy, good leadership, delivery-advancement toward goals, and accountability (Etech, 2005).

Two-year colleges that continue to have success must access fully and improve upon their instructional delivery systems. These instructional delivery systems may involve classroom, shop, laboratory, simulations, pilot systems, correspondence courses, computer-aided

instruction, satellite/broadcast delivery, and virtual reality. The delivery system utilized must be appropriate to the needs of the student population (Ateec, 2006).

The Wisconsin Technical Colleges are trying to meet their student scheduling needs. Currently on the Wisconsin Technical College website, it is noted that flexible class scheduling/learning options is one of the top ten reasons students attend a technical college. It stated that class scheduling is very adaptable for students who have busy work schedules or family responsibilities. There are many weekend, evening, and Internet courses available (Wisconsin Technical College System, 2008). "Community colleges need to be flexible institutions which seek to meet the lifelong learning needs and interests of residents" (Pearson, 2006, p. 3).

Northeast Wisconsin Technical College in the Wisconsin Technical College System stated that offering flexible learning options are not the wave of the future - they're here now (Northeast Wisconsin Technical College, 2008)! There are many benefits to the learner using flexible learning options. They include: accessibility training to students in rural areas, students may complete their course of study without suffering the loss of salary, and students are exposed to the expertise of the most qualified faculty (Ludlow, 1994).

Northcentral Technical College also from the Wisconsin Technical College System determined it needed to use current technology available to offer more flexible learning options in distance education specifically. NTC only had 39 courses online in the fall of 2002 and 81 in 2006 (M. Rhodes, personal communication, November 6, 2006). Northcentral Technical College formed learning subcommittees to address the student demand. From these subcommittees and need, some traditional delivery methods of courses were changed to online to be more attractive and convenient for the learner.

Numerous courses in educational institutions are now being offered in different delivery methods to meet this student flexibility/scheduling demand, but one must ask if effectiveness of student learning is suffering? Do all delivery methods suit the learner's learning styles? How are students performing when compared to traditional classroom formats? Have institutions looked at the effectiveness of student learning by changing its delivery methods or is it solely about increasing enrollments?

The conclusions comparing online and classroom sections of courses varies. Some studies have reported a score outcome advantage for the online course students (Maki, Maki, Patterson, & Whittacker, 2000; Poirier & Feldman, 2004). "Another researcher reported no differences between online and classroom sections when students self-selected themselves into sections or were randomly assigned to sections (Waschull, 2001, p. 1)". "Kinney (2001) on the other hand found no differences in exam performance between online and classroom based students on four of five exams. The remaining exam score favored students in a traditional classroom setting who performed better than online peers on a course final exam and had overall higher course grades (Edmonds, 2006, p. 1)".

Offering more flexible learning options may bring additional students to the college, but what is the right format for effective student learning? It seems reasonable that before colleges do away with traditional classrooms all together, research should be done to ensure students are effectively learning in the other delivery methods. If one method proves to be better for a particular topic, age, category, or gender of students, why would the delivery method change? Research needs to be done before permanent delivery method changes are made.

Statement of the Problem

The use of different delivery methods in relationship to the effectiveness of student learning had not been researched on the Cross Sectional Anatomy course at Northcentral Technical College (R. Hoffmann, personal communication, April, 2007). The question of whether students learn more or less using traditional, interactive television, and online delivery methods needed to be answered at Northcentral Technical College before permanent changes of delivery methods were made in Cross Sectional Anatomy.

The needs of the student may have been met as far as scheduling, but did effective student learning occur? Was quality and student learning sacrificed for convenience and higher enrollments? Because of budget constraints, students had only one delivery method option to select from when taking Cross Sectional Anatomy and it may have been online only. Before Northcentral Technical College replaces one delivery method permanently for another in Cross Sectional Anatomy, more data needs to be reviewed to compare the effectiveness of student learning comparing traditional, interactive television, and online delivery methods. This data will compare if all ages and all genders do better consistently in online or interactive television over traditional classrooms? Did students' overall GPA predict how successful they would be in all methods? What methods were students more satisfied in?

Purpose of the Study

The purpose of the study was to analyze the different delivery methods (traditional, interactive television, and online) in relationship to the effectiveness of student learning (exam scores) in Cross Sectional Anatomy at Northcentral Technical College from 2003-2007.

Cross Sectional Anatomy was an Associate Degree course chosen to be used for this student learning comparison at Northcentral Technical College because it had been taught in

traditional and interactive television delivery methods since its existence in 2003. In fall 2007, the traditional and interactive television delivery method was changed to an online offering only. There was concern from the instructor at that time that the online delivery method may not be right for the students.

Throughout the use of the different delivery methods (traditional, interactive television, and online), there were some main consistencies in the course. The competencies for the course remained the same, the same instructor was used, and the course utilized the same textbook and exams. Student age, gender, GPA, and satisfaction were also available for all three delivery methods.

Questions to be Answered

This study will answer the following research questions:

1. What are the differences in student learning (individual exam grades) when comparing traditional, interactive television, and online delivery methods in Cross Sectional Anatomy at Northcentral Technical College?
2. What are the differences in student learning (individual exam grades) when comparing traditional, interactive television, and online delivery methods based on age in Cross Sectional Anatomy at Northcentral Technical College?
3. What are the differences in student learning (individual exam grades) when comparing traditional, interactive television, and online delivery methods based on the time of year Cross Sectional Anatomy was offered at Northcentral Technical College?
4. What are the differences in student learning (individual exam grades) when comparing traditional, interactive television, and online delivery methods based on student's

cumulative GPA before entering Cross Sectional Anatomy at Northcentral Technical College?

5. What are the differences in student satisfaction of the course when comparing traditional, interactive, and online delivery methods in Cross Sectional Anatomy at Northcentral Technical College?

Importance of the Study

This research is important for the following reasons:

1. Northcentral Technical College will benefit from this analysis so good student decisions can be made based on research when proposing changes to delivery methods. Before permanently changing traditional classrooms to a different method or vice versa, research needs to be reviewed to look at the effectiveness of student learning. If students have not learned well in a particular method, possibly that method is not the best suited for that subject.
2. Northcentral Technical College is expanding their online course offerings and having the knowledge from this study will greatly enhance possible online requirements. Northcentral Technical College's Online Faculty Academy is trying to set guidelines to ensure their online offerings are effective for student learning. This study will provide data that may reinforce online delivery.
3. This study will provide research that evaluated which method of delivery: traditional, interactive television, and online is better for effective student learning. In which method do students learn the most? As different delivery methods are used, research needs to be continually done to evaluate if they affect student learning.

New delivery methods may be intriguing and technologically savvy, but if they don't work for student learning, they are not useful.

4. The study will be used as a follow-up to a study performed by Christine Golden, who analyzed course quality comparing online and traditional classroom delivery of allied health courses at Waukesha County Technical College, Pewaukee, Wisconsin. In 2003, Christine Golden performed a study similar to this one comparing traditional and online delivery methods in Medical Terminology (Golden, 2003). The conclusion from this study will be directly compared to her study from 2003. Both studies compared a health-related class in a technical college setting.

Limitations of the Study

The limitations of the study included the following:

1. This study only looked at the comparison of one course (Cross Sectional Anatomy) at NTC between the years of 2003-2007. No additional courses were evaluated. A small sample was done in the study since it only evaluated one class. One course from each division of the college would have given a better sampling.
2. This course is routinely only taken by health care students who are predominately female in gender. Cross Sectional Anatomy is a required course in two healthcare programs-ultrasound and computed tomography (CT) and can be used as an elective for other programs. There are a large number of females in the healthcare classes, so there were more females in the sampling and results may not be generalizable to males.

3. Since there was only one online session offered, there were only a small number of online students in the study for comparison. Of the total number of six sessions offered of Cross Sectional Anatomy, only one session was offered in an online delivery method. Because of only one online offering, the number of online students in the study were small compared to the total population for the study.
4. Students in the study were not able to self-select the delivery format that suited their learning style. Cross Sectional Anatomy had no choices for students as far as delivery method selection. They were not able to choose from different sections with different delivery method offerings. It was only offered one way in a given semester.
5. The online students' past history of computer usage and online learning was not known. Students may have entered the course with very little computer knowledge, which could have made the online course more difficult. There was an online student tutorial at the start of the online session, but it was not mandatory for students to take. This class could have been the first time a student ever took an online class, increasing their chances of problems while working on the course.
6. It was not known how many additional outside distracters a student had while taking the class. For instance, the number of courses taken at the same time, children at home, or working full or part-time could impact their success in the course.
7. The online session was the first online class taught by the instructor. This was the instructor's first attempt at teaching an online class. Instructor organization and

feedback to the students could have affected the performance of the students in the online session.

Definition of Terms

The following terms need to be defined for clarity of understanding. They are:

Cross Sectional Anatomy. Descriptive anatomy based on three-dimensional imaging of the body, organs, and structures using a series of computer multiplane sections, displayed by transverse, coronal, and sagittal analyses. It is essential to accurate interpretation by the radiologist of such techniques as ultrasonic diagnosis, MRI, and CT (Online Medical Dictionary, 1998).

Distance Education. The process of providing instruction when students and instructors are separated by physical distance and technology, often in tandem with face-to-face communication, is used to bridge the gap (Willis, 1994).

Flexible Learning Options. Flexible learning options are ways of taking courses at times and locations which go beyond the traditional school day. They are especially valuable for working adults who need to fit college into busy work and family schedules, but they can help anyone make education possible (Northcentral Technical College, 2008).

Information Age: The period beginning around 1970 and noted for the abundant publication, consumption, and manipulation of information, especially by computers and computer networks (Lanarkshire College, 2005, para. 7).

Interactive Television: Two way electronic communication between two or more groups in separate locations via audio, video, and/or computer systems (Willis, 1994).

Northcentral Technical College (NTC): One of the 16 technical colleges in Wisconsin. NTC represents a 10-county district that encompasses all of, or portions of, Marathon, Lincoln,

Taylor, Price, Langlade, Menominee, Clark, Portage, Shawano, and Waupaca counties. The College's central campus is located in Wausau, with regional campuses in Antigo, Medford, Merrill, Phillips, Spencer, and Wittenburg (Northcentral Technical College, 2008).

Online Learning: E-learning delivered over the Internet (LAN, WAN, or Internet) for delivery, interaction, or facilitation. This would include distributed learning, distance learning, CBT delivered over a network, and WBT (Education Dynamics, 2008).

Chapter II: Literature Review

Purpose of Study

The purpose of the study was to analyze the different delivery methods (traditional, interactive television, and online) in relationship to the effectiveness of student learning (exam scores) in Cross Sectional Anatomy at Northcentral Technical College from 2003-2007.

Cross Sectional Anatomy was an Associate Degree course chosen to be used for this student learning comparison at Northcentral Technical College because it had only been taught in a traditional, interactive television delivery method since its existence in 2003. In fall 2007, the traditional and interactive television delivery method was changed to an online offering only. There was concern from the instructor at that time that the online delivery method may not work because of the class content. Throughout the use of the different delivery methods (traditional, interactive television, and online), there were some main consistencies in the course. The course competencies for the course remained the same, the same instructor was used, and the course utilized the same textbook and exams. Student age, gender, GPA, and satisfaction were also available for all three delivery methods.

Introduction

This chapter will begin with a history of education in America, including the development and assumptions of different learning theories. As education progressed, so did the way in which it was offered. The evolution from the traditional classroom method to different delivery methods such as interactive television and online will be discussed. Studies that have been done to compare any of the three methods will be shared, along with studies that evaluated student learning.

History of Education in America

The State of Massachusetts played an integral role in the formation of formal education in America. This formal education can be traced back to the landing of the Pilgrims at Plymouth, Massachusetts in the early 1600's. By 1635, the first official public school was established in Boston, Massachusetts. The creation of Latin Grammar schools for higher education soon followed. Massachusetts enacted a law in 1642 stating any male child not being properly educated would have to be apprenticed to a trade. "This law encouraged other states to follow Massachusetts's lead to enact similar laws regarding the fundamentals and requirements of education" (Jones, 2005, p. 2).

In the early days before formal education, a child's education was not just a family responsibility, but a civil and church matter. For religious groups, being able to read the Bible was paramount, and thus education was essential to the success of their religious experience. A two-tier educational system developed during the seventeenth century, consisting of the dame school and the elite grammar schools. Dame schools were usually set up in the private homes of women who charged a modest fee to give boys and girls formal instruction in reading, writing, and rudimentary arithmetic. Students were forced to memorize the catechism, as well as poems, prayers, and hymns (American Foreign Relations, 2007).

Education across America developed in many different ways. In Pennsylvania, the Quakers set up elementary schools that provided basic reading and writing. Nonsectarian private secondary schools or academies also began to emerge. "After independent prominent figures, including Benjamin Franklin, pushed for a more secular and utilitarian secondary education, further growth of small private schools among the new merchant classes developed" (American Foreign Relations, 2007, p. 1).

During the eighteenth century and nineteenth century education in the South reflected the region's paternalist and agrarian society. In 1779, Thomas Jefferson encouraged education reform in Virginia to spread knowledge to a "free" society. A free elementary education for all white boys and girls was part of Jefferson's plan. Unfortunately, this plan did not pass Virginia's legislature. Only five percent of Blacks were literate while literacy rates for white males reached 80% by Civil War time. "As demand for skilled labor increased during the colonial era, the Southern colonies legally established an apprenticeship system. This marked the first time the Southern colonies enforced education" (American Foreign Relations, 2007, p. 3).

Noah Webster was the most famous advocate of American nationalism in education which led to the rise of the common school movement of the 1830s. The common school movement called for a state-supported school system that provided all children with a common curriculum, arguing that if children from diverse backgrounds were taught a common political and social ideology, a strong sense of community could be constructed and social problems limited. This movement provided the blueprint for the later development of the modern state public schools (American Foreign Relations, 2007).

Learning Style Theories

Throughout history there have been many changes in the educational system including the development of learning style theories. Education is no longer just a brick and mortar system. To understand how student learning occurs, the different learning styles are variables threaded into the learning equation.

Since the first law in 1642, people have been fascinated to find out how people learn. This fascination with how people learn or learning styles can be dated back to Charles Darwin's

theory of evolution and changes in behavior. The “science” of psychology was built on the contemplation of human experiences.

The science had to re-think its own theories when Darwin concluded that in man and animal, those best suited to the environment are the ones to survive. As their traits adapted to survive challenges, so did the consciousness and mind evolve (Jones, 2005).

One of Darwin’s biggest fans, British philosopher and sociologist Herbert Spencer, believed that an individual’s characteristics develop through evolution, including how one thinks and learns. William James, author of *The Principles of Psychology*, agreed. In publishing one his texts on psychology in 1890, he suggested that consciousness allows a person to override instinct, and adapt to new circumstances or information. His conclusion: learning is the process by which we adapt to our environment (cited in Jones, 2005).

Some believed learning was a direct observable change in behavior; others believed it was an internal process where learners either build new or modify existing knowledge. Learning involves the following framework:

- Learning is participatory
- Knowledge is social
- Learning leads development through predictable stages via shared activity
- A useful knowledge base emerges through meaningful activity with others
- Learners develop dispositions relative to the communities in which they practice.

Effective learning environments of all kinds must support participants as each becomes part of a community of practice through communication and co-construction (Bronack, Riedl & Tashner, 2006, p. 221).

There are four stages in learning that people experience regardless of age: introduction, assistance, testing, and accomplishment. "Something new is presented to the mind, reference is sought for learning how to deal with it, an attempt is made to utilize the new information, and then successful completion of the task by functioning with or around it" (Jones, 2005, p. 3).

There are three main learning theories commonly discussed in education: behaviorism, cognitivism, and constructivism. A theory provides a general explanation for observations made over time, it explains and predicts behavior, and can never be established beyond all doubt (Dorin, Demmin, & Gabel, 1990).

Learning theories can be traced back to the ancient Greeks. "In the 18th century, with the onset of scientific inquiry, people began in earnest to study and develop models of learning" (Mergel, 1998, p. 3).

Behaviorism can be traced back to Aristotle, whose essay "Memory" focused on associations being made between events such as lightning and thunder. Other philosophers that followed Aristotle's thoughts are Hobbs, Hume, Brown, Bain and Ebbinghouse (cited in Black, 1995).

"The theory of behaviorism concentrates on the study of overt behaviors that can be observed and measured" (Good & Brophy, 1990, p. 3). The mind is a "black box" in the sense that response to stimulus can be observed quantitatively, totally ignoring the possibility of thought processes occurring in the mind. Pavlov, Watson, Thorndike, and Skinner were names associated with the behaviorist theory.

General assumptions of the behaviorist theory include:

1. Principles of learning apply equally to different behaviors and to different species of animals. (Equipotentiality)

2. Learning processes can be studied most objectively when the focus of study is on stimuli and responses.
3. Internal cognitive processes are largely excluded from scientific study.
4. Learning involves a behavior change.
5. Organisms are born as blank slates.
6. Learning is largely the result of environmental events (Cunia, 2005, p. 1).

In the 1920's, people began to find limitations in the behaviorist approach to understanding learning. Edward Tolman was one such person who found that rats used in an experiment appeared to have a mental map of the maze he was using. When a certain portion of the maze was closed up, the rats did try a certain path because they "knew" that it led to the blocked path. By observing, the rats could not see that the path would result in failure, yet they chose to take a longer route that they knew would be successful (Geary, n.y.).

Cognitive theorists recognize that learning involves associations between contiguity and repetition. They believe in reinforcement, although they stress its role in providing feedback about the correctness of responses over its role as a motivator. "Cognitive theorists view learning as involving the acquisition or reorganization of the cognitive structures through which humans process and store information" (Good & Brophy, 1990, p. 187).

General assumptions of cognitive learning theory include:

1. Some learning processes may be unique to human beings.
2. Cognitive processes are the focus of study.
3. Objective, systematic observations of people's behavior should be the focus of scientific inquiry, however, inferences about unobservable mental processes can often be drawn from such behavior.

4. Individuals are actively involved in the learning process.
5. Learning involves the formation of mental associations
6. Knowledge is organized.
7. Learning is a process of relating new information to previously learned.

(Cunia, 2005, p. 1)

Cognitive psychology can also be traced back to the ancient Greeks such as Plato and Aristotle. The cognitive revolution became evident in American psychology in the 1950's. Jean Piaget developed the major aspects of his theory in the 1920's, but his ideas did not impact North America until the 1960's after Miller and Bruner founded the Harvard Center for Cognitive Studies.

There was one more learning theory that was developed called the constructivist approach cited in Good & Brophy). Bartelt was the person credited for this approach. Constructivists believe that “learners construct their own reality or at least interpret it based upon their perceptions of experiences. They believe that an individual's knowledge is a function of one's prior experiences, mental structures, and beliefs that are used to interpret objects and events” (Mergel, 1998, p. 8).

General assumptions of constructivism learning theory include:

1. Knowledge is constructed from experience
2. Learning is a personal interpretation of the world
3. Learning is an active process in which meaning is developed on the basis of single
4. Conceptual growth comes from the negotiation of meaning, the sharing of multiple perspectives and the changing of our internal representations through collaborative learning

5. Learning should be situated in realistic settings; testing should be integrated with the task and not a separate activity (Mergel, 1998. p. 9).

Traditional Classroom

A traditional classroom course is built around time honored educational activities of lecture, interaction, and testing. They occur in a fixed order without deviation. Lecture is used to provide students with the course's content. Interaction follows and may take the form of a teacher/student dialogue. This allows the student to process course content. T-testing occurs to assess knowledge transfer after lecture and interaction occurs. "The traditional paradigm implies a fixed order, but there is nothing sacrosanct about it. Others (e.g., Walvoord & Johnson Anderson, 1998) have proposed altering this traditional order" (Keefe, 2003, p. 1).

Bringing students together in a classroom is a perfect place for face-to-face interactions among instructors and students and was used in the early days of education. However over the years, the traditional classroom approach was found to use class time for one-way lectures. Modern educators have criticized the use of traditional lecture for being a monologue rather than an interaction (Johnson, Johnson, & Smith, 1991; Walvoord & Johnson Anderson, 1998). Using class time for one-way lectures may be a waste of valuable educational time. For example, in a traditional lecture, the instructor talks and the students listen and take notes. Lecturing in class is a time intensive activity that requires coordination between students and an instructor who must repeatedly travel to the classroom (Keefe, 2003). The lecture, in and of itself, is not a bad idea. It's just its location, duration, and situation that create its bad reputation. It's time for the good old lecture to be redesigned (Record, 2004).

Media is a word that is used to describe the transfer of a message between a sender and receiver. Face-to-face communication is known to be the most common media because it allows

the participants to simultaneously employ verbal and visual communication, as well as body language and immediate feedback. Even though face-to-face communication can satisfy the communication demands of interactive teaching techniques, there are a variety of Internet-based media available to enhance the process without the cost of using up valuable face time (Keefe, 2003).

The challenge and opportunity of technology invites experimentation, but raises questions about such things as student acceptance, student use, academic performance, active learning, and what to do with class time when lectures are put online. Students can easily master the technology, and today's software is available to help an instructor with the task. The harder issues that need to be addressed relate to instructional design and student behavior (Keefe, 2003, p. 1).

Interactive Television

The inclusion of interactive television (ITV) programs for learning is an emerging technology in education. Interactive television in the United States was set to grow 83% per year through 2005 compared to online growth that was predicted to grow only 9% during the same period. Research has concluded that any aspect of learning requires some form of interaction or feedback to be most effective. As interactive television evolves, it has the potential to engage learners and reach a mass audience on a scale much larger than traditional education.

Interactive television holds promise for adult learners based on the following three reasons: ITV instruction can motivate adult learners, ITV instruction promotes adult learners' self-efficacy, and ITV instruction offers an environment conducive for learning (Garito, 2001).

Interactive television offers possibilities for an innovative learning environment with the ability to overcome the physical and temporal limitations imposed by the traditional classroom. It

enables the creation of a stimulating “virtual environment” which constitutes a new learning context that directly influences perception, activation, and memory, and develops a new way of thinking (Garito, 2001).

Research indicates that the instructional format itself (interactive video vs. videotape vs. live instructor) has little effect on student achievement as long as the delivery technology is appropriate to the content being offered and all participants have access to the same technology.

Other conclusions drawn from this line of research suggest:

- Achievement on various tests administered by course instructors tends to be higher for distant as opposed to traditional students, yet no significant difference in positive attitudes toward course material is apparent between distant and traditional education (Martin & Rainey, 1993)
- Conventional instruction is perceived to be better organized and more clearly presented than distance education (Egan, Sebastian, & Welch, 1991).
- The organization and reflection needed to effectively teach at a distance often improves an instructor’s traditional teaching.
- Future research should focus on the critical factor in determining student achievements of instruction itself.

Research suggests distant students bring characteristics to their learning experience influence their success in coursework. Distance education students are voluntarily seeking further education. These students have post-secondary education goals with expectations for higher grades (Schlosser & Anderson, 1994).

Studies also conclude that similar factors determine successful learning, whether the students are distance or traditional. These factors include:

- willingness to initiate calls to instructors for assistance.
- possessing a more serious attitude toward the courses.
- employment in a field where career advances can be readily “achieved through upgrading in a distance education environment” (Ross & Powell, 1990).
- previous completion of a college degree (Berndt & Bugbee, 1993).

“Good distance teaching practices are fundamentally identical to good traditional teaching practices and “those factors which influence good instruction may be generally universal across different environments and populations” (Wilkes & Burnham, 1991, n.p).

Distance education needs extensive planning and preparation. Because of this need, distance educators must consider the following in their effectiveness (Schlosser & Anderson, 1994):

- Extensive pre-planning and formative evaluation is necessary. Teachers cannot “wing it”. Distance learners value instructors who are well prepared and organized (Egan, Sebastian, & Welch, 1991)
- Learners benefit significantly from a well designed syllabus and presentation outlines.
- Teachers must be properly trained both in the use of equipment and in those techniques proven effective in the distance education environment. Learners get more from the courses when the instructor seems comfortable with the technology, maintains eye contact with the camera, and possesses a sense of humor (Egan, Sebastian & Welch, 1991).
- Interactive television instruction is an effective tool for providing adult learners with new learning opportunities (Chen, 2004).

The costs of offering distance education courses may be high, but there are high costs with offering traditional courses as well. The benefits of distance education courses include accessible training to students in rural areas, students may complete course of study without suffering the loss of salary due to relocation, and students are exposed to the expertise of the most qualified faculty (Ludlow, 1994).

Online Classroom

Because of developments and upgrades in technology, new capabilities in learning have led the way to online instruction, in which the instructor and students do not see each other face-to-face, but interact via a software program. Online course content has become available on the Internet in written, photographic, video, and/or audio arrangements. "Growth in online enrollment of college courses increased from 19.8% in 2003 to 24.8% in 2004. With the continued investments in online course development and a consumer desire for flexible 24/7 learning, there is no evidence that enrollment rates will slow" (Redorbit, 2005, p. 1). Since online learning has only been available for a short time, the number of empirical studies examining online classes is still limited.

Statistics published in 2001 stated that the typical online student was over twenty-five, already working, a caregiver, and with some higher education. However, only two years later, the National Center for Education Statistics reported that all age groups showed an interest in online courses. Recent research has shown that online learning expands the scope of the classic university (cited in Hall, 1995).

Online learning can help solve two problems commonly associated with learning: time and place. There are many students who enroll in an online course because the classroom offering is at a time when they have another commitment. Online learning benefits people who

are mature, self-motivated, and looking for classes that teach various aspects of career and professional development. Online learning will never, and probably should never, be the dominant method of educating students, but it will be a fixed part of the delivery system of higher education. An important aspect will be the extent to which issues of security and honesty are dealt with so that online learning is not discredited.

Strengths of online learning include:

1. Overcomes limits of place and time and is convenient
2. Provides access for nontraditional, rural and other students
3. Eases communication for some students
4. Attracts more-motivated students
5. Improves institutional flexibility
6. Adds enrollments without the cost of new facilities

Weaknesses of online learning include:

1. Discourages peer-to-peer learning and socialization opportunities
2. Requires more academic support to help students succeed
3. Limits use by older people who aren't familiar with technology
4. Creates more intellectual-property issues
5. Creates more security issues (Maeroff & Zemsky, 2007)

Reviews of the distance education literature have looked at the impacts of using technology to perform various education activities that have traditionally been done face-to-face in a classroom. The “no significant difference effect” is arguably the most enduring phenomena in the distance education literature (Russell, 1999); Wetzal, Radtke, & Stern, 1994). It supports using more technology in education, but not because it increases teaching effectiveness.

According to this phenomenon, since technology is as effective as traditional means, it should be used because it is cheaper and more convenient. Ironically, if the “no significant difference effect” is true, technology makes no difference, is unimportant, and can be justified, only, based on cost and convenience (Keefe, 2003, p. 2).

A study was done to determine if there were any differences in motivation between students enrolled in 12 online and 12 traditional classroom university courses. Study results provide evidence that online students possess stronger intrinsic motivation than on campus students who attend face-to-face classes on three intrinsic motivation measures: a) to know, b) to accomplish things, and c) to experience stimulation. However, there was no evidence of motivational differences based on ethnicity. Online classes tend to require more independent work, and perhaps are actually more difficult for students to complete and be academically successful. This conclusion is very tenuous since other, non-examined factors could be contributing to academic course achievement such as motivation. One could create a very compelling argument that those students who are of higher ability or motivation are likely to achieve regardless of the situation in which they are placed (Rovai, Ponton, Wighting, & Baker, 2007).

A project at Texas State University reported the results of a project that examined student perceptions of the psychosocial learning environment in a distance education classroom. A Distance Education Learning Environments Survey was distributed as a pre-test/post-test to three sections of the same course taught in three distinct formats: traditional classroom instruction, online learning, and hybrid (partially on-line/partially face-to-face). Instructor support was rated highest by the students enrolled in the course taught in the traditional manner, closely followed by the hybrid course. However, student interaction and collaboration averaged higher scores in

the course taught in the hybrid manner, followed by the traditional course, and then the online course (Biggs, 2006).

The conclusions comparing online and classroom sections of courses varies. Some studies have reported a score outcome advantage for the online course students” (Maki, Maki, Patterson & Whittacker, 2000, Poirier & Feldman, 2004). “Another researcher reported no differences between online and classroom sections when students self-selected themselves into sections or were randomly assigned to sections” (Waschull, 2001, p. 1). Kinney (2001) found no differences in exam performance between online and classroom based students on four of five exams. The remaining exam score favored students in the online course section. And finally, Wang and Newlin (2000) report that students in a traditional classroom setting performed better than online peers on a course final exam and had overall higher course grades (Edmonds, 2006).

“People are thinking about classes very differently now. In the past, classes were considered as a series of sessions held on certain days, but the online world has helped us to interact with students in different ways (Bronack, Riedl & Tashner, 2006, p. 230).

Perhaps the question institutions must answer is whether it is part of their mission as educators to offer programs to those who might not be reached without distance education. The primary benefit to educational institutions through distance education may be the increased number of students they are able to attract and serve. “Research also suggests that as programs become more efficient, program costs should decrease” (Ludlow, 1994, p. 4).

While there will always be exceptions, future research will provide valuable information in helping higher educational institutions and students make informed decisions about course selection and delivery methods (Edmonds, 2006).

Chapter III: Methodology

Purpose of the Study

The purpose of the study was to analyze the different delivery methods (traditional, interactive television, and online) in relationship to the effectiveness of student learning (exam scores) in Cross Sectional Anatomy at Northcentral Technical College from 2003-2007.

Cross Sectional Anatomy was an Associate Degree course chosen to be used for this student learning comparison at Northcentral Technical College because it had only been taught in traditional and interactive television delivery methods since its existence in 2003. In fall 2007, the traditional and interactive television delivery methods were changed to an online offering only. There was concern from the instructor at that time that the online delivery method may not be right for the course content. Throughout the use of the different delivery methods (traditional, interactive television, and online) there were some main consistencies in the course. The course competencies for the course remained the same, the same instructor was used, and the course utilized the same textbook and exams. Student age, gender, GPA, and satisfaction were also available for all three delivery methods.

Research Design

The study was comparative and analyzed student learning using traditional, interactive television, and online delivery methods in one course, Cross Sectional Anatomy, at Northcentral Technical College between the dates of 2003-2007. The independent variables are the delivery methods and the dependent variable is student learning which will look at six student exam scores. Each exam was worth 100 points.

Selection of Participants

Participants of the study were students enrolled in the Cross Sectional Anatomy class at Northcentral Technical College from 2003-2007. Total population for the study was ninety-three participants. During this period, traditional, interactive television, and online delivery methods were used.

Data Collection

Data was collected from the Cross Sectional instructor's hard copy grade book and from the electronic grade book retrieved from the Blackboard software used for the course at Northcentral Technical College. This information included the delivery method used along with individual test scores which documented individual student learning that occurred in the class.

The student's age and GPA information were obtained through the college's student registrar information and documented on an Excel spreadsheet.

The satisfaction survey was a standard survey used by faculty at Northcentral Technical College and was the instrument used for the Cross Sectional Anatomy classes from 2003-2007. Once the instrument was given to students to complete at the end of the course, the completed surveys were given to the human resource department to compile results. This instrument used a Likert scale from strongly agree to strongly disagree. Once compiled, a report was generated of the results and provided to the faculty and supervisor. The satisfaction survey results from 2003-2007 were obtained from the Cross Sectional instructor for each class and compiled onto an Excel spreadsheet for comparison.

Data Analysis

To analyze the above data, the Statistical Package for the Social Services (SPSS) at the University of Wisconsin-Stout was used to electronically process the raw data. This data was compiled in narrative and chart formats.

Limitations

The limitations of the study included the following:

1. This study only looked at the comparison of one course (Cross Sectional Anatomy) at NTC between the years of 2003-2007. No additional courses were evaluated. A small sample was obtained for the study since it only evaluated one class. One course from each division of the college would have given a better sampling.
2. This course is taken by health care students who are predominately female in gender. Cross Sectional Anatomy is a required course in two healthcare programs: ultrasound and computed tomography (CT) and can be used as an elective for other programs.
3. Since there was only one online session offered, there were only a small number of online students in the study for comparison. Of the total number of six sessions offered of Cross Sectional Anatomy, only one session was offered in an online delivery method.
4. Students in the study were not able to self-select the delivery format that suited their learning style. Students only had one delivery method to select from. Cross Sectional Anatomy had no choices for students as far as delivery methods. They

were not able to choose from different sections with different delivery methods. It was only offered one way in a given semester.

5. The online students' past history of computer usage and online learning was not known. Students may have entered the course with very little computer knowledge which could have made the online course more difficult. There was an online student tutorial at the start of the online session, but it was not mandatory for students to take. This class could have been the first time a student ever took an online class, increasing their chances of problems while working on the course.
6. It was not known how many additional outside distracters a student had while taking the class. For instance, number of courses taken at same time, children at home, or working full or part-time.
7. The online session was the first online class taught by the instructor. This was the instructor's first attempt at teaching an online class. Instructor organization and feedback to the students could have affected the performance of the students in the online session.

Summary

Chapter Three has described the overall purpose of the study along with the research design. Selection of participants, data analysis, data collection and limitations were also discussed.

Chapter IV: Analysis of Results

Introduction

The purpose of this research was to analyze the different delivery methods (traditional, interactive television, and online) in relationship to the effectiveness of student learning (exam scores) in Cross Sectional Anatomy at Northcentral Technical College from 2003-2007. This chapter will begin with the demographic information from the study and conclude with the analysis of data.

Demographic Information

The total population for the study was 93 students. This number represented 100% of the total number of students who took Cross Sectional Anatomy at Northcentral Technical College between the years of 2003-2007. There were 33 traditional, 42 interactive television and 18 online students. Table 1 breaks down the total population by the different delivery methods. Interactive television accounted for the largest number of participants at 42. It should also be noted that only 18 students participated in the online section. The only year that experienced all three delivery method sections was 2007.

Table 1

Yearly Breakdown of Population By Delivery Method

	2003	2004	2005	2006	2007	Total
Traditional	7	7	5	7	7	33
Interactive Television		19	8	11	4	42
Online					18	18
Total	7	26	13	18	29	93

Table 2 shows the breakdown of gender of the participants in the study. Seventy-five students (81%) of the students were female and 18 (19%) were male. This data was expected since there are more females enrolled in the health programs at Northcentral Technical College who would take Cross Sectional Anatomy.

Table 2

Gender Breakdown of Study Participants

Gender	Total Number	Percentage
Female	75	81%
Male	18	19%
Total	93	100%

Table 3 illustrates the gender breakdown by delivery method. A total of six identical exams were used for comparison in the study. Each exam was worth 100 points, totally 600 points that could be earned by each student. Table 3 also shows the mean average out of the possible 600 points that was earned by gender within each of the delivery method. Of note, the traditional delivery method, female students earned the highest means score in the study.

Table 3

Gender Breakdown By Delivery Method Along With Exam Score Means

Course Type	Gender	N	Mean of 600 Total Exam Points	Std. Deviation
ITV	F	31	562.94	18.206
	M	11	563.36	25.765
Online	F	15	540.20	30.950
	M	3	536.67	43.097
Traditional	F	29	565.93	18.616
	M	4	558.75	21.838

Table 4 shows the breakdown of the mean by the delivery method without the breakdown by gender. The ITV and traditional mean averages were very similar but were more than 20 points above the online mean average.

Table 4

Delivery Method Breakdown Along With Mean Averages

Course Type	N	Mean of 600 total exam points
ITV	42	563.15
Online	18	538.43
Traditional	33	562.34
Total	93	554.64

Analysis of Data

A one-way Analysis of Variance (ANOVA) was done to answer if there were differences in student learning (total exam scores) when comparing traditional, ITV, and online delivery methods. A one-way ANOVA is used to look for differences among three or more group means with respect to a single variable. The single variable for this study is the total exam scores. The

three groups being looked at are the methods of course delivery. Table 5 illustrates the ANOVA results with F having a significance of .000 which that tells us there are differences somewhere between the different groupings of course methods such as ITV comparing it to online and traditional; online comparing it to ITV and traditional; and traditional comparing it to ITV and online.

Table 5

One-Way ANOVA Using The Total Score of Six Exams

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8662.197	2	4331.098	8.651	.000
Within Groups	45056.061	90	500.623		
Total	53718.258	92			

Table 6 shows the test ran for homogeneity of variances to see if the variances are the same using the total score of six exams by each delivery method. The significance using the Levene method was .004 which concluded that there are differences in the variances of the scores across the course level type.

Table 6

Test of Homogeneity of Variances

Total Score of 6 Exams				
Levene Statistic	df1	df2	Sig.	
5.860	2	90	.004	

The post-hoc test was done using the Tamhane formula to compare all possible combinations such as ITV to online and traditional; online to ITV and traditional; and traditional to ITV and online. Table 7 shows the post hoc test results which shows that online students had statistically lower test scores than traditional and ITV students. In addition, no statistically significant differences were noted between the total ITV and traditional students in the study. In general, the online and traditional students scored significantly higher than the ITV students.

Table 7

Post Hoc Tests- Dependent Variable: Total Score of 6 exams

	(I) course type	(J) course type	Mean		Sig.
			Difference (I-J)	Std. Error	
			Lower Bound	Upper Bound	Lower Bound
Tamhane	ITV	online	23.437(*)	8.105	.024
		Traditional	-2.013	4.511	.960
	online	ITV	-23.437(*)	8.105	.024
		Traditional	-25.449(*)	8.172	.014
	Traditional	ITV	2.013	4.511	.960
		online	25.449(*)	8.172	.014

* The mean difference is significant at the .05 level.

The majority of students in the population for the study were in the 20-30 years old and 31+ years old categories. Table 8 provides the number of students in each age category by course type. The categories are equally distributing the students with 47 students in the 20-30 category and 46 students from the 31+ years old category. The online and traditional delivery methods had a larger number of students from the 20-30 year old category than from the 31+ year old category which was the opposite for the ITV method.

Table 8

Summary of Number of Student By Age Category By Course Type

Course Type			Frequency	Percent	Cumulative Percent
ITV	Valid	20-30 years old	17	40.5	40.5
		31+ years old	25	59.5	100.0
		Total	42	100.0	
Online	Valid	20-30 years old	10	55.6	55.6
		31+ years old	8	44.4	100.0
		Total	18	100.0	
Traditional	Valid	20-30 years old	20	60.6	60.6
		31+ years old	13	39.4	100.0
		Total	33	100.0	

Table 9 shows the average mean scores earned by students within the different age categories across the six exams. The traditional, 31+ year old category scored the highest mean with 569.38. The online, 20-30 year old category had the lowest mean with a 532.70.

Table 9

Mean Exam Scores By Age Category By Course Type

Course Type	Age Category	Mean of 600 Total Exam Points	Std. Deviation
ITV	20-30 years old	558.94	23.528
	31+ years old	565.84	17.375
	Total	563.05	20.112
Online	20-30 years old	532.70	31.990
	31+ years old	548.25	31.331
	Total	539.61	31.768
Traditional	20-30 years old	562.25	18.008
	31+ years old	569.38	19.902
	Total	565.06	18.805
Total	20-30 years old	554.77	25.756
	31+ years old	563.78	21.763
	Total	559.23	24.164

A two-way ANOVA method was performed to evaluate for any differences in mean exam scores by age. The two-way ANOVA is a general test for differences in means. Table 10 shows the results of between-subject effects. The table shows the overall significance for the F was .002 and documenting a difference in the course type with a significance of .001. The interaction effect shows no significance at .769 and no significance noted between the age categories with a significance of .051.

Table 10

Tests of Between-Subjects Effects: Dependent Variable

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10619.530 (a)	5	2123.906	4.287	.002	.198
Intercept	24710137.075	1	24710137.075	49880.403	.000	.998
Type	8025.139	2	4012.569	8.100	.001	.157
Age_Cat	1941.623	1	1941.623	3.919	.051	.043
Type *	260.679	2	130.339	.263	.769	.006
Age_Cat	43098.728	87	495.388			
Error Total	29137934.000	93				
Corrected Total	53718.258	92				

aR Squared = .198 (Adjusted R Squared = .152)

Table 11 illustrates Levene's Test of Equality of Error Variances which had a significance of .048 which documented a need to run a Tamhane 2 post-hoc analysis in course type.

Table 11

Levene's Test of Equality of Error Variances(a)

Dependent Variable: Total Score of 6 exams

F	df1	df2	Sig.
2.340	5	87	.048

A post-hoc analysis finds out exactly where the differences occur in the course type.

Table 12 shows the Tamhane post-op analysis which shows online scores were significantly

lower than both ITV and traditional when comparing age using the two age categories.

Significance noted was 0.24 and 0.14. No statistically significant differences between ITV and traditional delivery methods were noted. When comparing the three different course types, ITV and traditional proved to be more effective for higher student scores than online.

Table 12

Tamhane Post-op Analysis

	(I) course type	(J) course type	Mean Difference (I-J) Lower Bound	Std. Error Upper Bound	Sig. Lower Bound
Tamhane	ITV	Online	23.44(*)	8.105	.024
		Traditional	-2.01	4.511	.960
	Online	ITV	-23.44(*)	8.105	.024
		Traditional	-25.45(*)	8.172	.014
	Traditional	ITV	2.01	4.511	.960
		Online	25.45(*)	8.172	.014

Based on observed means.

*The mean difference is significant at the .05 level.

Besides evaluating the age of the students, three independent t-tests were done to evaluate for any differences in average exam scores by gender for each of the course types. Table 13 shows the group statistics which include gender breakdown and mean exam scores out of 600 points. The traditional, female students had the highest mean average with 565.93. The online male students had the lowest mean average with 536.67.

Table 13

Group Statistics

Course Type		Gender	N	Mean	Std. Deviation
ITV	Total Score of 6 exams	F	31	562.94	18.206
		M	11	563.36	25.765
Online	Total Score of 6 exams	F	15	540.20	30.950
		M	3	536.67	43.097
Traditional	Total Score of 6 exams	F	29	565.93	18.616
		M	4	558.75	21.838

Table 14 breaks down the independent samples that were done. All course type significances scores were greater than 0.05 indicating that there are no statistically significant differences between genders for traditional, ITV, and online course delivery. Traditional significance scores was .483; online .867 and ITV .953.

Table 14

Independent Samples Test

Course Type		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig.
		Lower	Upper	Lower	Upper	(2-tailed)
ITV	Equal variances assumed	.258	.614	-.060	40	.953
	Equal variances not assumed			-.051	13.714	.960
Online	Equal variances assumed	.125	.729	.171	16	.867
	Equal variances not assumed			.135	2.430	.903
Traditional	Equal variances assumed	.078	.782	.710	31	.483
	Equal variances not assumed			.627	3.628	.568

Independent sample t-tests were also done for comparing 2003-2004, 2004-2005, 2005-2006, and 2006-2007 exam scores in relation to time of the year the class was offered. Table 15 is an example of the sample t-tests that concluded that there were no statistically significant differences between students based on the time of the year the class was offered. In Table 15 comparing 2003-2004, the significance was greater than .05. No significance was also noted between 2004-2005 (Table 16), 2005-2006 (Table 17), 2006-2007 (Table 18).

Table 15

Independent Samples Test Comparing 2003-2004

Course Type		Levene's Test for Equality of Variances				Sig. (2- tailed) Lower	Mean Difference Upper
		F Lower	Sig. Upper	T Lower	df Upper		
Traditional	Equal variances assumed	1.207	.294	-.420	12	.682	-5.143

Table 16

Independent Samples Comparing 2004-2005 Scores

Course Type		Levene's Test for Equality of Variances				Sig. (2-tailed) Lower
		F Lower	Sig. Upper	t Lower	df Upper	
ITV	Equal variances assumed	2.378	.136	-1.940	25	.064
Traditional	Equal variances assumed	.016	.902	-.886	10	.397

Table 17

Independent Samples Comparing 2005-2006 Scores

Course Type		Levene's Test for Equality of Variances			df Upper	Sig. (2-tailed) Lower
		F Lower	Sig. Upper	t Lower		
ITV		1.735	.205	.815	17	.426
Traditional		.163	.695	.518	10	.616

Table 18

Independent Samples Comparing 2006-2007 Scores

Course Type	Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)
	F Lower	Sig. Upper			
ITV	.174	.683	-.360	13	.725
Traditional	.005	.944	-.130	12	.899

A two-way ANOVA process was performed to analyze the average scores of students across delivery methods and across GPA categories. Two GPA categories were used which were up to 3.63 and 3.64 and above. Table 19 shows the GPA categories documenting the number of students in each by delivery method. Of note, the ITV and online delivery methods had an even split of 50% of the students falling into each of the two GPA categories.

Table 19

GPA Categories By Delivery Method

Course type			Frequency	Percent	Cumulative Percent
ITV	Valid	Up to 3.63	21	50.0	50.0
		3.64 & above	21	50.0	
		Total	42	100.0	100.0
Online	Valid	Up to 3.63	9	50.0	50.0
		3.64 & above	9	50.0	100.0
		Total	18	100.0	
Traditional	Valid	Up to 3.63	16	48.5	48.5
		3.64 & above	17	51.5	100.0
		Total	33	100.0	

Table 20 shows the two-way ANOVA results. It documents that the F had a significance of .000 which that tells us there are differences between any of the different groupings used which are the average total test scores across delivery methods, the average total test scores across the GPA categories and/or the interaction effect between course type and G PA category. The table further explains where the differences are. It shows that there are significant differences noted in all three groupings. A significant interaction effect was noted between GPA and course delivery type with .016. There is also a significance noted in course delivery type of .000 and a significant effect noted in GPA with .000.

Table 20

Two-way ANOVA Between-Subject Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	26408.360(a)	5	5281.672	16.826	.000	.492
Intercept	25346635.168	1	25346635.168	80745.715	.000	.999
Type	8562.860	2	4281.430	13.639	.000	.239
GPA_cat2	17158.710	1	17158.710	54.662	.000	.386
Type* GPA_cat2	2745.384	2	1372.692	4.373	.016	.091
Error	27309.898	87	313.907			
Total	29137934.000	93				
Corrected total	53718.258	92				

Levene's Test of Equality of Error Variances is shown in Table 21 which indicated to use LSD for post-hoc testing. The significance noted was .076.

Table 21

Levene's Test of Equality of Error Variances

Dependent Variable: Total Score of 6 exams

F	df1	df2	Sig.
2.074	5	87	.076

Table 22 shows that the post-hoc test shows indicated students with higher GPA had higher test scores. There were no differences in the average test score across delivery methods or across GPA categories.

Table 22

Post-Hoc Test -Dependent Variable: Total Score of 6 exams

(I) course type	(J) course type	Mean Difference (I-J)	Std. Error	Sig.
		Lower Bound	Upper Bound	Lower Bound
ITV	Online	23.44(*)	4.991	.000
	Traditional	-2.01	4.121	.626
Online	ITV	-23.44(*)	4.991	.000
	Traditional	-25.45(*)	5.191	.000
Traditional	ITV	2.01	4.121	.626
	Online	25.45(*)	5.191	.000

Figure 1 shows the two categories used for GPA. The top line illustrates GPAs 3.64 or above. The bottom line illustrates GPAs up to 3.63. Mean total scores are on the y axis and the three different course types are on the x axis. Of note, the online students had lower mean scores than ITV and traditional in each of the GPA categories. In addition, students with lower GPAs did worse in online classes than traditional and ITV and higher GPA students did the same.

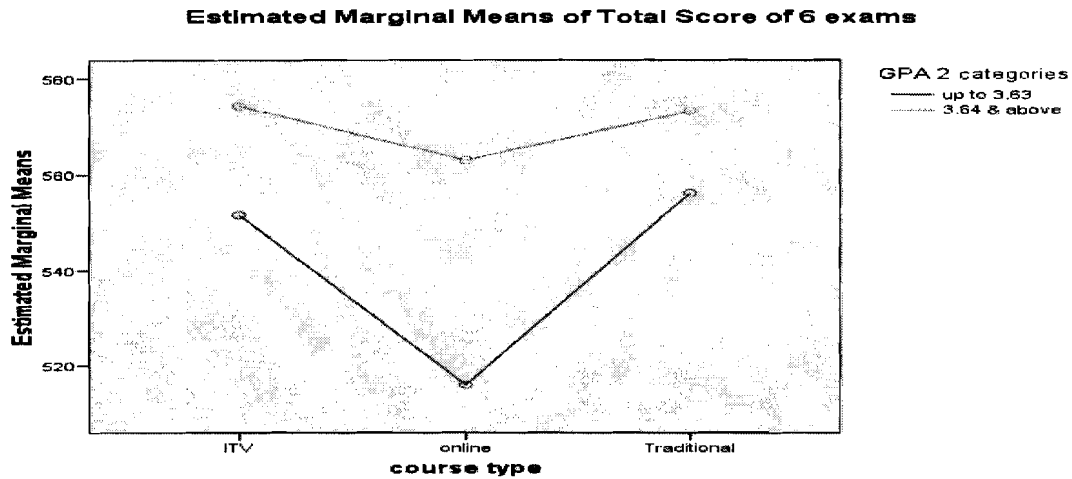


Figure 1: Estimated Marginal Means of Total Score of 6 exams

In addition to the above data, student satisfaction with the course was done by comparing traditional, ITV, and online delivery methods. A total satisfaction score was calculated by assigning numbers to a Likert response scale and then summed up across questions. This data was based on a 5 point scale where 1=strongly disagree and 4=strongly agree. The scale included a non-applicable category which was given a zero. There were a total of 15 questions scored with 60 being the maximum and 15 being the minimum. Data analysis that was done was mean comparisons of total scores using three separate t-tests. Figure 1 demonstrates that there were no differences in the mean total satisfaction scores between ITV and traditional and traditional and online. ITV, however, had statistically significantly higher average ratings than online.

Table 23

Standard Satisfaction Descriptive Statistics Using A 60-15 Scale

	Traditional	ITV	Online
Mean	56.84	57.20	54.30
Variance	28.11	15.33	4.17
Standard Deviation	5.30	3.92	2.04
N	33	36	10

There were three open ended questions on the survey for students to complete asking about their overall satisfaction with the course. Some traditional student comments included that the class went too slow and at other times too fast. Many students in all three delivery methods noted that the organization of the class was good and that the class was easy to follow. ITV students mentioned the class was sensitive to all of the different learning styles. Online students commented on the flexibility they had in the class with the ability to complete things according to their schedule. Please see Appendix A for a table listing all student comments noted from all three open ended questions by year and delivery method.

Summary

Results of the study included that online students have statistically significantly lower test scores than traditional and ITV and that there is no differences between ITV and traditional students. There are no statistically significant differences between genders or on the time of the year the course was offered. Students with higher GPAs had higher test scores and ITV students had a statistically significantly higher average satisfaction rating than online students.

Chapter V: Summary, Conclusions, and Recommendations

Introduction

This chapter will discuss the study along with conclusions and recommendations.

Summary

With the explosion of new technology and capabilities, the traditional classroom delivery method is being changed to an interactive television or online learning method. The literature review has shown that online classes can be effective when compared to the traditional classroom, but this type of research had not been done at Northcentral Technical College.

Cross Sectional Anatomy, was one course that was changed to an online offering only at Northcentral Technical College. Since its existence in 2003, the course was offered in a traditional and interactive television delivery method. This study was performed to answer the five research questions stated in Chapter One.

The pertinent student data was obtained from the instructor's hard copy and electronic grade book. These scores consisted of six identical exams that were given in each delivery format. Student age, gender, and GPA information was received from the registrars office at the college. All of the above data was entered into an Excel spreadsheet and analyzed.

For student satisfaction of the course, a standard survey is used at Northcentral Technical College to evaluate courses. The survey consisted of a 5-point Likert scale Along with three qualitative open ended questions. This survey was used for all Cross Sectional Anatomy classes.

Conclusions

Each research question will be restated and conclusions drawn based on the results.

Research Question #1. What are the differences in student learning (individual exam grades) when comparing traditional, interactive television, and online delivery methods in Cross Sectional Anatomy at Northcentral Technical College?

Results from study indicate that online students had statistically lower test scores than traditional and interactive television. There were no statistically significant differences between ITV and traditional. This may have been because the ITV and traditional students had weekly communication with the instructor where any questions on the content could have been answered. This is of interest because all offerings were taught by the same instructor, utilized the same textbook, and used the same exams. This finding was similar to Kinney (2001) who found that traditional classroom students performed better on exams than the online students. This finding was different than the results Christine Golden found in 2003 when comparing traditional and online classroom delivery methods. She concluded that the two delivery environments (online and traditional) were of comparable quality when evaluated in terms of student exam scores.

Research Question #2. What are the differences in student learning (individual exam grades) when comparing traditional, interactive television, and online delivery methods based on age and gender in Cross Sectional Anatomy at Northcentral Technical College?

Results of the study showed no statistically significant differences between male and female in terms of learning when analyzing total exam scores. It should be noted that there was a larger number of female students than males enrolled in every class. Two age categories based on the age distribution in each delivery method were used to ensure large enough cell sizes.

The two categories that had enough students per cell were 20-30 years old and 31+ years old. Online scores were significantly lower than both ITV and traditional when comparing age using the two categories. No statistically significant differences between ITV and traditional delivery methods were noted. These age categories were not surprising because in general students who take this course are older than 20. Also, for students who have had little computer experience in the past, online testing may have been more challenging, thus explaining the lower scores.

Research Question #3. What are the differences in student learning (individual exam grades) when comparing traditional, interactive television, and online delivery methods based on the time of year Cross Sectional Anatomy was offered at Northcentral Technical College? Based on the exam scores analyzed in the study, there were no statistically significant differences in exam scores in relation to the time of the year it was offered. Cross Sectional Anatomy had been offered during the summer and fall terms. This is an indication that varying the time of year does not statistically alter student exam scores. Students may have a busier schedule in the fall, but may be less attentive in the summer.

Research Question #4. What are the differences in student learning (individual exam grades) when comparing traditional, interactive television, and online delivery methods based on student's cumulative GPA before entering Cross Sectional Anatomy at Northcentral Technical College?

Results from the study show that interaction between GPA and the course delivery method was statistically significant. Students with a higher GPA entering the course had higher test scores. This would be consistent because the higher GPA students have proven in their past that they know how to earn higher grades in their courses. This finding agreed with Golden's

research in 2003 that also found students with higher cumulative GPA achieved higher course grades. Students who had a GPA over 3.64 in this study experienced higher exam scores than students below a GPA of 3.64

Research Question #5. What are the differences in student satisfaction of the course when comparing traditional, interactive, and online delivery methods in Cross Sectional Anatomy at Northcentral Technical College?

The results from the study indicate that no statistically significant differences were found in course satisfaction between the different methods of delivery. However, interactive television had statistically significantly higher average ratings than online. Student's satisfaction can be a difficult component to measure in a course because there can be many variables that affect the student. For example, the time of the day the survey was given, the personal things the student was going through, and the grade the student is getting in the course on the day the survey was given out. Because of the higher average interactive television ratings over online, one can conclude that the instructor taught in a conducive manner to connect with the students not located in the actual classroom.

Many of the findings of this study were consistent with the majority of studies reported in the literature that stated students perform equally well in the classroom and online delivery methods.

Recommendations

The following recommendations are made based on the findings from this study:

1. The information from this study will be shared with the Northcentral Technical College's On-line Learning Academy committee who is involved in future online development for the school. This Academy was recently formed and the data from

this study will provide valuable input to their current process. Since this study concluded information from two additional delivery methods other than online, these results will also be able to be shared with the Executive Leadership Team at Northcentral Technical College.

2. The information from this study will be shared with the program faculty whose students are taking Cross Sectional Anatomy. This information will be helpful when making future scheduling and course delivery option decisions. The study concluded that the time of year was not a factor for student learning. The offering of the course in Fall or summer did not make a statistical difference in student learning.
3. Since Cross Sectional anatomy is a course used in State-wide health curriculums, the study will be shared with State-wide curriculum designers who facilitate course offerings. The information from this study will be important when trying to sequence this course into a curriculum. More curriculums are using online classes, and this study can provide information on how they compare to the traditional classroom offering.
4. This study had a small number of online students compared to the number of traditional and interactive television students. Because of this low number, this study should be repeated in the future where more online data can be analyzed. This course is scheduled to be offered again in Fall of 2008 with an enrollment of 20. By adding 20 more online students to the study, the online student total would be up to 38, which would fall between the 33 traditional and 42 interactive television students who currently were in the study.

5. This study was performed using a course that is generally more female than male gender. Because of this inequality, this study should be done on other courses who have a more equal gender ratio. A course such as accounting would be a better choice.
6. This study showed that online learning can be an effective tool in the field of education, but continuous research on online learning is warranted. For continuous improvement to occur, continuous evaluation needs to occur. While there will always be exceptions, research is key for continued student success.
7. Data in this study was analyzed by using the total points of the exams earned by the student in each delivery method. Future studies in this type of analysis could use the average of the exams rather than the total points. By using the average of the exams, different results may be found.

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Appendix
Student Satisfaction Survey

Student Satisfaction Survey

Question #1 – What did you like about the format and facilitator?

Class	Comments
Summer 2003 Traditional method	<ul style="list-style-type: none"> • Sometimes the class went too slow and other times it went too fast • Shelly is very warm, friendly, and caring. Excellent role model in teaching caring. • I really enjoyed the class. • The instructor really cares about our successes and goals of the program
	<ul style="list-style-type: none"> • This class was a wonderful learning experience and allowed us to humanize this experience. • The instructor spoke well. Slow and easy to understand.
Summer 2004 Traditional method	<ul style="list-style-type: none"> • The facilitator is intelligent and an easy person to get along with. • The class was interesting and easy to learn • I felt I could approach Shelly at any time if I needed help and that she was truly concerned with how we are doing in her class
Summer 2004 Interactive television method (ITV)	<ul style="list-style-type: none"> • I really enjoyed the class and I felt I really gained a lot of knowledge. • Try to have an instructor in the classroom more. I did not really care for the ITV format. • As a student, you know what to expect and that makes it easy to study and do your best to meet those expectations.
Summer 2005 Traditional method	<ul style="list-style-type: none"> • Shelly did a great job of explaining things. She took her time. • Very organized • I felt the class was very helpful. • I enjoyed this class- facilitator was wonderful. Very patient and understanding • The instructor always tried to make sure we understood the material before she moved on.
Summer 2005 Interactive Television method (ITV)	<ul style="list-style-type: none"> • Shelly is a great teacher. You can tell she loves her field and really cares about her students. • Shelly was able to communicate in a manner and format that we were all able to grasp. Went at a reasonable pace and understood we had other obligations as well. • Shelly was very organized and sensitive to the different learning styles of all her students. • Teacher had a good method of teaching. • Shelly was by far the best college instructor that I have had. She is very easy to learn from and exudes a personality that is warm and caring.

Summer 2006 Traditional method	<ul style="list-style-type: none"> • I liked how the lecture went. • I felt that each week I gained more knowledge
Summer 2006 Interactive television method (ITV)	<ul style="list-style-type: none"> • I thought the class was laid out very purposeful. • Concise and clear content
Summer 2007 Traditional method	<ul style="list-style-type: none"> • The instructor always made me feel welcome in this class. • The class was easy to follow • The instructor seems to understand the adult learner very well. She sets us up to succeed if we put in the time and effort.
Summer 2007 Interactive Television method (ITV)	<ul style="list-style-type: none"> • Shelly did an excellent job of teaching and also giving me confidence on the material. • The instructor was well prepared for the classes. She had a variety of ways to teach. Presented information in new ways. • The instructor was very informative and explained things well. • The instructor is always willing to listen and is very fair.
Fall 2007 Online method	<ul style="list-style-type: none"> • I would recommend this class online. Most of the material is pretty straight forward. • Flexibility • The flexibility to complete the work when it's convenient for me is the best thing about the way the instructor has this class organized. • Not having to drive to school and not having to change my work schedule. • That I could still be at my job on the day the class was suppose to be scheduled and complete the tests as I was able to in the timeframe given. • It was nice not having to meet at a specific time and work at your own pace. • Nothing. • I liked the freedom of not having to be in class and take the test when you feel you are ready. • You can work at your own pace. • It opens up my schedule and allow me to do homework/take tests at my time

Question #2 – What suggestions for improvement do you have?

Class	Comments
Summer 2003 Traditional	<ul style="list-style-type: none"> • None. • Reduce the amount of work • I really never liked the format – the 2 hr sessions were too long.
Summer 2004 Traditional	<ul style="list-style-type: none"> • Maybe run tests through Monday more often so if you are out of town it won't get difficult to take the test.
Summer 2004 ITV	<ul style="list-style-type: none"> • I wish the class would have been in the 1st semester of the program. • Do not have students use flashcards.
Summer 2005 Traditional	<ul style="list-style-type: none"> • None
Summer 2005 ITV	<ul style="list-style-type: none"> • The review materials for tests were not as close to what the actually test questions were.
Summer 2006 Traditional	<ul style="list-style-type: none"> • Make the class cover more information
Summer 2006 ITV	<ul style="list-style-type: none"> • A weekly quiz would be helpful I think. It would make us review each week.
Summer 2007 Traditional	<ul style="list-style-type: none"> • None- keep up what you are doing. • I think things went well.
Summer 2007 ITV	<ul style="list-style-type: none"> • I think this class should be offered during the school year.
Fall 2007 Online	<ul style="list-style-type: none"> • I felt this class was very hard online. I would have rather taken this class in person. I felt this course was very hard to learn and teach your self. • Nothing, but my own time management. • I like to learn from any instructor in person or on ITV. It's very hard for me to teach myself because to be honest I don't have the complete

	<p>motivation I should have as I do when I take a personal class with an instructor.</p> <ul style="list-style-type: none"> • Not being able to go over tests face-to-face with the instructor. I learn better when someone is teaching me. I can teach myself, but it's easier when you are forced to sit through a lecture rather than trying to do it on your own. • The information all seemed to fall together at the end, but I feel I would have grasped it sooner and better, if I had been in a face to face setting, instead of teaching it to myself.
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Question #3 – What about the format and facilitator gave you a sense of accomplishment?

Class	Comments
Summer 2003 Traditional	<ul style="list-style-type: none"> • Shelly was interested as well in what she was teaching • Great format
Summer 2004 Traditional	<ul style="list-style-type: none"> • Shelly made me feel good about the program and myself.
Summer 2004 ITV	<ul style="list-style-type: none"> • She explained everything very thorough and didn't leave anyone behind. • Being able to study what was necessary and achieve a passing grade.
Summer 2005 Traditional	<ul style="list-style-type: none"> • Shelly made the classes interesting. She was interested in what she was teaching.
Summer 2005 ITV	<ul style="list-style-type: none"> • I felt I learned a great deal from this class
Summer 2006 Traditional	<ul style="list-style-type: none"> • Each week we learned more and more.
Summer 2006 ITV	<ul style="list-style-type: none"> • The instructor cared about us as individuals and encouraged us "I know you can do it" all the time
Summer 2007 Traditional	<ul style="list-style-type: none"> • The instructor commented how well we were doing week to week. • After tests, the instructor congratulated us on our test scores and efforts.

Summer 2007 ITV	<ul style="list-style-type: none">• Knowing the instructor thought we were doing well and she always encouraged us.• The instructor always cared about her students, gave help when needed. Great instructor• I learned a lot from this class and would not change a thing.
Fall 2007 Online	<ul style="list-style-type: none">• The timely feedback received from the instructor• Course was user friendly
	<ul style="list-style-type: none">• Very informative class and well put together to know exactly what is expected of the learner.• The flexibility and valuable content